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# JCCA

## Journal of the Canadian Chiropractic Association

*(Formerly the Canadian Chiropractic Association Journal)*

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# Contents

JCCA Vol 54 No 2 ISSN 00083194

## Chiropractic Researchers

- 73 Dr. Daniel Avrahami, DC, MSc  
74 Dr. Shawn Rossi, DC, MSc, PhD candidate

## Commentary

- 76 Belief systems as the foundation for our professional evolution  
Dr. Greg Dunn, DC  
Dr. Doug Pooley, DC

## Commentary

- 81 Our culture of research  
Dr. Ayla Azad, DC

## Fondation de recherche chiropratique du Québec

- 83 Dr. Richard Dussault, DC  
Président, FRCQ

## Editorial

- 85 Immunization in Canada: a 6-year update  
Dr. Scott A. Halperin, MD  
Kiersten Pianosi

- 92 Conservative management of uncomplicated mechanical neck pain in a military aviator  
Dr. Bart N. Green, DC, MEd  
Dr. Andrew S. Dunn, DC, MEd, MS  
Dr. LCDR Solomon M. Pearce, DO  
Dr. Claire D. Johnson, DC, MEd

- 100 Conservative management of a case of tarsal tunnel syndrome  
Dr. Karen Hudes, BSc, BS, DC

- 107 The diagnosis and emergency care of heat related illness and sunburn in athletes:  
A retrospective case series  
Dr. Andrew L. Miners, BPHE, BSc (Hons), CSCS, CK, DC, FCCSS(C)

- 118 Outcome measures and their everyday use in chiropractic practice  
Dr. Paul M. Hinton, DC, FCCRS(C)  
Dr. Randall McLeod, DC, FCCRS(C), DACRB  
Dr. Blaine Broker, DC, FCCRS(C)  
Dr. C. Elizabeth MacLellan, BSc, DC, FCCRS(C)

- 132 Book Reviews

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### Profile – Dr. Daniel Avrahami, DC, MSc



Dr. Daniel Avrahami, DC, MSc

Dr. Avrahami completed a Bachelor of Physical Health and Education degree from Queen's University before graduating from the Canadian Memorial Chiropractic College in 2007. Following his studies at CMCC he was

accepted into the Sports Sciences Residency Program (SSRP) through the College of Chiropractic Sports Science (CCSS(C)) concurrently with an MSc program in Biomechanics at McMaster University. His studies at McMaster were supervised by Dr. Jim R. Potvin, an Associate Professor in Biomechanics from the Department of Kinesiology. He successfully defended his thesis titled "Responses of Trunk Muscles to Perturbations before and after Active Release Technique® of the Hip Flexor." Dr. Avrahami was granted a \$5000 award through the FCER fellowship program. Dr. Jim R. Potvin's research program focuses on spine mechanics and coordination under a variety of load challenges. His applied research has been conducted to quantify injury risk and establish acceptable forces for a wide variety of automotive assembly tasks.

Dr. Avrahami's studies through the SSRP have been supervised by Dr. Jason A. Pajaczkowski. Under the direction of the CCSS(C) he has completed field work with numerous sports teams along with clinical placements with surgeons, radiologists and sports physicians. He has also completed the academic focus in exercise physiology, strength and conditioning, sport nutrition, sport psychology and sports injury management.

Currently, Dr. Avrahami practices part-time within a multidisciplinary sports injury clinic while he completes his SSRP requirements and publishes his research. He is an instructor at CMCC and he is the team doctor for the North York Rangers Jr. A hockey club and the Toronto Titans senior woman's lacrosse team.

### Profile – Dr. Shawn Rossi, DC, MSc, PhD candidate



Dr. Shawn Rossi, DC, MSc, PhD candidate  
Laurentian University

Dr. Shawn Rossi is from Sudbury, in northern Ontario (population 165,000).

Shawn received his Bachelor of Science degree from Laurentian University in 2001 and a Master's degree in pharmacology in 2004. His master thesis focused on antimicrobial efficacy of a new antibiotic-loaded poly (hydroxybutyric-co-hydroxyvaleric acid) controlled release system in prosthetic hip replacement. In 2003, Shawn was accepted to the undergraduate program at CMCC while continuing his research on a part time basis until his graduation in 2007. Upon graduation Shawn was accepted

in the PhD program in Interdisciplinarity at Laurentian University. The program focuses on interdisciplinary research in various fields of study. Shawn's field of study is in health services research.

Dr. Rossi's research focuses on the delivery of health care in an efficient cost effective manner utilising an interdisciplinary setting. He is the principal investigator in a research study titled "Interprofessional Health Care Delivery Study: Implementing an Interdisciplinary Collaborative Practice" involving Laurentian University Faculty and Vale Inco Ltd. His study is investigating an inter-professional group in the diagnosis and treatment which would allow the patient to receive the utmost quality of care utilising the most current treatment protocols of multiple professions. The provider of health care delivery is chosen based on scope of practice and most cost effective route. This allows the patient to receive treatment from a member of the team in a cost effective manner without compromising their care, ensuring a high rate of quality control. As a collateral project, Shawn also conducts research on the effect of physical exercises on Multiple Sclerosis patients in conjunction with physical therapy at the TARP centre.

Dr. Rossi is very active in his local community. He currently holds positions on the Laurentian University Alumni Board of Directors, the University Senate and also on the selection committee for Honorary Doctorates recipients. His off campus involvement includes volunteer work for the Multiple Sclerosis society's advisory committee for the Ontario Government Relations 2009 work plan on access to medical treatment and services in Northern Communities, in which he was a co-author in a position paper. He is a co-founder of TARP, a not for profit fitness facility for seniors and people with disabilities. TARP was created with the hope that people with disabilities can go work out and feel comfortable which most find difficult in larger fitness centers. He sits on the

Sudbury Chapter board of directors for the M.S. Society as director of client services and is currently working on the establishment of a new neurological health center for people stricken from neurological diseases.

Since his graduation in 2007, Shawn has been working as a chiropractor in part time private practice. In 2009 he

was received the Sudbury's Favourite Chiropractor award and recently received a faculty appointment at the Northern Ontario School of Medicine where he serves as a clinical supervisor and lecturer. Dr. Rossi looks forward to this new role and advancing research and evidence based collaborative practices.

Supporting the Canadian Chiropractic Research Foundation means  
Building Excellence through Research



Dr. Zoltan Szaraz DC  
Associate Professor, Applied Chiropractic, CMCC  
Rehabilitation Specialist in private practice

“Research is the backbone of credibility. If we are to promote chiropractic as a credible healthcare profession we, as chiropractors, must embrace and stand behind the ever expanding Canadian Chiropractic Researchers. You, and especially your patients, will be proud of your thoughtful and generous support assisting the Canadian Chiropractic Research Foundation in its vision to maintain essential chiropractic research programs. Please join the CCRF now!”

### Belief systems as the foundation for our professional evolution

Dr. Greg Dunn, DC\*

Dr. Doug Pooley, DC\*\*



Dr. Greg Dunn, DC



Dr. Doug Pooley, DC

“If you believe you can or believe that you can’t ... you’re right.”

In this one sentence, Henry Ford essentially summed up the most fundamental element in any success strategy. It does not matter how big or small aspirations are. Without the appropriate belief system in place, complete with effective grounding pillars of reference, chances for fulfillment of any dream or goal are seriously imperiled.

There is plenty of historical evidence to support this with countless cases of worlds being changed and fortunes won and lost based upon the strength of a belief. This holds true not just in the evolution of the individual, but also for any business or undertaking; in this case, the chiropractic profession.

Everyone reading this article is acutely aware of the pummeling that chiropractic has taken over the past ten

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\* COO, Canadian Chiropractic Protective Association.

\*\* Private practice

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years. The profession has been scrutinized, questioned and criticized over everything from efficacy and safety, to billing practices and beyond. It would be easy and convenient to blame these circumstances on medical bias, sensationalism by the press, or just bad luck. The reality is that in large part, we are the architects of our own ill fortunes, because of the failure of our overarching belief system.

To understand this more fully let's investigate what a "belief" actually is? Webster's defines it as: "The conviction of the truth of some statement or the reality of some being or phenomenon when based on the examination of evidence." The key to this definition is in the three words "conviction," "truth" and "evidence."

In short, we are dealing with certainty of thought. The one unassailable truth from this is; the strength of the beliefs that we espouse create our reality. Essentially success and growth in all areas of life are a reflection of the belief systems that we have taken on throughout our personal evolution. They can be familial, cultural, societal, educational or experiential. We all have them, and they serve as the guideposts directing much of our life's evolution over time. Just as core beliefs define us as individuals, and can often serve as a predictor of personal growth or success, the same holds true for the evolution of a profession. Our successes and failures can essentially be boiled down to how effective and supported our conceptual systems about chiropractic are.

Of equal importance is how they compare to the beliefs held about us by others, both competitors and stakeholders. We have all heard the saying: "If it walks like a duck, talks like a duck and acts like a duck, it must be a duck." Where turmoil arises, is when views about the "duck" conflict. In other words, when our belief about who and what we are conflicts with what others see as the truth; confusion ensues, credibility is challenged and growth stalls. We assert that in our case this disconnect is indeed present and appears to be central to our recent ill fortunes. The disparity between "our" beliefs and "their" beliefs created a conundrum and with it a sense of chaos affecting the players, stakeholders and most importantly consumers.

Just as the beliefs of others fundamentally impact our reality, perverse internal attitudes can be even more damaging. One of the greatest factors in the failure of the chiropractic profession to reach its full potential is the crippling notion that chiropractic is inferior and less rel-

evant than other professions invested with the privilege to use the title "Doctor."

When you cut through the bravado, and posturing to the contrary, there is still a cancerous rancor that epitomizes a "poor boy" mentality. This engenders a feeling among providers of lacking when measured against the established "medical" model. This core and often unconscious assumption among DC's and their staff is a foundational flaw that seems to keep perpetuating itself from one generation of chiropractors to the next and finds its roots in our unique metamorphosis as a profession.

During our thirty plus years in practice, we have had opportunity to observe a very profound evolutionary process in some aspects of chiropractic but sadly not in others. Chronologically our development can be broken down into three distinct periods of "then, now and when," with the success and or failure within each, being a reflection of how well our belief systems served us.

1. ***Then ... Life on the Fringe*** – This period of time, from our inception in 1895 up to the inclusion of chiropractic services as part of government sponsored health care plans in the early 1970's, marks the first era from a belief standpoint in the evolution of the profession. Also, this represents our most powerful and passionate period philosophically.

During this first 80 plus years, there was little true scientific exploration into the core precepts of how chiropractic worked or its true effects upon health and wellbeing. Whether a practitioner was a "straight or a mixer," the only essential justification for the profession's efficacy lay in a strong, almost metaphysical, philosophy or belief. This belief can be boiled down to the following tenet: "Health is essentially a reflection of an optimally functioning nervous system and that the innate intelligence which empowers all life can be influenced through the correction of blockages in spinal function (subluxation) by the adjustment."

A simple and convenient rallying point which when combined with positive clinical outcomes and strong user satisfaction created an almost irrefutable assumption among chiropractors of the time, that: "It works, so it must be right."

The latter part of this era was also a time of almost passive toleration by allopathic medicine. In essence, the chiropractic profession, due to the relatively modest

number of practitioners and small consumer utilization, was essentially deemed unworthy of much attention or critical investigation. There was also no concerted effort or systematized approach in the medical system, at that time, to treat patients with musculoskeletal complaints. In reality, there was little or no competition to the chiropractic profession in this arena.

Physiotherapy had not yet developed sufficiently outside of hospital settings to offer any threat to the ownership of manipulation. As well, massage therapy, naturopathy and acupuncture were unregulated or essentially unknown entities to the masses. Coincided this with the failure of consumers to press for scientific accountability and it remained easy to hold to a relatively simple, but unsubstantiated belief system of: “above-down-inside-out.” As there was no public demand for pragmatic justification of our scope, the same inertia held true within the profession. There was little pressure to harmonize modes of practice or adopt unified standards to define what a chiropractor is or does. In spite of this, all appeared well as we moved towards the new millennium. Then abruptly, fortunes started to change.

2. **Now ... *The Day the Rubber Hit the Road*** – During the latter 1970’s, 80’s and early 90’s, the chiropractic profession experienced a period of unparalleled growth. For the average practitioner, earnings rose dramatically as the numbers of consumers seeking out chiropractic care steadily grew. While public acceptance rose, enrollment in chiropractic colleges exploded, and the profession was viewed as one of the most promising growth sectors in health care. The numbers of new providers entering practice shot through the roof. Then with one incident on February 6th, 1998 in the province of Saskatchewan it all changed. Laurie Jean Mathiason suffered a fatal stroke that was temporally associated with a chiropractic manipulation. This event was the catalyst that burst the bubble of much of our accumulated success.

Imperceptibly at first, then with gaining momentum, attitudes towards the chiropractic profession changed. Our cache with other health care providers as well as the public started to fragment. Hard questions about efficacy as well as scientific substantiation and safety were now being asked. Due to the prevailing belief up to that point that “it just works,” there was a real pau-

city of evidence available to effectively formulate answers to these questions.

When the Lana Dale Lewis case broke in late 1999 (another allegation of death relating to a stroke from cervical manipulation) the public’s love affair with the chiropractic profession soured even further.

The former tolerance and quiet interdisciplinary collaboration with other health care providers started to dissipate. The previous forbearance quickly turned to distrust and panic driven disillusionment or even condemnation. The fear of the unknown subsequently served to fuel those forces in government less supportive of the chiropractic profession’s inclusion in universal health care. When the dust settled from these very public events, two provinces that enjoyed at least partial government funding, British Columbia and Ontario, found themselves on the outside looking in at the publicly funded health care system. A case can be made for the assumption that the downward spiral triggered by the Mathiason and Lewis Inquests was an unfortunate layering of unrelated circumstances. On the other hand, if you drill down deeper, a strong case can be made that the same belief system that brought the profession its prosperity in the latter decades of the 20th century, also served to sew the seeds of our current undoing. **In short, the demands for accountability levied by an evolving health care system grew beyond the sustainable limits of our defining philosophy.**

The chiropractic profession’s inability to effectively defuse the stroke issue (in essence the safety of chiropractic manipulation) and have it examined in the proper perspective is the symptom of a greater deficiency. The lethal weakness therein is the fundamental shortcomings of a belief system that failed to keep pace with the expanding demands for justification and relevance placed upon modern health care professions. **The chiropractic profession was found somewhat hamstrung by an unsustainable paradigm.** The underpinnings of our belief system could no longer withstand the pressure of external scrutiny. Consumer confidence wavered and the profession stalled.

The assertion of: “It works so it must be right” combined with the naïve simplicity of the “above down inside-out” philosophical tenet that served to create the defining framework for the early stages of chiropractic practice just didn’t work anymore. Ultimately

this unsubstantiated philosophy was found lacking when placed under critical examination by those on the outside looking in. Like the toppling of dominos, the chain of unfortunate and often unjustified falls continued.

Aside from the aforementioned philosophical box that the profession was trapped in, most chiropractors had the untenable belief that their treatment could do no harm. For this reason, professionally, the stroke issue was initially sloughed off by the average practitioner as absurd sensationalism. As incomplete science and public perception further linked the temporal association of posterior brainstem strokes with causation relating to chiropractic manipulation, many practitioners panicked. They were confronted with a “monster” that shook their belief system: “Could chiropractic treatment actually hurt someone?” Rather than pragmatically evaluating circumstances, they also succumbed to panic and became uncertain.

In their failure to embrace the science that demonstrated the efficacy of neck manipulation, many practitioners began to shy away from cervical adjusting. This demonstrable uncertainty among practitioners created further confusion in the public about the stroke hysteria. (You adjusted my neck yesterday, but today you are just using ultra-sound and massage ... was the adjustment wrong?)

Although a strong scientific case was made to defend the use of cervical manipulation by the chiropractic profession, the battle was, for the most part, already lost at street level. The crippling blow was not the stroke issue, but rather the failure of the “belief system” to dispel the initial accusation of culpability in the public’s perception that cervical manipulation causes strokes. Quite simply, our collective equity with the public was not sufficient to outweigh the fear associated with the procedure and the already existing skepticism about the profession. Although the association of strokes with cervical manipulation by chiropractors (ranging from 1/5.8million to 1/500,000 treatment encounters) made the likelihood of incidence statistically insignificant when viewed against many accepted medical procedures, panic and sensationalism overcame reason. Even the publication of the latest epidemiological evidence, in 2008 by Cassidy et al, that calls into question any causal link between cervical manipulation and vert-

ebrobasilar strokes has not eased the tension about the safety of chiropractic care.<sup>1</sup>

The Mathiason and Lewis Inquests opened the flood gates of public scrutiny exposing other formerly ignored inconsistencies and shortcomings that lay inside the chiropractic profession. For years, lack of scientific justification was excused by positive clinical outcome and our collective inferiority complex was masked by our congenial attitude and mastery of the doctor-patient relationship. This is no longer enough. We believe that to hold our present course without serious introspection for purposes of change will only subject the chiropractic profession to ever increasing challenge and controversy.

The public has placed us under a microscope and they will not let us off the hook until we regain their confidence. For the chiropractic profession to move forward and rebuild, there is no option but to evolve. This must occur now, in order to avoid further marginalization that would lead to our eventual redundancy as a provider of health services.

These are the facts but as gloomy as they appear, still, the greater truth is, chiropractic does work, is relevant and is cost effective. As well, much of our defining core belief system and philosophy are in many ways just as in tune with needs today as they were at their inception. Regardless, the world has changed and history has proven ideology cannot stand alone. So, where do we go next?

3. ***Then ... The Day After The Night Before*** – It is always easy to look back because thankfully there is little error with hindsight. The question is not what happened, but rather how to proceed?

The blows associated with the issues of stroke, safety and efficacy have served to shake us from our complacency. Professionally, economically, inter-professionally, politically and educationally, every facet of our professional make up has been impacted and continues to be affected. Do we have to change? No, survival is not mandatory. We believe that chiropractic seems ready for a change.

The salient and logical rallying point is: ***What is the winning strategy that regains public confidence?*** The formula for answering this requires addressing several other fundamental questions that will assist the profession in finding its way. We believe the following to be

the two non-negotiable points upon which there must ultimately be consensus in order for us to move forward with effectiveness.

- a) What evidence and research best positions and supports us as the logical authority in the assessment and treatment of “neuro-musculo-skeletal dysfunction and its potential impact on health?” (Survival is contingent upon achieving authority status in key areas of scope)
- b) How do we re-tool philosophy so it can serve as a more empowering rallying point to inspire confidence and passion at the grassroots level of our profession? In short, how can we create a belief system that is congruent among providers, consumers and allied professionals? Moreover a belief system that makes sense in view of current evidence and research and that will resonate with the public.

In order to succinctly arrive at answers to the above two defining points, we must realistically deal with the following deeper foundational questions:

1. What is it that we as chiropractors do that nobody else does?
2. Are these services of current and future value to health care consumers (some will be, some will not)?
3. How can we make it/them better?
4. How can we establish dominion over this so as to be accepted as the unchallenged authority?
5. What are the unique characteristics that define a chiropractor?
6. Are these particular unique traits empowering?
7. Do they enhance our credibility?
8. How do we make the key empowering traits stronger?
9. What are our current markets?

10. What are the logical areas for market expansion?
11. What research must be done to justify chiropractic as the authority in these areas?

Essentially, addressing these core areas of inquiry requires nothing more than logical processing and consensus. Answer these and the Rubicon will have been crossed.

By effectively satisfying the first four of the above questions, we will have taken a giant leap towards standardizing what this profession represents for both providers and consumers. It also reveals where we can logically stake claims of authority and therefore ownership.

Questions five through eight look directly at our belief systems and pragmatically strips away the trappings of pretense down to core governing principles that empower and bolster our self-image. As well it reveals how we are ultimately measured against our competitors and are viewed by our stakeholders.

Questions nine to eleven cannot really be effectively addressed without satisfying the first two, but these most importantly represent the promise of a future and serves as the roadmap where hope, relevance, growth and prosperity can comfortably venture.

At the end of the day, we are all motivated by the same needs for security, appreciation, purposeful and satisfying labors and a sense that what we are doing is actually making a difference. This paper is a challenge to those who govern our profession to band together today for the common good of the chiropractic profession to create a magnificent future for our profession!

## References

- 1 Risk of Vertebrobasilar Stroke and Chiropractic Care Results of a Population Based Case – Control and Case Crossover Study, Cassidy et al SPINE Volume 33, Number 4S, 2008.

### Our culture of research

Dr. Ayla Azad, DC\*



Dr. Ayla Azad, DC  
Chair, Research Committee  
Ontario Chiropractic Association

I got involved in chiropractic research by accident. After graduating from Palmer College in 1995, I decided to take a part-time job at the Palmer Research Center while I looked for an Associateship out in the field. My job was to scan B.J. Palmer's patient files that were found in an elevator shaft at the college. I was amazed at what I found in

those files. All patients had a full medical work up including blood work, and urinalysis before and after receiving a chiropractic adjustment. There was a tremendous amount of data included in each file. B.J. Palmer had a team of medical doctors and nurses working with him. He already had a "family health team" of sorts all those years ago! He was already collecting data and doing research before the term "evidence based" was even around. That project made me realise how important it was that we continue on this research path, that we continue to question and learn, just like B.J. Palmer was doing all those years ago. I was amazed that B.J. was so interested in research and collaborative care. Within a few months I found myself fully immersed into the "Chiropractic research world." I worked with some amazing chiropractic researchers like Drs. Cheryl Hawk, Lisa Killinger, Charles Henderson, Bill Meeker et al.! I learned about research principles, publishing, grant writing, presenting and realised why there weren't many chiropractic researchers – research is hard and requires such a huge amount of commitment and dedication, not everyone can do it.

The "chiropractic research world" was very small when I was involved. I remember going to conferences and presenting to the same group of people over and over again. I would sometimes wonder what the point of it all was since it appeared as though the majority of the chiropractors out in the field did not know what we were doing or why. In a commentary piece by Stuber, Bussi eres and Gotlib<sup>1</sup> they summarized some key messages based on a survey they conducted looking at Chiropractic research capacity in Canada. I feel they are important and should be repeated:

– *Less than 1% of chiropractors in Canada are actively engaged in research.*

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- *Chiropractic researchers in Canada are substantially under-funded.*
- *Many chiropractic researchers and graduate students are solely self-funded.*
- *Finding new ways to secure funding for chiropractic researchers is imperative.*
- *There is an urgent need to continue to build chiropractic research capacity.*

After all these years, it seemed as though nothing has really changed. I am no longer involved in active research either as I am now involved in full-time practice. Then I attended the World Federation of Chiropractic meeting in Montreal. I was stunned and overwhelmed with joy to see the rooms packed at the research sessions. We must continue to support the small group of people who are out in the trenches of the research world. They are truly dedicated and have such a passion for our profession by doing the work that they are doing. It was wonderful to see practitioners like you and me, acknowledge the work of people like Dr. Mark Erwin, Dr. Greg Kawchuck and Dr. Jay Triano, just to name a few!

Chiropractic is slowly but surely making some inroads into the research world and because of this, into the health care system as a whole. At the Ontario Chiropractic Association (OCA) it is one of our priorities to support chiropractic research and chiropractic researchers. The priority areas of research involvement for the OCA during the fiscal period 2008–2013 are:

1. Research evaluating or demonstrating the value of chiropractic services to patients, payers and other stakeholders.
2. Integration of chiropractic into the health care system through collaborative health services delivery research.
3. Support of chiropractic research chairs / professorships at Canadian universities.
4. Support for the establishment of chiropractic schools in Canadian universities.

The OCA currently provides funding for:

- Dr. Mark Erwin DC, PhD, Assistant Professor, Department of Surgery, Faculty of Medicine, University of Toronto

- Dr. John Srbely DC, PhD, Assistant Professor, College of Biological Sciences, Department of Human Health and Nutritional Sciences, University of Guelph
- Dr. Paul Bishop DC, MD, PhD, Head of non-operative care in the Division of Spine, Department of Orthopaedics at Vancouver General Hospital, Clinical Associate Professor of Orthopaedics, Faculty of Medicine, University of British Columbia.

The OCA also has previously funded or is funding research conducted by Drs. Cassidy, Côté, Ammendolia, Stern, van der Velde, Hayden, Mior, Vernon and Kopansky-Giles. We recognise the time and dedication these researchers have put in for the advancement of Chiropractic. It is because of their work that the body of chiropractic research is growing and will continue to do so.

Despite all this great work, there is still a lot more to do. As mentioned previously, only 1% of chiropractors in Canada are conducting research and these researchers are substantially underfunded.<sup>1</sup> We must make the “culture” of research more appealing to more chiropractors by creating more opportunities in the research field. The OCA will continue to support and fund chiropractic research in the years to come. Recently the OCA has also pledged its support to the Canadian Chiropractic Research Foundation (CCRF) by channelling research funds through the CCRF. We are very fortunate that there is an organisation like the CCRF that the OCA can rely upon for the expertise required to assess funding requests and help us allocate the much needed funds.

If you are an OCA member you will be pleased to know that a part of your membership fees are going directly towards supporting chiropractic research. I would urge all of you to continue to support your colleagues out in the “research trenches.” If you are out in the field you can still do your part to help advance chiropractic research. Please support your research organisations such as the CCRF, read the journals, attend the conferences and let’s move chiropractic forward, integrated into our health care system. I know our founding fathers would have expected nothing less from us.

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## Profile – Dr. Richard Dussault, DC



Dr. Richard Dussault, DC  
Président, FRCQ

Dr. Richard Dussault graduated magna cum laude from Palmer College of Chiropractic in Davenport, Iowa in 1978. He began his practice in Longueuil, Québec in January 1979. He is a member of the Order of chiropractors of Québec (OCQ), the Québec Chiropractic Association (ACQ), the Canadian Chiropractic Association (CCA) and the Canadian Chiropractic Protective Association (CCPA).

In 1995, he was elected to the Council of the Order of chiropractors of Québec and has held the positions of second Vice-President and Secretary-Treasurer.

In 1997, he became a member of the Fondation de recherche chiropratique du Québec (FRCQ) and from 1999 to 2001, he served on the Executive Committee and held the position of Treasurer.

In 2007, he received the distinguished Award of Merit from the Canadian Chiropractic Association.

In 2009, Dr. Dussault received the Award of Merit from le conseil interprofessionnel du Québec which is an association of all the professions in Québec. In June of that same year, he was elected Président of the Fondation de recherche chiropratique du Québec by its Executive Committee composed of Drs André-marie Gonthier, George Lepage, Daniel Saint-Germain, Richard Giguère and past president Guy Beauchamp.

Dr. Dussault is an advance proficiency rated instructor in Activator Methods and from 1997 to 2008, lectured to students in the chiropractic program at the Université du Québec à Trois-Rivières.

The Fondation de recherche chiropratique du Québec (FRCQ) raises funds through a variety of initiatives to support many research activities to advance the chiropractic profession.

In 2006, the FRCQ-System platinum Research Chair was established at the Université du Québec à Trois-Rivières and is funded in great part from the contributions of chiropractors from Québec but also Platinum Systems and its president M. Claude Côté. Dr. Martin Descarreaux DC, PhD is the Titulaire de la Chaire de Recherche en Chiropratique.

An additional goal of the FRCQ is to assist students in the chiropractic program at UQTR who wish to become researchers after graduation and obtain advanced research

degrees in an effort to provide ongoing support to the Research Chair at UQTR.

In 2009, the FRCQ provided funding to the following recipients: Dr. Ariane Desmarais, Dr. Sébastien Houle, Dr. Justin Jefferson-Falardeau, Dr. Mathieu Piché, Dr. Marc-André Blanchette, Dr. Jean-Philippe Pialasse, and the Research Chair FRCQ-Système Platinium.

In 2008, the past president Dr. Guy Beauchamp, on behalf of the FRCQ, concluded a partnership with the Fonds de recherche en santé du Québec (FRSQ) to establish the FRSQ-FRCQ Normand Danis postdoctoral training award in chiropractic research. In this joint partnership, an eligible chiropractor with a PhD degree will receive

funding from the FRSQ and FRCQ. The candidate will be chosen by the scientific committee of the FRSQ and with approval from the FRCQ. Also, Dr. Beauchamp, along with the OCQ concluded a second partnership with the FRSQ to award grants to chiropractors involved in research. Dr. Beauchamp is to be congratulated for these historic accomplishments.

As the late Dr. Normand Danis said so often “chiropractic will achieve its greatest potential and its rightful place in health care in Canada as chiropractic research explains and confirms why we get such wonderful results with our patients”.

Supporting the Canadian Chiropractic Research Foundation means  
Building Excellence through Research



Dr. Norm Skjonsberg  
President  
New Brunswick Chiropractic Association

The quality of chiropractic researchers in universities across Canada ensure that the credibility of chiropractic in Canada continues to develop as our profession continues to mature. These researchers produce valuable information that can benefit every Canadian chiropractor in their daily practice. The NBCA is a proud supporter of the CCRF.



### Immunization in Canada: a 6-year update

Scott A. Halperin, MD\*

Kiersten Pianosi\*\*



Scott A. Halperin, MD



Kiersten Pianosi

#### Introduction

In the six years since the publication in this journal of “Immunization in Canada: a success to build on,” immunization programs in Canada have changed substantially. In this commentary, we will review the current status of immunization programs in Canada, highlighting vac-

cines newly introduced into Canada’s publicly funded programs. We will also describe immunization committees recently established in Canada and the role they play in Canada’s vaccine program decision-making process. Finally, we will briefly review new vaccines that may soon be available in Canada.

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In 2003, there was universal, publicly funded immunization against nine diseases in Canada (diphtheria, tetanus, pertussis, polio, *Haemophilus influenzae* type b, hepatitis B, measles, mumps, and rubella).<sup>1</sup> Despite the National Advisory Committee on Immunization's (NACI) recommendations for immunization of infants against varicella, *Neisseria meningitidis* type C (meningococcal C conjugate vaccine), *Streptococcus pneumoniae* (pneumococcal conjugate vaccine), and against pertussis in adolescents, there were no publicly funded programs set-up at the time. Since 2003, new vaccines have been added to Canada's list of universal, publicly funded programs. As well, NACI has released updates and statements on the recommended immunization schedules for certain diseases that were previously publicly funded in 2003.

In 2003, NACI was the committee that provided recommendations on the use of vaccines in Canada.<sup>2</sup> Although NACI's role is to make national recommendations on vaccine use, the decision to implement a new vaccine into publicly funded immunization programs as well as the purchasing of the vaccine is the responsibility of the provinces and territories. Decision-making structures for each province/territory varied greatly and in part led to lack of standardization and inconsistencies in the immunization programs and schedules across Canada.<sup>3</sup>

#### Current epidemiology and vaccine programs in Canada

Since 2003, seven vaccines have been added to Canada's universal, publicly funded immunization program: 1) varicella vaccine, 2) pneumococcal conjugate vaccine, 3) influenza vaccine for young children and pregnant women, 4) Human papillomavirus (HPV) vaccine, 5) meningococcal C conjugate vaccine (MenC), 6) Quadrivalent meningococcal conjugate vaccine (Men ACYW), and 7) adolescent and adult formulation tetanus, diphtheria, and acellular pertussis vaccine (Tdap).<sup>4</sup>

The varicella-zoster virus (VZV) is a DNA virus; primary infection with VZV causes chickenpox. VZV can establish a latent infection in the sensory ganglia, from where it can be reactivated in later years as zoster (shingles).<sup>2</sup> In 2002, NACI recommended varicella vaccine for all children at 12 months of age.<sup>1</sup> In 2003, less than half the provinces/territories provided the vaccine as part of their publicly funded program. Since 2007, all provinces and territories have provided universal, publicly funded

vaccinations against varicella for all children ages 12–18 months, and half of the provinces and territories have catch-up programs.<sup>4</sup> Outbreak studies done in the United States showed that there was an overall vaccine effectiveness of 70%–90% in preventing varicella disease of any severity, and 95% protection against severe varicella for 7 to 10 years after immunization.<sup>5</sup>

Since 2003, the pneumococcal conjugate vaccine has been incorporated into the publicly funded immunization programs for all provinces and territories. Based on NACI's recommendations, infants in all of the provinces and territories, except Quebec, are immunized at 2, 4, 6, and 12–18 months of age.<sup>6</sup> In Quebec infants are immunized at 2, 4, and 12 months of age.<sup>4</sup> In Alberta, the first province to implement universal pneumococcal conjugate vaccine, surveillance in the Calgary region showed a large decline in the occurrence of invasive pneumococcal disease (IPD) among children <2 years of age. When compared with the combined rate between 1998 and 2001, the rate in 2004 decreased by 81.6% to 11.7 cases of infection per 100,000 for all serotypes, by 92.6% to 3.9 cases for the seven serotypes included in the vaccine and by 93.4% to 3.9 cases for these vaccine serotypes and related serotypes within the same serogroups.<sup>7</sup> In 2004–2005, investigators of the Canadian Immunization Monitoring Program, Active (IMPACT) undertook active, population-based surveillance for invasive pneumococcal infections in Greater Vancouver (473,000 children) and demonstrated a rapid and substantial decrease in incidence rates of infection for children 6–23 months old with routine infant vaccination. Disease rates for 6–23 month olds decreased 84.6% (92.5% for vaccine serotypes), further confirming the effectiveness of the pneumococcal vaccination program.<sup>8</sup>

Several changes have been made to the immunization schedule for influenza within Canada since 2002 to provide publicly funded vaccine for additional groups at increased risk of complications from influenza. Throughout Canada, there is now universal public funding for influenza vaccine for all children aged 6–23 months.<sup>6</sup> Influenza vaccine is now recommended for all pregnant women, regardless of their stage of pregnancy.<sup>6</sup> In Ontario, there is universal public funding for influenza vaccine for people of all ages. In April of 2009, a significant shift in the influenza virus led to emergence of a novel H1N1 strain of swine origin and the World Health Organization declaring

an influenza pandemic.<sup>9</sup> A nationwide program of H1N1 vaccination for all Canadians was implemented in late October 2009.

One of the biggest successes in Canadian immunization and immunization programs in the last six years has been the implementation of a universal vaccination program against HPV. HPV is one of the most common sexually transmitted viruses, comprising at least 40 types that are able to infect the genital tract. Almost all cervical cancers are the result of HPV infections;<sup>10</sup> the overall prevalence of HPV (any type) in Canada ranges from 10.8% to 29.0%. The most recent Canadian data show that the highest prevalence (26.9%) of HPV is in women <20 years of age. Subtypes 16 and 18 are the most prevalent (16.7%), although prevalence does vary with age, region, and ethnicity.<sup>11</sup> The incidence of cervical cancer has greatly declined since the integration of regular PAP smears, yet cervical cancer is still estimated to be the second most common malignancy in women. In 2005, it was estimated that approximately one million women had cervical cancer, with over 250,000 deaths attributed to the disease.<sup>12</sup> For each new case of invasive cancer found by cytology in Western countries, there are approximately 50 to 100 other cases of precursor lesions that require follow-up or management.<sup>13</sup>

The recommendations for the use of the first licensed HPV vaccine (Gardasil®, Merck) were published by NACI in February 2007. A second vaccine (Cervarix™, GlaxoSmithKline) will soon be available. Because HPV is a sexually transmitted infection, the primary age group targeted for the immunization is girls aged 9 to 13, before they become sexually active.<sup>6</sup> Gardasil® is a quadrivalent vaccine administered on a separate three-dose schedule of 0.5 mL per injection, at 0, 2, and 6 months. Once administered, the vaccine prevents against infection with HPV 16 and 18, as well as HPV 6 and 11. The former are two common high-risk types of HPV that cause 70% of cervical cancer cases. The latter are two lower risk types that are rarely associated with cervical cancer, but are the major causes of genital warts.<sup>10</sup> Clinical studies have been performed with the quadrivalent vaccine to measure its immunogenicity and efficacy. During Phase II and Phase III trials, the efficacy against cervical cancer and the prevention of HPV-16 and HPV-18-related cervical cancer surrogates (cervical intraepithelial neoplasia [CIN] 2, CIN3 or adenoma in situ [AIS]) was 100% (95% CI: 93%

to 100%) and 99% (95% CI: 93% to 100%). In the combined data set from the Phase II and Phase III studies, efficacy against external genital lesions, vulvar intraepithelial neoplasia, and vaginal intraepithelial neoplasia related to HPV-6, -11, -16, or -18, including warts, was 99% (95% CI: 95% to 100%) in the per protocol efficacy and 95% in the modified intention to treat analysis (95% CI: 90% to 98%).<sup>14</sup> Cervarix is a bivalent HPV 16 and 18 vaccine. Clinical trial results were similar to the quadrivalent vaccine, with 90%–100% efficacy against the development of high-grade cervical lesions associated with HPV 16 and 18 for periods of up to 5.5 years. One month following the administration of the third dose, nearly all participants (>99%) had developed antibodies against the types of HPV contained in the vaccine. Further surveillance has showed that aside from the prevention of lesions caused by HPV 16 and 18, the bivalent vaccine is also 35% to 60% effective in preventing infections caused by types 31 and 45, which are responsible for 8%–10% of cervical cancers.<sup>15</sup> As of May 2009, Cervarix™ was under review by Health Canada, and Gardasil® is used for HPV vaccination programs across Canada.<sup>15</sup>

In 2006, \$300 million was allocated by the federal government for implementation of HPV programs across Canada.<sup>16</sup> Currently, all the provinces and territories within Canada offer universal public funding for immunization against HPV, except for Nunavut which has announced a program that will be starting in the winter of 2009.<sup>4</sup> HPV vaccine has only been integrated into the universal, publicly funded immunization programs across Canada as of 2009, so there is little information on the long-term effectiveness of the vaccine. Studies are still in progress testing the long-term efficacy, and its effectiveness in decreasing the occurrence of HPV and cervical cancer.

Since 2001, NACI has recommended meningococcal C conjugate vaccine for children <1 year of age, children from 1–4 years of age, adolescents, and young adults.<sup>1</sup> However, full implementation of a universal, publicly funded vaccine program with meningococcal C conjugate vaccine did not occur across Canada until 2007. In more recent years, there has been a significant decline in occurrence of serogroup C invasive meningococcal disease (IMD). IMPACT's 12 centres, located in children's hospitals in eight different provinces, conducted active population-based surveillance for hospital admissions

in all ages related to *Neisseria meningitidis* from January 2002 to December 2007. Incidence rates of Group C invasive disease decreased six-fold in provinces that were first to establish universal infant immunization. Rates decreased in both children and adults suggesting an effect of herd immunity.<sup>17</sup> In 2006, a quadrivalent meningococcal A, C, Y, W135 conjugate vaccine (Menactra®, Sanofi Pasteur) was approved for use in Canada. The incidence of serogroup Y IMD has remained relatively stable across time in Canada, with a slightly higher median age, due to more cases in the >65 age group. The remaining two serogroups, A and W135, protected against in the quadrivalent vaccine remain rare in Canada.<sup>18</sup> In May 2007, NACI recommended the use of the quadrivalent meningococcal vaccine for immunization of persons 2–55 years in the following high-risk groups: persons with anatomic or functional asplenia; persons who have complement, properdin, or factor D deficiencies; travelers when meningococcal vaccine is indicated, including pilgrims to the Hajj in Mecca; research, industrial, and clinical laboratory personnel who are routinely exposed to *N. meningitidis*; and military recruits. Presently, although all provinces have implemented publicly funded immunization programs with the meningococcal C conjugate vaccine, only three provinces have funded use of the quadrivalent vaccine. In New Brunswick and PEI, the quadrivalent conjugate meningococcal vaccine is used as part of each province's catch-up program in grade 9. In Ontario, quadrivalent meningococcal vaccine is used in accordance with NACI's recommendations for individuals 2–55 years of age who fall under the high-risk category.<sup>4</sup> There are no data yet on the efficacy of the MenACYW vaccine.

Pertussis, or whooping cough, is a highly contagious infection of the respiratory tract, caused by *Bordetella pertussis*. Since the introduction of pertussis vaccination, the number of reported cases has drastically declined, from 160 cases per 100,000 in the mid-20th century to <20 cases per 100,000 in the 1980s. The infection is most severe in infants, though it can affect individuals of any age. In the last decade, the number of adolescents and adults with pertussis has steadily increased. The proportion of pertussis cases in adolescents and adults ≥15 years of age has increased from 9.6% in 1995 to 16.4%, 21.2%, and 31.3% in 1998, 2001, and 2004 respectively. This increased incidence may be due in part to better detection and reporting of cases of pertussis. Active surveillance for

pertussis in Canada has documented pertussis infection in 10–20% of adolescents and adults with a non-improving cough illness lasting 7 or more days.<sup>2</sup> For many years, the immunization schedule against pertussis has consisted of a primary series at 2, 4, and 6 months of age, and booster doses at 18 months and 4–6 years. Immunization for adolescents and adults against pertussis was not included in the schedules, despite the increases in occurrence. In 2002, NACI recommended that all adolescents should receive a single booster dose of the adolescent/adult formulation of the Tdap vaccine, as well as adults who have not previously received a dose.<sup>1</sup> As of 2008, all provinces and territories had implemented a publicly funded, adolescent immunization program against pertussis.<sup>4</sup>

#### The Canadian Immunization Committee (CIC)

The National Immunization Strategy was approved in 2003, with \$45 million from the Canadian federal government. One year later, in 2004, the Canadian Immunization Committee (CIC) was established.<sup>19</sup> CIC is a federal/provincial/territorial body that provides leadership in immunization by giving advice and recommendations on implementation of the National Immunization Strategy (NIS) and issues affecting immunization. The committee comprises a senior representative, often the Chief Medical Officer of Health, from each province/territory. Although NACI produces statements on its recommendations for immunizations, it is up to the individual provinces and territories as to what vaccine programs they choose to implement and fund. Each jurisdiction decides which products will be purchased and which will be offered free of charge to certain target groups. The goal of the CIC is to aid individual provinces and territories in this decision-making process. In order to best assist the provinces, the CIC performs a thorough cost-analysis, and utilizes an analytical framework created by Erickson and De Wals.<sup>20</sup> The framework was developed to allow comprehensive and systematic evaluation of all factors that should be considered before making decisions regarding the pertinence of new immunization programs. Before its use within the Canadian immunization programs, the framework had been used to structure reports on control programs against communicable diseases in Quebec. The first step in adapting and developing the framework to the Canadian immunization structure was to contact key scientific and public health experts involved in the planning

Table 1 *Criteria and key questions outlined in the Erickson–De Wals framework for assessing Canadian immunization programs.*

<i>Criteria</i>	<i>Key Questions</i>
1 Burden of disease	Does the burden of disease justify a control program?
2 Vaccine characteristics	Do the characteristics of the vaccine permit implementation of an effective and safe immunization program?
3 Immunization strategy	Is there an immunization strategy which allows goals of the control program as well as sanitary and operational objectives to be attained?
4 Cost-effectiveness	Is it possible to obtain funding for the program and are cost-effectiveness indices comparable to those of other health care interventions?
5 Acceptability	Does a high level of demand or acceptability exist for the immunization program?
6 Feasibility	Is program implementation feasible given existing resources?
7 Ability to evaluate	Can the various aspects of the program be evaluated?
8 Research questions	Have important research questions affecting implementation of the program been adequately addressed?
9 Equity	Is the program equitable in terms of accessibility of the vaccine for all target groups?
10 Ethical considerations	Have ethical considerations regarding implementation of the immunization program been adequately addressed?
11 Legal considerations	Have legal concerns regarding implementation of the immunization program been adequately addressed?
12 Conformity of programs	Does the planned program conform to those planned or implemented elsewhere (other regions, countries)?
13 Political considerations	Will the proposed program be free of controversy and/or produce some immediate political benefit?

of immunization programs across Canada. These specialists were asked their views on what factors have been of most importance when making recent decisions regarding publicly funded immunization programs. After repeated questionnaires and analysis of responses, a list was generated of a framework that outlined 58 criteria classified into 13 categories, all directly pertinent to the implementation of new vaccine programs (Table 1) that were shown to increase the reliability in decision-making.<sup>20</sup> It is hoped that the formation of the Canadian Immunization Committee will bring homogeneity and equity to immunization programs across Canada.<sup>3</sup>

#### The link between the CIC & NACI

The first step in the process of introducing a new vaccine in Canada is its regulatory approval by the Biologics and Genetic Therapies Directorate (BGTD) of Health Canada. In order for a vaccine to be authorized for use in Canada it must undergo multiple preclinical studies and clinical

trials that measure its safety and efficacy. After extensive review of all supporting data the vaccine may be approved for sale. The BGTD conducts prerelease testing on every lot of vaccine and monitors subsequent safety in use, in collaboration with the Public Health Agency of Canada (PHAC) and the vaccine manufacturer.<sup>21</sup> After the vaccine is approved for use, NACI reviews and summarizes the studies, evaluating the level and quality of the evidence, and makes a recommendation regarding the use of the vaccine. The CIC performs a cost-analysis and characterizes the factors associated with a universal program according to the Erickson–De Wals framework. Using NACI's recommendations and the CIC analysis, each province and territory then decides whether or not to fund the vaccine and utilize it in their immunization programs.

#### Vaccines of the future

With the continuing success of vaccinations and immunization programs, it can be predicted with confidence that

the addition of additional vaccines to routine schedules is on the horizon. Currently, there are two safe and effective vaccines against rotavirus gastroenteritis (RGE) (RotaTeq®, Merck; Rotarix™, GlaxoSmithKline) that are approved for use in Canada. Rotavirus (RV) is one of the leading causes of severe diarrhea among infants and young children.<sup>22</sup> Despite limited Canadian data, RV appears to have a high prevalence among Canadian children <5 years of age (1/62 to 1/312 children hospitalized for rotavirus infection). Based on the observed vaccine efficacy in clinical trials that were performed, implementation of universal immunization of all Canadian infants could be expected to prevent as many as 56,000 cases of RGE, 33,000 physician visits, 15,000 emergency department visits and 5,000 hospitalizations annually.<sup>23</sup> The significant protection against RGE is sustained through two years after vaccination.<sup>24</sup> NACI has released a limited statement on the rotavirus vaccine. CIC has not yet made a statement regarding the rotavirus vaccine and there are no universal programs in Canada. In the United States, universal rotavirus vaccine programs have been implemented and have resulted in a significant reduction in hospitalizations related to rotavirus infection.<sup>23</sup>

Due to the high success of the varicella vaccine in children, a vaccine to prevent zoster/shingles (varicella for the elderly) has been approved for use in Canada (Zostavax™, Merck). The risk of having at least one reactivation to herpes zoster is 15% to 20%, which means there are likely a significant number of cases occurring each year in Canada.<sup>6</sup> Zoster vaccine has been widely implemented in the United States but is not yet widely available for use in Canada.

Two combination vaccines for measles, mumps, rubella, and varicella will soon be available in Canada. MMRV was licensed in 2006 in the United States, and quickly recommended for routine use in children. The MMRV combination vaccine is currently not available in Canada.<sup>2</sup>

A 9-valent pneumococcal conjugate vaccine (Synflorix™, GlaxoSmithKline) is available in Canada and may replace the 7-valent pneumococcal vaccine (Prevnar®, Wyeth) in some jurisdictions. A 13-valent pneumococcal conjugate vaccine (Wyeth) will soon replace their 7 valent vaccine. A quadrivalent Men ACYW conjugate vaccine that can be administered to infants is under development as well as a meningococcal B vaccine.

## Conclusion

With the undeniable past success of vaccine and immunization programs, it is important for the public and, in particular, health care workers to keep themselves up to date and informed. The public must be reassured about the safety, effectiveness, and benefits of immunization. Primary care practitioners must be knowledgeable advocates for the individual and population benefits of immunization as a lifelong investment into Canada's future. With the constantly changing field of vaccinology in Canada, undoubtedly another update will be needed in the next 4–5 years.

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## New – Practitioner Guide for the Management of Whiplash-Associated Disorder in Adults

Your English-language hard copy of the *Practice Guide for the Management of Whiplash-Associated Disorder in Adults* is included in this mailing of the *Journal of the Canadian Chiropractic Association (JCCA)*. The French-language Practitioner Guide will be distributed in the next issue of the JCCA to those members who have indicated a French-language preference.

The chiropractic clinical practice guideline, *Management of Whiplash-Associated Disorder in Adults*, is now available on the Canadian Chiropractic Association website. Both the full Guideline as published in the journal *WORK* (Issue 35, 2010), and the easy reference Practice Guide for practitioners are posted on the website. To locate the Guideline and the Practice Guide visit [www.chiropracticcanada.ca](http://www.chiropracticcanada.ca), click on About Us on the top navigation bar, then choose Clinical Practice Guidelines from the left navigation bar.

The development of chiropractic clinical practice guidelines is a joint initiative of the Canadian Chiropractic Association and the Canadian Federation of Chiropractic Regulatory and Educational Accrediting Boards.

*Management of Whiplash-Associated Disorder in Adults* complements the clinical practice guideline *Treatment of Adult Neck Pain Not Due to Whiplash*. A guideline on management of headache is currently in progress and is expected to be published in 2011.

# Conservative management of uncomplicated mechanical neck pain in a military aviator

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*Non-radicular neck pain arising from local musculoskeletal structures, known as mechanical neck pain or somatic dysfunction, is highly prevalent in the fighter jet aviator population. The management of this problem includes both therapeutic and aeromedical decisions. In addition to non-steroidal anti-inflammatory medications, waiver guides recommend therapeutic exercise and manipulative therapy as treatments for somatic spine pain in aviators, and such treatments are employed in many military locations. However, there are currently no published studies that describe the use of manipulative therapy for fighter jet aviators. We report the case of an F/A-18 instructor pilot who experienced long-term relief of uncomplicated mechanical neck pain following interdisciplinary management that included manipulation and a home exercise program. Diagnostic considerations, conservative treatment options, and aeromedical concerns are discussed.*

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*Douleur au cou non radiculaire découlant des structures musculosquelettiques locales, connue sous le nom de douleur mécanique au cou ou trouble somatique, très prévalente auprès des pilotes d'avion de combat à réaction. La gestion de ce problème inclut des décisions à la fois d'ordre thérapeutique et aéromédicale. En plus de médicaments anti-inflammatoires non stéroïdiens, les guides de dérogation recommandent de l'exercice thérapeutique et de la thérapie manuelle comme traitement pour la douleur somatique de la colonne vertébrale chez les pilotes. Ces traitements sont employés dans de nombreuses installations militaires. Toutefois, il n'existe à présent aucune étude publiée qui décrit l'usage de la thérapie manuelle chez les pilotes d'avion de combat à réaction. Nous rapportons le cas d'un pilote instructeur de F/A-18 qui a éprouvé un soulagement à long terme d'une douleur mécanique au cou non complexe à la suite d'une gestion interdisciplinaire qui incluait la thérapie manuelle et un programme d'exercices à domicile. Les considérations diagnostiques, les options de traitement conservatrices et les soucis au plan aéromédical font l'objet d'une discussion.*

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**KEY WORDS:** neck pain, manual therapy, aviation, exercise therapy, manipulation, spinal.

**MOTS CLÉS :** douleur au cou; thérapie manuelle; aviation; rééducation par l'exercice; manipulation, colonne vertébrale.

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## Introduction

Fighter jet aviators are exposed to large tensile, axial compression, and shear forces when flying, especially during aerial combat maneuvers (ACM).<sup>1</sup> Non-radicular neck pain arising from mechanical structures in the neck (somatic pain) is a common outcome of exposure to high gravitational (G) forces.<sup>2</sup> The weight of the helmet and oxygen mask and the various non-neutral head postures assumed when observing for enemy aircraft contribute to this problem.<sup>1</sup> Spinal disorders can result in disability<sup>3</sup> and conditions that may disqualify pilots from flight duties.<sup>4</sup> Thus, neck pain in the fighter jet aviator population has a negative impact on work performance, productivity, and is a threat to combat readiness.<sup>5</sup> In addition to non-steroidal anti-inflammatory drugs (NSAIDs) and short courses of analgesics, the US Navy Aeromedical Reference and Waiver Guide and the US Air Force Waiver Guide recommend mobilization exercises and manipulative therapy in the management of mechanical non-radicular spine pain.<sup>6,7</sup> Despite recommendations by these guides and the high prevalence of neck pain,<sup>8</sup> we could find no published studies that describe the use of manual therapy, spinal manipulation, or spinal mobilization and therapeutic exercise for managing mechanical neck pain in aviators. In this article we present the case of a jet fighter aviator with uncomplicated mechanical neck pain who had a favorable response to conservative interdisciplinary management using manual therapy and therapeutic exercise.

## Case report

A 38-year-old male active duty US Marine Corps F/A-18 instructor pilot with 2693 total flight hours, of which 2134 were in the F/A-18 (fighter/attack aircraft), was referred by his flight surgeon to one of the naval hospital's on-station doctors of chiropractic for treatment of intermittent neck pain. The neck pain was experienced intermittently over a period of two years, the most recent episode being initiated after assuming an instructor role that involved flying frequent ACM training sorties during the previous eight weeks. The pain was located in the right side of his neck and worsened when he turned or laterally flexed his head to the right. The neck pain became more bothersome during and after ACM. Typically the pain was described as being dull and aching in character; however it could become sharp with rapid right rotation of the neck or under high G situations. He experienced difficulty turning

his head to the "check six" position because of pain and decreased range of motion, thereby interfering with his ACM capabilities. The patient was referred to the chiropractor when it had not resolved with a two-week course of acetaminophen, flight grounding, and topical applications of heat and had been present for more than 8 weeks. The pain did not interfere with sleeping and had no features related to time of day. He denied radiating pain, paresthesia, upper or lower extremity weaknesses, bowel or bladder incontinence, visual disturbances, dizziness, or headache. His numerical pain scale rating for severity was 3/10 (10 represented by 'the worst pain imaginable') and his Neck Disability Index<sup>9</sup> score was 6%. The patient was a very healthy male Marine engaging in multiple forms of exercise per week, including running, yoga, weightlifting, Marine fitness training, and mountain biking. He did not smoke or drink, was not under any new stress and had a stable married home life.

His gross active neck range of motion was visibly decreased for right rotation and right lateral flexion. Stiffness was observed by both the patient and the doctor at the end range of passive right rotation as well as with right lateral flexion. The patient experienced pain on the right side of the neck with axial loading of the neck in the neutral position.<sup>10</sup> In the sitting position, manual axial traction<sup>11</sup> decreased his pain and increased his active range of motion. Neural tensioning through contralateral rotation and extension of the neck while the upper extremity was abducted with the elbow, wrist, and fingers passively extended<sup>11</sup> elicited no radiating pain, numbness, or tingling in the upper extremities. Tenderness to palpation was present in the right cervico-thoracic paravertebral and upper trapezius muscles.<sup>12</sup> No signs of infection were present, and there were no abnormal neurological findings detected with dermatome assessment, deep tendon reflex testing, upper extremity myotomal strength testing, or Valsalva's maneuver.

The patient was diagnosed with Grade I neck pain,<sup>13</sup> also known as mechanical neck pain or somatic pain, and dysfunction of the cervicothoracic junction. Fracture, disc herniation, and dislocation were considered unlikely differential diagnoses due to the patient having no history of frank trauma, the relatively low level of pain severity and disability, the absence of neurological signs or symptoms, and the absence of any red flags suggesting more ominous processes.<sup>12</sup> Imaging was not obtained, consistent with

the best available evidence of the limited utility of plain radiographs, CT, or MRI for patients with non-acute, non-radicular neck pain.<sup>12</sup>

As recommended by the US Navy Aeromedical Reference and Waiver Guide and the US Air Force Waiver Guide, in addition to the medication already tried, the management plan included mobilization exercises and manipulative therapy. No findings in the history or examination were present that would contraindicate spinal manipulation. The patient was treated by a chiropractic practitioner with more than 600 hours of training in spinal manipulation/manual therapy and over 16 years of practice experience. Four treatments occurred over five weeks; treatments were modified based upon the patient's improved signs and symptoms at each consecutive visit. During the first office visit, the patient was treated using high velocity, low amplitude, manual manipulation of the upper thoracic and lower cervical spine to improve right lateral flexion and right rotation. These manipulations were selected based upon the presence of pain, decreased symmetry in active and passive range of motion, and tenderness to palpation.<sup>14</sup> The cervical spine was manipulated in the supine position using a spinous process contact and the thoracic spine in the prone position using a modified pisiform contact.<sup>14</sup> Active stretching of the right upper trapezius muscle was also performed while digital pressure was applied by the provider to tender areas located in the muscle. In addition, home stretches for the upper trapezius muscles<sup>15</sup> were prescribed 3–5 times daily and the patient was advised to hold each stretching position for 30 seconds. The patient reported an immediate reduction in pain and improved mobility after the first visit. At the three-week follow up, he had stiffness without pain and had been returned to flying, but had only flown two ACM missions. The previous treatment was repeated.

At the four-week follow up visit (third treatment), improvements in outcome measures included minor limited range of motion, mild tenderness to palpation, and stiffness with no neck pain. He had flown a few ACM missions to ascertain a rigorous response to treatment. Since he was still having some residual stiffness, reduced range of motion, and tenderness to palpation, the treatment protocol was repeated once more. Standing multiplanar isometric endurance home exercises for the neck musculature<sup>16</sup> were prescribed in an effort to enhance paracervical muscular strength and endurance, based upon the



Figure 1 *Standing isometric neck exercises. The patient stands upright, slightly contracts his abdominal muscles for stability, and pushes his forehead against a ball that is held against a wall (isometric neck flexor contraction) for at least 10 seconds. The patient is then instructed to position his body 45 degrees to the ball and repeat the isometric procedure, thereby exercising the neck with combined muscle groups. Isometric exercises are prescribed for each successive 45 degree radius for a total of 8 positions and the patient is asked to perform 2 repetitions of each position and 2 sets of these exercises daily.*

increased physical demands of the neck musculature during flight (Figure 1). These exercises were aimed at functional restoration and therefore modified to closely mimic the tasks associated with flying the F/A-18.

At the five-week follow up visit (fourth treatment), he reported no neck pain, including during and after ACM. He had no tenderness to palpation and nearly full restoration of neck range of motion. He reported that he had been compliant with the neck isometric exercises and felt that they were of benefit. Based upon his apparent improvements with the isometric exercises, the patient was provided isotonic exercises aimed at further improving the strength and endurance of the posterior neck musculature and scapular stabilizers (Figure 2). These exercises were intended to provide a therapeutic delivery of load, simulating those forces placed on the neck during ACM.



*Figure 2 Standing isotonic scapular stabilization exercises. The patient stands upright and slightly contracts the abdominal and interscapular muscles for stability. An elastic therapy band is used to create resistance and the patient simulates the movement associated with shooting an arrow from a bow. These exercises employ 2-second concentric muscle contractions from the starting point to the point of tension, a 5-second isometric hold at the point of maximum tension, and a 5-second eccentric contractions back to the starting point. These can be performed with the leading arm parallel to the floor and also angled 45 degrees toward the ceiling and toward the floor. Ten repetitions of each exercise vector were prescribed.*

At the eight-week follow up (fifth visit, no treatment, re-examination only), he reported no pain and no stiffness and had flown numerous ACM missions without a recurrence of neck pain. His Neck Disability Index score was 0/50. Examination revealed full active and passive ranges of cervical motion and no tenderness to palpation. The patient had no subsequent neck pain episodes that were reported to his flight surgeon or chiropractic physician over the ensuing 6 months and deployed to the combat theater without incident.

### Discussion

Mechanical neck pain is a common disorder in the general population<sup>13</sup> and is typically described as a local, non-rad-

icular pain that is sometimes increased with movements of the neck.<sup>17</sup> The anatomical sources of mechanical neck pain typically include muscles, ligaments, and joints of the cervical spine.<sup>17</sup> Uncomplicated mechanical neck pain must be differentiated from radicular pain, in which neurologic pathology is present (e.g., disc herniation, nerve root entrapment) as these conditions may be managed differently.<sup>18</sup> A thorough history and physical examination will help to determine if neck pain is mechanical and to rule out signs or symptoms of major pathology, such as fracture, myelopathy, neoplasm, or systemic disease.<sup>12</sup> These pathologies (i.e., “red flags”) should receive immediate and additional investigation. Red flags for neck pain history are presented in Figure 3. Diagnostic imaging and laboratory studies are not typically necessary for mechanical neck pain unless they are needed to rule out potentially pathologic conditions.<sup>12</sup>

The Neck Pain Task Force has established an updated classification of neck pain. These include: Grade I (no signs or symptoms of major pathology and minor interference with activities of daily living); Grade II (no signs or symptoms of major pathology and major interference with activities of daily living); Grade III (no signs or symptoms of major pathology and presence of neurologic signs, which may include decreased deep tendon reflexes, sensory, or motor deficits); and Grade IV (signs or symptoms of major pathology, such as fracture, neoplasm, systemic disease, or myelopathy).<sup>13</sup> Conservative methods for the treatment of neck pain may include NSAIDs (e.g., ibuprofen, naproxen). However prolonged treatment with NSAIDs is not recommended due to some of their associated complications (e.g., gastric bleeding). Sometimes muscle relaxants are prescribed (e.g., cyclobenzaprine, metaxalone), but they are considered temporarily disqualifying from flight duties due to the potential side effects (e.g., dizziness, drowsiness). Cervical collars are typically not recommended, as the research evidence does not support their use.<sup>19</sup> Manual therapies (e.g., mobilization, manipulation) and physical treatments (e.g., physiotherapy, exercise) have evidence to support their use for uncomplicated neck pain without severe neurologic deficit.<sup>19,20</sup> To address mechanical dysfunction, manipulative and physical therapies in addition to exercise may assist with treatment of the current episode and the prevention of future neck pain. Manipulation should be performed by healthcare providers who are trained in this proced-

Figure 3 *Red flags for neck pain, which suggest more ominous underlying pathology than uncomplicated mechanical neck pain and may require further evaluation (adapted from reference 18).*

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- Progressive neurologic deficit (e.g., loss of strength, paresthesias, loss of bowel/bladder control, loss of balance/coordination)
  - Coughing or sneezing makes the pain radiate
  - Signs of instability or spinal cord compromise (inability or unwillingness to move neck due to pain, unbearable pain)
  - Vascular deficit
  - Signs or symptoms of infection
  - History of trauma, cancer, bone disease, neurologic disease, systemic diseases, or immunosuppression (e.g., HIV/AIDs, inflammatory arthritis, or recent corticosteroid use)
  - Past medical history (i.e., previous neck surgery, dislocation)
- 

ure. If a flight surgeon does not have this training, he or she can work in conjunction with an on-station osteopath, chiropractor, or physical therapist who is trained in these procedures.

While the management of mechanical neck pain in the aviation community may be similar to that of the general population, there are some important differences of which flight surgeons and other healthcare providers should be aware. Of special consideration are the prevalence of neck pain in this population and the aeromedical consequences when managing these patients. The prevalence of neck pain in fighter jet aviators ranges from 26.8%<sup>5</sup> to 89.1%,<sup>21</sup> and because of its commonality has been called a work-related musculoskeletal disorder of fighter jet aviators.<sup>8</sup> In comparison, the 12-month prevalence of neck pain in the general population ranges from 30–50%.<sup>22</sup> Neck pain not only diminishes pilot concentration and function during flight<sup>23</sup> but also can be severe enough to ground pilots or result in decreased flying time.<sup>4</sup> Since neck pain can result in disability or progress to a non-waiverable flight disqualification,<sup>4</sup> neck pain in the fighter jet aviator population has a negative impact on performance and is a threat to combat readiness.<sup>5</sup>

The US Navy Aeromedical Reference and Waiver Guide states that neck and back pain from biomechanical derangements of the spine and resulting muscle aches and spasms, known as somatic dysfunction,<sup>6</sup> are not considered to be disqualifying for flight status unless the condition is persistent or has required hospitalization.<sup>6</sup> For pain that does not require a waiver, the Waiver Guide recommends mobilization exercises, physical therapy,

manipulation, and occasional use of flight surgeon prescribed NSAIDs for a short-term course of care to manage back or neck pain.<sup>6,7</sup> These medications are considered disqualifying for flight if used chronically and would then require a waiver.<sup>6</sup> Muscle relaxants are considered disqualifying and should not be used by military aviators while on flying status. The use of therapeutic exercises,<sup>6,7</sup> manual therapy provided by a physician,<sup>6</sup> or manipulation<sup>7</sup> are not considered disqualifying for flight. Thus, for this unique population, conservative non-pharmaceutical management may be considered when developing a treatment plan.

The literature discussed below suggests that individuals who have neck pain have diminished muscle control and coordination. It has been noted that fighter pilots who do not have neck pain possess greater efficiency of neck extensor muscles (more antagonistic muscle EMG activity) than non-pilot subjects<sup>24</sup> and greater neck extensor muscle strength than pilots with neck pain.<sup>25</sup> However, Seng et al have demonstrated that asymptomatic pilots do not have greater isometric strength than non-pilot controls and advocate for on-land neck muscle strengthening exercises for aviators.<sup>26</sup> O'Leary, Falla, and Jull identified that neck pain subjects have altered coordination between the superficial and deep neck muscles, poorer kinesthetic sense, and higher rates of muscular fatigue when exposed to sustained loads,<sup>27</sup> which may explain the difference in muscle strength between pilots with and without neck pain, as noted by Ang et al.<sup>25</sup> Exposure to G forces during regular flying has been associated with limited increases in isometric neck muscle strength,<sup>28</sup> suggesting that flight-

induced gains in strength are negligible to counteract the forces placed on the body during ACM.

Several authors have investigated the potential use of strengthening programs to prevent neck pain in this population. It has been shown that pilots who engage in muscle endurance training have less acute in-flight neck pain,<sup>29</sup> and pilots engaged in a supervised neck-specific strength and flexibility program demonstrated significant increases in neck strength and endurance compared to pilots provided a home exercise program.<sup>30</sup> Recently, it has been shown that certain isotonic elastic band exercises and resistance machine neck strengthening exercises can generate similar neck muscle activation to G forces in the z axis measured in-flight and may represent a useful and job-specific physical training program for pilots involved in ACM.<sup>31</sup> However, to our knowledge, there are no prospective controlled investigations of the efficacy of neck exercises for neck pain in fighter pilots that can inform clinical practice decisions.

While there are anecdotal reports of aviators receiving manipulative therapy for neck pain,<sup>8,23</sup> the effectiveness of this therapy in managing neck pain in fighter jet aviators is not reported in the literature. It is known that manual therapy is an effective non-pharmacological and non-surgical treatment option for whiplash and non-whiplash associated neck pain in the general population,<sup>19</sup> and it would seem rational to extend those results to the fighter aviator population. Hence, it is theoretically plausible that pilots with somatic neck pain may benefit from a rehabilitation program that includes proprioceptive activities, spinal manipulation or mobilization, muscle co-activation, and neck muscle strength and endurance training. This was the rationale employed in the rehabilitation of the pilot in this case.

In the highly work-motivated flight community it is vitally important that members of the medical team work together to minimize patient recovery time while ensuring maximum flight safety. Flight surgeons are best qualified to interpret aviation safety guidelines, such as those in the US Navy Aeromedical Reference and Waiver Guide, and therefore, a close working relationship between the manual therapist and the pilot's flight surgeon is invaluable. In this manner, appropriate modalities can be maximized, consistent follow-up can be ensured, and all regulations can be closely followed. By utilizing the skills and knowledge unique to each medical team member, the pilot can be maintained on flight status, or returned to it

quickly, without breaking any aviation safety regulations or endangering the aviator.

There are limitations to this case report. Although the patient improved and was released from care after only five visits, the time over which these treatments were given was considered suboptimal. The patient was not able to be seen as frequently as desired due to scheduling conflicts. A higher treatment frequency over a shorter duration would have been preferred to optimize treatment response related to manipulative and soft tissue therapy.<sup>32</sup> Range of motion assessment, such as dual inclinometry, would have been preferred over visual assessment. Limitations inherent to the case report design prevent one from generalizing beyond this single case since this was a non-controlled retrospective study. The natural history of neck pain is episodic and recurrent<sup>13</sup> and may possibly explain the short term resolution of his neck pain. Summarily, this case study reports one pilot presenting with neck pain that was interfering with his job performance, who was motivated to maintain a high level of job-related function, and who appeared to have a favorable response to a conservative management approach that is under-reported within this population. We hope this report stimulates further research interest in the treatment and prevention of neck pain in this population.

### Conclusion

Neck pain is highly prevalent in fighter jet aviators and can compromise mission safety and aviator function.<sup>3,8</sup> Chronic neck pain and some medications may be considered disqualifying for flight for military pilots according to the US Navy Aeromedical Reference and Waiver Guide. Manual therapy and therapeutic exercise are recommended for treating this problem and are not considered disqualifying. Therefore, applying these conservative options that help with managing pain and function for aviators could be considered. In this case, a pilot with neck pain was managed following these recommendations and was able to successfully continue flying without return of pain or dysfunction.

### Endnotes

The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the United States Government.

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# Conservative management of a case of tarsal tunnel syndrome

Dr. Karen Hudes, BSc, BS, DC\*

**Objective:** *This case study was conducted to evaluate the treatment and management of a patient presenting with chronic foot pain, diagnosed as tarsal tunnel syndrome.*

**Case:** *61 year old female presenting with plantar and dorsal foot pain and burning sensation of 6 months duration.*

**Treatment:** *Treatment was initiated using custom orthotics only for the first ten weeks of care as the patient did not follow up or initially respond to follow up calls placed by the practitioner. A course of high-velocity, low-amplitude adjustments using a toggle board to the cuboid and the talonavicular joint and fascial stripping was added upon report from the patient that the orthotic therapy alone did not resolve the symptoms. Improvement of pain reported on the Verbal Rating Scale was noted with a complete resolution of the condition at the conclusion of treatment. No pain was reported on a ten month follow up with the patient.*

**Conclusion:** *Conservative management, including orthotics, manipulation, and fascial stripping may be beneficial in the treatment of tarsal tunnel syndrome. (JCCA 2010; 54(2):100-106)*

**KEY WORDS:** tarsal, foot, pain, syndrome.

**Objectif :** *Cette étude de cas a été effectuée afin d'évaluer le traitement et la gestion d'un patient qui présentait de la douleur chronique au pied, avec un diagnostic de syndrome du tunnel tarsien.*

**Cas :** *femme de 61 ans qui présente de la douleur plantaire et dorsale au niveau du pied, ainsi qu'une sensation de brûlure qui dure depuis 6 mois.*

**Traitement :** *Le traitement initial consistait d'orthèses uniquement pour les dix premières semaines puisque la patiente ne s'est pas présentée pour un suivi et ne rappelait pas le praticien. Une série d'ajustements à haute vitesse et basse amplitude effectuée à l'aide d'une planche à bascule au niveau de l'articulation cuboïde et talo-naviculaire et du décollement fascial a été rajouté lorsque la patiente a relaté que la thérapie orthétique ne suffisait pas à traiter les symptômes. La douleur s'est amenuisée selon des notes effectuées sur une échelle d'appréciation verbale, et, au terme du traitement, le problème était complètement résolu. Aucune douleur n'a été rapportée lors d'un suivi avec la patiente dix mois plus tard.*

**Conclusion :** *Une gestion conservatrice comprenant orthèses, manipulation et décollement fascial, peut être bénéfique dans le traitement du syndrome du tunnel tarsien. (JCCA 2010; 54(2):100-106)*

**MOTS CLÉS :** tarsien, pied, douleur, syndrome

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## Introduction

Pes planus and hyperpronation of the foot are common observable signs that are often associated with foot pain.<sup>1,2</sup> Foot pain is a common complaint of patients and although it is difficult to determine the prevalence, one study reported rates in women between 32% and 80%<sup>1</sup> while another study reported rates of 52% among elderly patients.<sup>2</sup> Plantar fasciitis, metatarsalgia, hallux valgus, and posterior tibial tendon dysfunction are common problems associated with hyperpronation of the foot.<sup>1</sup> Hyperpronation of the foot is also associated with tarsal tunnel syndrome, though the condition is less common in the general population.

The cause of tarsal tunnel syndrome can be identified in 60–80% of cases, the most common causes being trauma (17%), varicosities (13%), heel varus (11%), fibrosis (9%), and heel valgus (8%). However the exact incidence of tarsal tunnel syndrome is not known.<sup>3</sup> There is a slightly higher incidence of tarsal tunnel syndrome in females compared to males.<sup>3</sup> Tarsal tunnel syndrome may be difficult to identify and manage conservatively, and surgical intervention may be required.

According to the National Board of Chiropractic Examiners 2005 Job Analysis of Chiropractic, in general the chief presenting complaint on initial visit of 8.9% of chiropractic patients in 2003 was a lower extremity complaint. "Survey participants were asked to provide information regarding their management of 121 conditions that they might have seen in their practices during the previous year."<sup>4</sup> It was reported on a scale of 0 to 4, where 0 meant the practitioners never treated the condition and 4 meant that the practitioners routinely treated the condition, that carpal and tarsal tunnel syndrome earned a rating of 2.1. Additionally the respondents indicated that 57.1 % of the respondents were the sole managers of the condition and 40.9% of the respondents co-managed the condition.<sup>4</sup> There were few case study reports of tarsal tunnel syndrome found in the chiropractic or other conservative care literature. The purpose of this article is to report a case of tarsal tunnel syndrome and its management using conservative treatment methods.

## Case report

A 61 year old female presented for treatment of intermittent left foot pain of 6 months duration. The patient presented to the clinic in January and reported that she had

been wearing winter boots outdoors for one to two months that she described as 'fairly unsupportive,' over which time the pain in her foot had worsened. The patient reported discomfort and burning pain in the left foot on the plantar and dorsal aspect of the foot, over the distal metatarsal region. She was not able to pinpoint the location of pain but rather referred to the general area of the forefoot. She denied paresthesias, and/or lack of sensation in the area. She rated the pain as a 9/10 in intensity on a Verbal Rating Scale where 0 is no pain and 10 is the worst pain that she had ever experienced. She reported that she had a pair of custom orthotic insoles made for her by a podiatrist a few months prior that did not seem to help reduce her pain and that she had felt the need to alter herself by way of gluing material padding around the metatarsal area of the orthotics with adhesive. The orthotics were three quarter length, hard in nature and lacked any type of top cover or intrinsic padding. Although they seemed appropriately worn for the age of the orthotic, the patient reported that the orthotics were not comfortable. She showed the clinician that she had built herself a makeshift pad that she would insert above the orthotic that she placed under her metatarsals which helped temporarily relieve the symptoms. Walking for any length of time, standing in one place for a few minutes, sitting for a few hours on an airplane, and wearing certain shoes such as boots increased the pain; however, she reported that these increases in pain were highly variable whereas taking off her shoes and/or boots tended to decrease the pain. She reported that while on vacation in a warm climate, she had been unable to wear a pair of sandals that she had previously found comfortable and that she had similar pain in her right foot when wearing certain shoes, to a much lesser degree.

Range of motion testing of the cervical and lumbar spines were found to be full and pain free in all directions tested. Range of motion of the ankles was full and pain free bilaterally. Resisted range of motion testing including resisted dorsiflexion, plantarflexion, inversion, and eversion of the ankle was found to be pain free and of equal strength bilaterally. Neurological testing of the upper and lower extremities was found to be within normal limits with respect to sensation, motor strength, and reflexes bilaterally. Non weight bearing examination of the feet uncovered 'medium' and approximately equal plantar longitudinal arch height bilaterally. Toe and heel walking were unremarkable bilaterally. Hallux valgus was noted

on the left foot only. A separation between the 2nd and 3rd digits was noted on the right foot. The patient reported that this was due to an injury that she had suffered 2–3 years prior in which she reports that she tore the ligament between the metatarsals. Deep palpation and pressure in this location did not reveal any pain. Morton's test (grasp the foot around the transverse metatarsal arch and squeeze the heads of the metatarsals together<sup>5</sup> to rule out Morton's neuroma), and Tinel's sign (tap over the posterior tibial nerve inferior and posterior to the medial malleolus<sup>5</sup>) were negative bilaterally. No hallux rigidus was noted bilaterally. Lower back evaluation was conducted to ensure the symptoms were not referred and was found to be unremarkable, including the following orthopaedic tests (bilaterally where applicable): active and passive straight leg raise, Patrick's test (passive flexion, abduction, and external rotation of the hip placing the lateral malleolus of the involved leg over the knee of the uninvolved leg<sup>5</sup>), sacral thrust test (posterior to anterior pressure on the sacrum while the patient is prone), Hibb's test (while the patient is prone bend the knee passively to 90 degrees and internally rotate the hip by moving the lower leg away from the midline), and the thigh thrust test (passively flexing the hip and knee to 90 degrees while putting an anterior to posterior pressure through the sacroiliac joint). Upon weight bearing, the height of the plantar longitudinal arches diminished bilaterally but noticeably more on the right side. Gait analysis revealed toeing out bilaterally and over-pronation of the forefoot bilaterally. Rearfoot valgus deformity was noted bilaterally on standing. Loss of the transverse tarsal arch was noted bilaterally with increased severity on the left. No calluses were noted on the plantar surface of the feet. A diagnosis of tarsal tunnel syndrome was made based on physical findings including over pronation of the rear foot, loss of transverse arch height with standing as well as reported symptoms and location of pain.

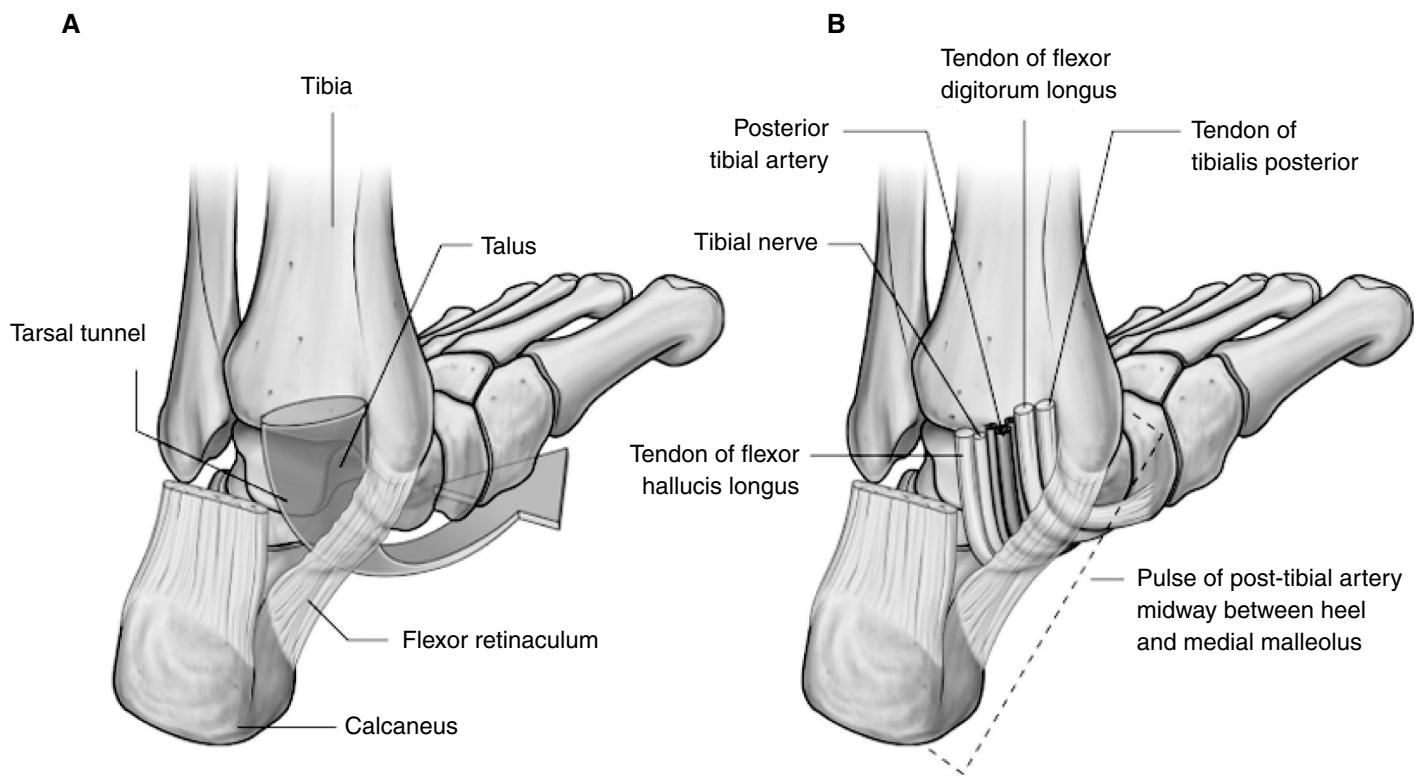
As the patient reported some relief with the makeshift metatarsal pad that she had placed in her shoe, she expressed discomfort and dissatisfaction with her current custom orthotics and was cast in non weight-bearing subtalar neutral for a new pair of custom fit orthotics. The new orthotics were made with a metatarsal pad built in to the top cover bilaterally and were dispensed to her 10 days after the initial visit. The patient was given the following instructions on the use of her orthotics: wear the

orthotics for one hour the first day, two hours the second day after which time doubling the length of time the orthotics are worn each day up to eight hours. She was told to discontinue use if she found the orthotics uncomfortable and contact the practitioner. She was then discharged from care as she stated that she was leaving for vacation out of the country within the week and did not desire further treatment. The patient was given instructions to return for further care and to call the clinic if her pain did not diminish or if she had any further questions. A follow up call was placed approximately 1 month after dispensing the orthotics with no response. A further follow up call was placed 10 weeks after the initial visit at which time the patient reported very little change in her condition and a VRS of 8/10 in intensity. She reported that she had been wearing her orthotics as instructed. A treatment plan using fascial stripping techniques including cross friction massage and instrument assisted fascial stripping to the lateral heel over the tarsal tunnel, and over the plantar and dorsal surfaces of the forefoot, and high velocity low amplitude (HVLA) toggle board adjustments of the talonavicular joint and mobilizations of the cuboid as well were initiated based on motion palpation. Treatment was given twice per week for two weeks, followed by a break in treatment of two weeks due to the patient leaving on holiday. Upon her return, she reported that her symptoms had decreased to 2/10 in intensity and that she did not have any pain while flying, or while walking in the aforementioned sandals. Treatment was resumed at a frequency of once per week for 2 weeks at which time the patient reported that the pain had decreased to 0/10 in intensity with intermittent recurrences of a low level sensation over the dorsal and plantar surfaces of the forefoot that she could no longer classify as burning. Treatment was decreased to once every 2 weeks for the following 6 weeks during which time the patient reported that she did not have any recurrences of pain. The patient was subsequently discharged from active care and advised to return as needed for supportive care.

## Discussion

Foot pain is a common complaint in a chiropractic practice. Common causes of foot pain include arthritic changes, plantar fasciitis, stress fractures, and Morton's neuroma, while less common causes may include painful accessory bones, complex regional pain syndrome

Figures A and B



Drake: Gray's Anatomy for Students, 2nd Edition.  
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(CRPS), Baxter's nerve entrapment, and tarsal tunnel syndrome.<sup>6</sup> Even more rare causes include Freiberg's disease (avascular necrosis of the metatarsal head) and tarsal coalition,<sup>5</sup> as well as Sever's Disease (calcaneal apophysitis). With the presentation of foot pain of 6 months duration, all of the aforementioned conditions should be on a list of differential diagnoses.

Tarsal tunnel syndrome is associated with complaints of tingling and/or numbness around the medial ankle and on the plantar surface of the foot extending towards the toes,<sup>7,8,9</sup> caused by stretching or compression of the posterior tibial nerve in the tarsal tunnel. The tarsal tunnel is bordered by the calcaneus, medial malleolus, talus, and flexor retinaculum, and houses the posterior tibial nerve, artery and vein, the tibialis posterior and the tendons and muscles of the flexor digitorum longus and flexor hallucis longus.<sup>3,7</sup> It is illustrated in figures A and B (reprinted with permission).<sup>10</sup>

The pain is often worse with activity, certain shoes that

the patient may find aggravating or standing, and can be relieved by rest (with permission).<sup>3,8</sup> Symptoms can occur suddenly as a result of direct trauma or related to an inversion sprain of the ankle but may also be a result of overuse as in the case of excessive standing, walking, or exercise. Symptoms are often diffuse and poorly localized. The physical findings may vary,<sup>3</sup> and in 43% of cases the pain is worse at night.<sup>11</sup> The patient may report significant or relatively minor trauma to the foot.<sup>3</sup> The symptoms can be misinterpreted as plantar fasciitis or even radicular pain from the lumbar spine.<sup>5</sup> Proximal radiation of tingling and numbness is seen in approximately one third of cases and is called the Valleix phenomenon.<sup>3</sup>

As the tarsal tunnel has limited space available, any compromise to the space in the tunnel can put pressure on the structures within, and may cause symptoms. It is important to recall that this may include systemic diseases which cause edema such as arthritis and diabetes. Direct injuries and hyperpronation, may compromise the struc-

tures within the tunnel by physically decreasing its cross sectional area, highlighting the need to record valgus or varus deformities of the foot.<sup>9</sup> Plain film radiography, bone scan or CT is useful for identifying causes of tarsal tunnel syndrome such as fractures or osteophytes, whereas MRI is more appropriate for other causes of tarsal tunnel syndrome including: varicosities, trauma, fibrosis, accessory muscles, ganglion cysts, lipoma, and nerve sheath tumours.<sup>6</sup> Two point discrimination on the plantar surface of the foot is the first sign of sensory loss, which may progress to pinprick hypoesthesia.<sup>3</sup> Sensory testing should therefore be repeated periodically throughout the course of treatment in order to appropriately monitor the condition. Percussion of the posterior tibial nerve (Tinel's sign) may cause paresthesias along the course of the nerve,<sup>3,8,9</sup> with one study reporting that Tinel's sign is positive in only 67% of cases.<sup>11</sup> The Dorsiflexion-eversion test for tarsal tunnel syndrome (dorsiflexion and eversion of the foot with extension of the metatarsophalangeal (MTP) joints) may also be positive and create pain in the heel or reproduce the patient's pain.<sup>12</sup> This test has been shown to increase the tension on the structures of the tarsal tunnel, though it is not specific enough to differentiate between tarsal tunnel syndrome and plantar fasciitis.<sup>12</sup>

Severe presentations of tarsal tunnel syndrome may exhibit weakness of intrinsic foot muscles.<sup>11</sup> Weakened plantar muscles may cause the patient to have difficulty spreading their toes.<sup>13</sup> Atrophy may develop in the intrinsic and plantar muscles if the condition runs unchecked.<sup>13</sup> Detection of minor weaknesses in the intrinsic foot musculature is difficult in the clinical setting and referral for a nerve conduction study should be made if compromise to the motor nerves is suspected.<sup>10</sup> Signs of muscle atrophy may warrant a surgical consult.

Tarsal tunnel syndrome that is not complicated by muscle atrophy may be managed conservatively. Treatment may include: reassurance, custom orthotics, taping, bracing, stretching, strengthening, icing, soft tissue manipulation, chiropractic adjustments, massage, fascial stripping, non steroidal anti-inflammatory medication, corticosteroid injection, analgesic medication, or opioid medication.<sup>13,14,15,16</sup> If conservative intervention fails to relieve symptoms, surgical approaches may be explored, such as microsurgical decompression of the tibial nerve with splitting of the flexor retinaculum.<sup>13,15</sup>

As with other chronic conditions, beneficial effects of

manipulation and soft tissue treatment such as massage and stretching done with the intent to relieve pain and restore normal myofascial movement have been noted for plantar fasciitis and other foot disorders.<sup>16</sup> Manipulation and mobilization of hypomobile foot joints has been recommended in treatment of foot disorders such as plantar fasciitis.<sup>17</sup> Other foot conditions such as Morton's neuroma may also derive short term relief after manipulation and mobilization of the foot.<sup>18</sup> Manual therapy such as Graston technique, an instrument assisted soft tissue mobilization, Active Release Therapy and other soft tissue mobilization techniques administered with the clinicians hands have been used to treat a wide variety of conditions including, but not limited to, relieving the signs and symptoms of sprains, strains, muscular adhesions and entrapment syndromes such as carpal tunnel syndrome.<sup>19,20</sup> One study outlined the efficiency of both instrument assisted techniques as well as soft tissue mobilization done with the clinician's hands noting that while the clinical improvements were not different between the therapy groups, improvement in both groups was maintained on a 3 month follow up.<sup>19</sup>

Orthotic therapy using semi-rigid orthotics cast in non weight-bearing subtalar neutral has also been widely used to treat a variety of chronic foot conditions and are found to be beneficial in the management of plantar fasciitis.<sup>17</sup> A randomized controlled trial of chiropractic manipulation and Achilles stretching versus orthotics found that both treatments appeared successful when used individually for treatment of plantar fasciitis.<sup>21</sup> In a clinical setting, a practitioner will often use several of the tools available simultaneously to shorten the course of a complaint.

While the symptom presentation and history in this case ruled out CPRS, and a negative Morton's test decreased the likelihood of Morton's neuroma, the remaining 7 conditions remained on the differential. Tarsal tunnel syndrome may be under-diagnosed as it can be difficult to diagnose due to the ease of confusing symptoms with plantar fasciitis and other foot conditions. Additionally, it was found while researching this topic that two clinical tests for plantar heel pain, the dorsiflexion-eversion test for tarsal tunnel syndrome and the Windlass test for plantar fasciitis ("passive extension of the first MTP joint or all MTP joints with the ankle in neutral {90 degrees}"<sup>12</sup>), "seem unable to differentiate between conditions that lead to plantar heel pain."<sup>12</sup> Although the dorsiflexion-ever-

sion test may not be specific to tarsal tunnel syndrome, if performed it may have provided further support for the diagnosis. Tinel's test, which has been traditionally used to determine if an entrapment neuropathy is present, is positive in 67% of cases of tarsal tunnel syndrome, but was not present in this case. If the patient did not respond to conservative management, radiographs and/or a bone scan could have been performed to help to rule out rheumatologic causes as well as stress fracture and the rare possibility of infiltration by tumour. Unless there are signs of muscle atrophy or motor involvement, a conservative approach to treating tarsal tunnel syndrome should be attempted before referral for a nerve conduction study and prior to considering a surgical referral.

Previous studies have reported successful management of tarsal tunnel syndrome with: custom orthotics,<sup>3,14,15,16</sup> taping, bracing, stretching, icing, soft tissue manipulation, chiropractic adjustments, massage, fascial stripping, non steroidal anti-inflammatory medication, corticosteroid injection, analgesic medication, or opioid medication.<sup>13,14,15,16</sup> The patient in this case was prescribed a pair of custom orthotics but reported little change in her condition after wearing the orthotic devices for 10 weeks. A course of fascial stripping techniques to the lateral heel over the tarsal tunnel, and over the plantar and dorsal surfaces of the forefoot, and HVLA toggle board adjustments of the talonavicular joint and mobilizations of the cuboid were initiated as restrictions of joint motion were noted when evaluated for joint play. As significant improvement was reported by the patient after 4 treatments; the same treatment was continued throughout the course of therapy.

There are several factors that may have influenced the favourable outcome of this case. HVLA adjustments were used to attempt to re-establish normal motion of the cuboid and the talonavicular joint. Although orthotics alone did not ease the symptoms, orthotics were used to attempt to correct faulty biomechanics and to address dysfunctional foot mechanics, which play a role in influencing changes along the kinetic chain. Soft tissue techniques including fascial stripping were used to attempt to break down scar tissue that may have accumulated in the area.<sup>22</sup> With the onset of manual therapy, the patient seemed to have a rapid reduction of subjective symptoms, but it is important to note other factors that may have produced a favourable outcome in this case such as the use of orthotics prior to manual intervention.

Further study is needed to identify other possible treatment avenues such as specific rehabilitative exercises. Exercises that influence the strength and stability of the intrinsic musculature of the foot may prove a useful tool in the treatment of tarsal tunnel syndrome. This research might take the form of other case reports or a small scale clinical trial to compare the effectiveness of treatment with and without specific exercise prescription.

### Conclusion

Although favourable results were obtained, it is important to remember that the nature of this investigation was that of a case study, and therefore treatment was applied to only one patient. Limited as it may be, this case does demonstrate the conservative management using custom orthotics, manipulation, and fascial stripping of one case of tarsal tunnel syndrome. Conservative management of tarsal tunnel syndrome should be explored prior to more invasive procedures such as injection of corticosteroids or surgery.

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# The diagnosis and emergency care of heat related illness and sunburn in athletes: A retrospective case series

Andrew L. Miners, BPHE, BSc (Hons), CSCS, CK, DC, FCCSS(C)\*

**Objective:** *Heat illnesses contribute to significant morbidity and occasional mortality in athletic populations. Sunburn increases the risk of various skin carcinomas. This report provides an overview of the etiology, symptomatology, risk identification, prevention, and treatment for heat related illnesses and sunburn.*

**Clinical Features:** *Four cases are presented to illustrate the diagnosis and immediate treatment of exercise related heat illness and sunburn.*

**Intervention and Outcome:** *Identification of signs and symptoms combined with prompt treatment, achieved resolution in three athletes presenting with exercise related heat illness and one athlete with sunburn.*

**Conclusion:** *The best treatment approach is prevention. Chiropractors can be an important resource for information regarding prevention and treatment strategies. For mild to moderate heat illness, quick identification of signs and symptoms, followed by rapid cooling and re-hydration comprises treatment. For heat stroke, rapid and aggressive cooling is essential to reduce mortality. Best evidence treatment of sunburn is symptomatic relief with emollients and pain control via medications.*

(JCCA 2010; 54(2):107-117)

**Objectif :** *Les coups de chaleur contribuent significativement à la morbidité et occasionnellement à la mortalité pour plusieurs athlètes. Les coups de soleil augmentent le risque de développer divers carcinomes de la peau. Ce rapport présente un survol de l'étiologie, de la symptomatologie, de l'identification du risque, de la prévention et du traitement pour les coups de chaleur et les coups de soleil.*

**Caractéristiques cliniques :** *Ce rapport présente quatre cas qui illustrent le diagnostic et le traitement immédiat des coups de chaleur et des coups de soleil en lien avec l'activité physique.*

**Intervention et résultat :** *L'identification des signes et des symptômes, combinée à un traitement prompt, a permis de soulager trois athlètes qui souffraient de coups de chaleur en lien avec l'activité physique et un athlète souffrant d'un coup de soleil.*

**Conclusion :** *La meilleure approche thérapeutique est la prévention. Les chiropraticiens peuvent être une ressource importante pour diffuser l'information au sujet des stratégies de prévention et de traitement. Pour les coups de chaleur bénins à modérés, le traitement consiste en une identification rapide des signes et des symptômes, suivie d'un refroidissement et d'une réhydratation rapide. Pour les coups de chaleur plus graves, un refroidissement rapide et agressif est essentiel pour réduire l'incidence de mortalité. Le meilleur moyen prouvé de traiter les coups de soleil est le soulagement symptomatique à l'aide d'émollients et le contrôle de la douleur par les médicaments.*

(JCCA 2010; 54(2):107-117)

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**KEY WORDS:** heat illness, sunburn, diagnosis, chiropractor.

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**MOTS CLÉS :** coup de chaleur, coup de soleil, diagnostic, chiropraticien.

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## Introduction

Heat related illnesses and sunburn are extremely common but dramatically under reported.<sup>1</sup> Heat illness, including heat edema, heat cramps, heat syncope, heat exhaustion, and heatstroke, contribute to significant morbidity as well as occasional mortality in athletic, elderly, paediatric and disabled populations.<sup>1,2</sup> The incidence of heatstroke alone, in urban areas of the United States during times of high ambient temperature, is upwards of 20 cases per 100,000 people, and accounts for at least 240 deaths annually.<sup>2</sup> Among US high school athletes, “heat illness is the third leading cause of death.”<sup>1</sup> Although often associated, sunburn is not considered a true heat illness since it is a direct result of excessive sunlight exposure, whereas heat illness is a result of an increase in body temperature.<sup>1-3</sup> The data from 4,023 respondents of the 1996 Canadian National Survey on Sun Exposure & Protective Behaviours (NSSE&PB) indicated that; 53% of Canadians of age 15 years or older experience one or more sunburns during a summer, 68% of those being between the ages of 15 and 24, and a higher proportion of males reported sunburn than females.<sup>3</sup> Evidence suggests that sun exposure leading to sunburn, including a history of sunburn at young ages, increases the risk of melanoma, basal cell carcinoma, and possibly squamous cell carcinomas.<sup>4</sup> In addition to the risks of cancer, sunburn is commonly associated with heat exhaustion and heatstroke.<sup>5</sup> These are alarming statistics, considering that heat illnesses and sunburns are almost completely preventable, especially in a sporting situation.<sup>1,2</sup>

This report will describe the on-field diagnosis and immediate treatment of four teenaged female athletes with various presentations of heat related illness and/or sunburn. The report will provide an overview of the etiology, symptomatology, risk identification, prevention, and the treatment for heat related illnesses and sunburn. The illustrative cases and discussion are of interest to chiropractors due to the high occurrence rate in athletes and people who enjoy physically active lifestyles, the risk of serious illness or death, and the fact that such situations are almost completely preventable. Chiropractors, as pri-

mary contact health care providers, are ideally suited to provide evidence based information and patient education regarding the prevention and treatment of heat related illness and sunburn.

## Case Presentations

A female under-17, Canadian representative soccer team was competing in multiple games on a hot, sunny day with clear skies and minimal wind, in Central America during March break. The team flew in from Canada the evening previous, slept in a hotel, and woke-up early to arrive at the soccer fields on time. The ambient temperature was approximately 38°C (100.4°F), and no sun shelter was available. Midway through the 2nd half of the second game, several players reported various symptoms.

### Case 1

A 14-year-old female, 5'6" in height and 135 lbs., reports extreme thirst, feeling abnormally tired, and slightly dizzy. She states that she is too tired to continue playing without taking a break. Upon questioning, she states that she only had a little water in between this game and the previous game. She feels quite hot. Physical examination reveals normal vital statistics; blood pressure (BP), pulse rate (PR), respiration rate (RR), and tympanic membrane body temperature (BT).

### Case 2

A 14-year-old female, 5'8" in height and 145 lbs., with a self-reported history of “hypoglycemia,” removes herself from the game and describes symptoms of “light headedness” and “wooziness.” She also claims an abnormally high level of fatigue, and she appears very flushed with rosy cheeks, and sweaty. She reports that she has been drinking Gatorade™ fairly regularly during the day, and states that she has almost finished a 1-litre bottle. Physical examination reveals normal vital statistics (BP, PR, RR, and BT).

### Case 3

A 14-year-old female, 5'6" in height and 130 lbs., with-



draws from the game and describes symptoms of headache, extreme fatigue, dizziness, weakness, and exhibits a very flushed, rosy cheeked, sweaty appearance. She also shows mild swelling in her fingers and feet. She reports a previous history of “mild heat problems” which have included episodes of “fatigue, headaches, and dizziness” occurring during and after strenuous exercise in the heat. She uses an inhaler as required for exercise induced asthma, and she had just recently experienced the onset of menses. She has been trying to drink lots of water during the day, but is unsure of how much she may have consumed. Physical examination reveals strong and regular peripheral pulses, normal respiration, a BP of 110/74, PR of 110 beats/min, and a BT of 38.9°C (102°F).

#### Case 4

Later that evening a 16-year-old female, 5'6" in height and 117 lbs., presented with severely sunburned forehead and arms. The skin on both her forehead and arms is very red and painful to touch. Her forehead exhibits significant swelling and is starting to blister. She reports the additional symptoms of feeling hot and dizzy. She does not feel like eating. Previous medical history reveals that she takes oral acne medication and has a history of menstrual irregularity and dysmenorrhoea. Physical examination reveals normal vital statistics (BP, PR, RR, and BT).

The first three athletes were diagnosed with various severities of heat exhaustion and dehydration, from a mild to a more moderate presentation, respectively. They were removed from play for the remainder of the day, superfluous clothing was removed, cool water was splashed over their heads and upper torsos, and cool, wet towels were placed on their foreheads and necks. The third athlete presented, also had ice packs applied to both armpits and her neck. Shade was provided as best as possible using clothing and umbrellas as available. They were given easily digestible food, and instructed to slowly consume cool water until dinner time. All three of the athletes recovered rapidly and within approximately 30 to 60 minutes, reported little to no residual symptoms, with the exception of mild thirst. Upon follow-up that evening all three of the athletes had completely recovered and were continuing to slowly rehydrate with water and electrolyte sport drinks.

The fourth athlete presented, was diagnosed with multiple, moderate to severe sunburns, and the associated symptoms of excessive sun exposure. The burst blisters

on her forehead were cleaned with a mild anti-bacterial wound cleanser, and a clean dressing was applied. She was given a cool compress to apply to both her arms and forehead, and a moisturizing lotion was repeatedly applied to the burned areas on her arms. She was instructed to slowly re-hydrate with cool water, consume food when she felt better, and to maintain bed rest for the remainder of the evening and the next morning.

All four athletes were withheld from competition the next day and were continually monitored. After sunburns were covered with opaque clothing, and each athlete was instructed on, and monitored for, proper hydration and sun protection practices, all four athletes were cleared for return to play on the third day. None of the athletes experienced a recurrence of symptoms for the remainder of the trip, despite competing in five additional games under the same environmental conditions.

## Discussion

### *Heat Related Illness*

Humans are homeothermic organisms, meaning that humans regulate their own warm-blooded body temperature.<sup>6</sup> Typically speaking, humans are successful in maintaining their body temperature within a normal range of 35.8°C to 37.3°C (96.4°F to 99.1°F).<sup>1,6</sup> However, exercising in the heat places demands on the body's ability to thermoregulate.<sup>1</sup> Heat production during exercise is 15 to 20 times greater than at rest, and is sufficient to raise a persons core body temperature 1°C every five minutes, if there were no inherent regulatory mechanisms.<sup>1</sup> The heat generated by the body and the heat absorbed from the ambient environment must be offset by multiple mechanisms for heat dissipation.<sup>1</sup> These cooling mechanisms which work simultaneously to varying degrees depending on the situation include conduction, convection, radiation, and evaporation.<sup>1,2,7</sup> Conduction refers to heat loss through direct contact with a cooler object.<sup>2,7</sup> Convection is the dissipation of heat when relatively cool air passes over exposed skin.<sup>2,7</sup> Radiation is the release of heat from the body directly into the environment, and evaporation through sweating, is a process that incorporates the processes of both convection and radiation by the secretion of body water through to the skins surface.<sup>2,7</sup>

Assuming a healthy body, heat exchange using the aforementioned mechanisms is dependent on gradients of

temperature and moisture.<sup>6</sup> As the ambient temperature and humidity increases, the thermal transfer from the body to the environment becomes less efficient.<sup>1,2,6</sup> When the ambient temperature rises above 20°C (68°F), the processes of conduction, convection, and particularly radiation, become less and less efficient.<sup>1</sup> In such situations the bulk of heat dissipation, especially in an exercising individual, results from evaporation through the process of sweating.<sup>1,7</sup> In hot, dry conditions, evaporation from sweating can account for as much as “98% of dissipated heat.”<sup>1</sup> Thus, any factor that limits the body’s ability to utilize evaporative sweating processes, such as high humidity, dehydration, or restrictive non-breathable clothing, will have a profound effect on physiological function, athletic performance, and the risk for heat illness in exercising individuals.<sup>1,7</sup>

Body temperature homeostasis is about balance.<sup>8</sup> Heat dissipation must equal heat accumulation. When heat accumulation surpasses heat dissipation, homeostasis is lost and hyperthermia is the result.<sup>8</sup> Marsh and Jenkins (2002) state that the “continuum of hyperthermia symptom progression results in the clinical subcategories of heat illness,” meaning that the various subcategories of heat illness (heat edema, heat cramps, heat syncope, heat exhaustion, and heatstroke) are the attendant clinical symptoms of various stages of hyperthermia.<sup>8</sup> Although traditionally heat edema, heat cramps, heat syncope, heat exhaustion, and heatstroke are the five common types of heat illness typically associated with strenuous activity in hot, humid weather, there is disagreement as to whether heat edema and heat cramps are distinct conditions.<sup>1,7-9</sup> Additionally, heat syncope is often used interchangeably with heat exhaustion.<sup>1,7,8,10</sup> In fact, recent observations contend the idea that heat edema, heat cramps, heat syncope, and heat exhaustion are “heat illnesses” at all.<sup>7,9</sup> A narrative review by Noakes (2008) contends that “heat stroke is the only condition that can be truly described as a heat illness, since it is the only condition in which there is clear evidence for a pathological elevation of body core temperature.”<sup>9</sup>

Heat edema is the mildest form of exercise related heat illness, and most commonly affects unacclimatised individuals in extreme heat.<sup>1,8</sup> It is characterised by transient peripheral vasodilation complicated by orthostatic pooling of venous blood return, and it is generally considered to be a warning sign for heat exhaustion.<sup>1</sup> Symptoms include;

mild dependant edema in the hands and feet, normal vital signs, and concurrent symptoms of heat exhaustion may be present.<sup>1</sup> Heat cramps can occur during or after strenuous activity in unacclimatised individuals in extreme heat.<sup>1,8</sup> Cramping is attributed to excessive fluid and sodium loss via sweat, and the negative sodium balance which results from replacing lost water only.<sup>1,8</sup> Like heat edema, heat cramps are considered a warning sign for the onset of heat exhaustion.<sup>1</sup> Symptoms include; acute muscle spasms, normal vital signs, and concurrent symptoms of heat exhaustion.<sup>1</sup> Heat syncope (fainting) is typically associated with prolonged standing or with a sudden rise from a seated or lying position in the heat.<sup>1</sup> The condition is thought to result from inadequate cardiac output and postural hypotension from prolonged dehydration.<sup>1</sup> Symptoms of heat syncope include acute/sudden temporary loss of consciousness and typically normal vital signs, however blood pressure may be abnormally low temporarily.<sup>1</sup> Heat exhaustion is the most common form of exercise related heat illness, and realistically, likely encompasses the first three subcategories of heat illness.<sup>1,2,8-10</sup> It represents a failure of the cardiovascular response to workload, typically under conditions of high external temperature and dehydration, and results in the inability to continue exercise or strenuous activity in the heat.<sup>1,2,8,10</sup> Onset is usually sudden and the duration is typically brief.<sup>1</sup> Symptoms include a core body temperature rise within the range of 37.3°C to 40°C (99.1°F to 104°F), and any combination of the signs and symptoms listed in Figure 1.<sup>1,2,8,10</sup> However, recent studies have shown that the range of rectal temperatures in collapsed ultra-marathon runners is no different from those measured in asymptomatic runners, and that temperatures in some asymptomatic runners exercising in the heat can be above 40°C.<sup>7,10,11</sup> Researchers point to the observation that “approximately 75% of subjects seen in the medical tent at the finish of an ultra-marathon race had collapsed after they had finished the race, not during.”<sup>7,9</sup> This observation seems to contradict the notion that athletes collapsing at the end of an endurance event are experiencing “heat exhaustion.”<sup>7,9</sup> If such athletes were experiencing significant dehydration combined with excess body heat, then it seems intuitive that they should have collapsed during the race, when demands on the cardiovascular and heat dissipation systems are maximally stressed, not at the end when the stress has been reduced.<sup>7,9</sup> Evidence suggests that the fainting mechanism is actually a result of postural

Figure 1 *Signs and Symptoms of heat exhaustion.*


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Signs and Symptoms of heat exhaustion may  
Include...

- Headache
- Extreme weakness
- Dizziness, vertigo
- Heat sensations
- Heat cramps
- Chills
- Irritability
- Syncope
- Sudden onset
- Low blood pressure
- Elevated pulse
- Vomiting/nausea

and a core temperature rise of ...

**37.3°C (99.1°F) ↔ 40°C (104°F)**

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hypotension that develops after prolonged exercise due to “exercise-induced changes in blood pressure regulation and a state of low peripheral vascular resistance.”<sup>9</sup> Hence, Noakes (2008) suggests that athletes presenting with signs and symptoms consistent with a diagnosis of heat exhaustion would better be diagnosed with “exercise-associated postural hypotension.”<sup>9</sup> An interesting and likely accurate argument, however for the purposes of this paper the classical diagnostic term of “heat exhaustion” is utilized. Heatstroke is defined by the American College of Sports Medicine as “a condition in which body temperature is elevated to a level that causes damage to the body’s tissues, giving rise to a characteristic clinical and pathological syndrome affecting multiple organs.”<sup>10</sup> It is a medical emergency involving total thermoregulatory failure that will not spontaneously reverse without external cooling measures.<sup>1,2,10</sup> Heatstroke is subdivided into classical and exertional forms.<sup>8,10</sup> Classical heatstroke is caused by environmental exposure and results in core body hyperthermia in excess of 40°C (104°F), central nervous system dysfunction, and the inability to sweat, a sign called anhidrosis.<sup>1,2,8,10</sup> It primarily occurs in the elderly and those with chronic illness, and may develop slowly over several days.<sup>2</sup> Exertional induced heatstroke is associated

with hard exertion or exercise in a hot, humid environment resulting in core hyperthermia above 40°C (104°F) and central nervous system dysfunction.<sup>1,8-10</sup> In contrast to the classical form, patients with exertional heatstroke may continue to sweat temporarily.<sup>8,10</sup> It primarily affects younger, active persons, and has a relatively rapid onset, developing in hours, not days.<sup>1,8,10</sup> It is important to note that the diagnosis of heatstroke, either classical or exertional, rests on two critical factors; hyperthermia in excess of 40°C (104°F), and central nervous system dysfunction.<sup>1,2,8-10</sup> Additional signs and symptoms that may accompany a diagnosis of heatstroke are listed in Figure 2.

### *Sunburn*

Sunburn is the acute reaction of the skin to damage by ultraviolet (UV) light exposure.<sup>5,12-14</sup> It is estimated that 90% of UV light reaching the earth is UV light type “A” (UVA), which has been shown to penetrate into the dermis and contributes to the visible signs of aging and skin degeneration.<sup>12</sup> The remaining 10% of UV light is UV light type “B” (UVB), the light responsible for sunburn erythema.<sup>12</sup> The pathogenesis of sunburn is most likely due to vasodilation and increased vascular permeability of blood vessels in the upper dermis leading to erythema,

Figure 2 Diagnostic criteria and additional signs and symptoms associated with heatstroke.

The diagnosis of heatstroke rests on two critical factors:

1. Hyperthermia > 40°C (104°F)
2. Central Nervous System Dysfunction

Additional signs and symptoms may include...

- Anhidrosis\*
- Cardiac Arrhythmias
- Hyperventilation
- Shock
- Visual Disturbances
- Irritability
- Seizures
- Confusion
- Anorexia
- Dizziness
- Fatigue / Weakness
- Headache
- Nausea
- Ataxia
- Coma

\* Patients with exertional heat stroke may temporarily continue to sweat !!

edema, inflammatory response, and irreversible DNA damage.<sup>12</sup> It is DNA damage that leads to the increased risk of skin cancer.<sup>3,12</sup> The signs and symptoms of sunburn include; erythema, edema, blisters, ulcerations, and pain.<sup>5,12</sup> Signs and symptoms typically become evident 3 to 5 hours after exposure, peaking in 12 to 24 hours, and generally start to dissipate by 72 hours post exposure.<sup>5,12</sup> Although not common practice, sunburns can be graded in terms of severity.<sup>5</sup> First-degree sunburn involves only erythema, second-degree burns have erythema and blistering, and third-degree burns have erythema, blisters, and ulcerations.<sup>5</sup>

#### *Risk Factors for Exercise Related Heat Illnesses and Sunburn*

The major risk factor for exercise related heat illness is high ambient heat combined with a high level of humidity.<sup>1,8,15</sup> Determination of the wet bulb globe temperature (WBGT) is used to assess environmental conditions and the associated risk of heat illness.<sup>1</sup> WBGT is a standardized index of environmental heat stress that can be obtained using commercially available devices.<sup>1</sup> It takes

into account the contributions of ambient temperature, radiant heat, and humidity.<sup>1</sup> WBGT above 27.8°C (82°F) is considered 'very high risk.'<sup>1</sup> WBGT between 22.8°C (73°F) and 27.8°C (82°F) is considered 'high risk.'<sup>1</sup> WBGT between 18.3°C (65°F) and 22.8°C (73°F) is considered 'moderate risk,' and WBGT below 18.3°C (65°F) is considered 'low risk.'<sup>1</sup> The risk associated with high environmental heat and humidity can also be assessed by utilizing a heat illness risk assessment chart (see Figure 3) in combination with readings for temperature and humidity available from local news stations or internet weather sites. Another major risk factor for exercise related heat illness is hydration status.<sup>1,15-17</sup> Athletes typically dehydrate during exercise in the heat because of the unavailability of fluids or a mismatch between thirst and water requirements.<sup>15</sup> A 1% reduction in body weight due to water loss can induce stress on the cardiovascular system in addition to increases in heart rate and an inhibition in heat transfer to the skin and the environment, thus contributing to an increase in core body temperature.<sup>17</sup> When exercising in the heat, water intake equalling sweat loss results in the slowest core temperature rise compared

Figure 3 Example of heat illness risk assessment charts. A) Heat index value is determined from temperature ( $^{\circ}\text{C}$ ) versus relative humidity (%). B) The risk of heat illness is estimated from the heat index value.

A)

		Relative Humidity (%)					
		90	80	70	60	50	40
Temperature $^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	26.7 (80)	85	84	82	81	80	79
	29.4 (85)	101	96	92	90	86	84
	32.2 (90)	121	113	105	99	94	90
	35.0 (95)		133	122	113	105	98
	37.8 (100)			142	129	118	109
	40.5 (105)				148	133	121
	43.3 (110)						135

B)

Heat Index Value	Risk of Illness	Possible Heat Related Illness
80 – 90	Mild	Fatigue and heat illness possible with prolonged exposure and physical activity
90 – 105	Moderate	Heat exhaustion possible
105 – 130	Severe	Heat exhaustion likely, and heatstroke possible
> 130	Extreme	Heatstroke highly likely with continued exposure

Note: The values for heat index are based upon shady, light wind conditions. Exposure to direct sunlight can increase the heat index by up to  $9^{\circ}\text{C}$  ( $15^{\circ}\text{F}$ ). Information adapted from <http://www.crh.noaa.gov/pub/heat.php>.

Figure 4 Additional risk factors for exercise related heat illness.<sup>1,8,10</sup>

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### Additional risk factors for exercise related heat illness

- Prior history of heat illness
  - Sleep deprivation
  - Prepubescent Age
    - Sweat less than adults and have lower heat tolerances
  - Obesity
    - Reduced ability to dissipate heat
  - Gender
    - Theoretical risk increase during the luteal phase of the menstrual cycle when core body temperature is increased by ~ 0.6°C (1.2°F)
    - However, clinical evidence to support this theory is lacking
  - Heavy or restrictive clothing or protective equipment
  - Medications
    - Diuretics, antidepressants, antihistamines, stimulants
  - Stimulants
  - Alcohol consumption
  - Sweat gland dysfunction
    - Spinal cord injury
  - Sunburn
    - Lack of sunscreen use
  - Upper respiratory illness
    - Fever
  - Acute gastroenteritis within 1 week of strenuous exercise
    - Diarrhea
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with ‘at will’ drinking and no water consumption.<sup>1,15,17</sup> Lack of acclimatisation is the third major risk factor for exercise related heat illness.<sup>16</sup> People who are adjusted to activity in heat show a significantly increased ability to resist heat illness due to an increased sweating response, decreased heart rate, and a reduction in the level of perceived exertion during exercise in the heat.<sup>16</sup> Compared to non-acclimated persons, acclimated persons demonstrate a comparatively lower core and skin temperature during exercise in the heat.<sup>16</sup> The fourth major risk factor for heat illness in athletes is poor relative fitness level.<sup>16</sup> Studies have shown that persons with high cardiovascular fitness, compared to untrained individuals, have an increased ability to dissipate heat, increased heat tolerance, and an increased glycogen storage ability which increases a body’s ability to store water.<sup>16</sup> In addition to the major risk factors for exercise related heat illness, there are a variety of other factors that have been theoretically linked to an increased risk of heat injury.<sup>1,8,10</sup> The associated risk factors are listed in Figure 4.

Purdue et al., (2001) utilizing information collected from the 1996 National Survey on Sun Exposure & Protective Behaviours (4,023 respondents) determined that the following factors are related to an increased risk of sunburn for persons in Canada; Ontario resident, younger

age, male sex, upper middle to high income status, birth-place in North America, lighter skin colour, lighter hair colour, no personal history of skin cancer, family history of skin cancer, high awareness of the UV index, having worked outdoors over the previous summer, and increased leisure-time sun exposure.<sup>3</sup>

#### Prevention

Heat illness prevention depends on removing and/or minimizing risk factors.<sup>1</sup> Thus, education is the first stage of prevention. Coaches, trainers, and the athletes themselves must be exposed to current and accurate information regarding the risks of exercise induced heat illness.<sup>16</sup> It is of utmost importance that the athletes understand the various risks and predisposing factors, and that they are educated on how to minimize them.<sup>1,16</sup> Proper hydration is an excellent example. Athletes are often poorly educated regarding hydration practices.<sup>1</sup> In some athletic cultures, an ‘old school’ mentality persists where fluid restriction during athletic training is practiced and deemed necessary to ‘toughen up’ the athletes.<sup>1</sup> Additionally, it is not uncommon for athletes to receive much of their hydration information from well intentioned but under-informed coaches, team-mates, or parents.<sup>1,16</sup> This may impart from the fact that there remains some variability within

the literature regarding the best hydration and re-hydration protocol.<sup>11,15-17</sup> However, most sources recommend that athletes should consume 500 ml of fluid (water or electrolyte sports drink) one to two hours prior to an athletic event, and then consume approximately 250 ml of fluid every 20 minutes during exercise in activities lasting greater than one hour.<sup>1,15-17</sup> Following exercise, an athlete should replace sweat water loss with 1.2 L of water containing 4% to 8% of carbohydrate (CHO) for every kilogram of body weight lost.<sup>1,15-17</sup> However athletes should be careful not to consume greater than 1.5 L of fluids each hour to avoid gastric discomfort.<sup>1,15-18</sup>

Another area where an athlete can practice prevention is by becoming acclimated or acclimatized to exercise in the heat. This is more of an art than a science, as proper adaptation depends on the intensity and duration of exercise, on the environmental conditions, and the individual athlete.<sup>16,18</sup> However, adaptation generally requires 7 to 10 days of 60 to 100 minutes of moderately strenuous exercise carried out in hot conditions, with the objective of raising body temperature and stimulating a significant sweating response.<sup>16</sup>

In addition to the above, exercise related heat illness can be prevented by athletes having heat exercise experience, and a self-awareness of how their body is responding to activity in the heat.<sup>1,15-17</sup> Events can be timed to take place around the cooler times of the day, as opposed to occurring during or through high heat daytime hours.<sup>15-17</sup> Athletes should wear light coloured, low weight, loose breathable clothing which does not interfere with the body's cooling processes of conduction, convection, radiation, and evaporation.<sup>1,2,11,15-17</sup> Athletes can maintain good lifestyle practices of eating a well balanced diet, maintaining regular hydration, and keeping cardiovascular fitness levels high.<sup>1,15-17</sup> In addition to actively minimizing risk and predisposing factors, it is the responsibility of the athlete, team-mates, parents, coaches, trainers, and team doctors to monitor how someone is responding to exercising in the heat, and to obtain help and/or implement prevention/treatment strategies should any signs or symptoms of heat illness arise.

As with heat illness, the prevention of sunburn starts with education. Simple behavioural measures have been proven to minimize the risk of experiencing sunburn.<sup>13</sup> Minimizing sun exposure, wearing protective clothing, and using topical sunscreens, are simple measures to undertake, which will significantly reduced a persons

risk of incurring sunburn.<sup>3,13</sup> It is generally recommended that the minimum level of sunscreen protection utilized when exercising in the heat is sun protection factor (SPF) 15, however longer sun exposure times will necessitate higher levels of protection and repeated applications.<sup>3,13</sup>

### *Treatment*

When signs and symptoms of exercise induced heat illness present in an athlete prompt recognition is essential. Once symptoms have been recognized and the athlete assessed, treatment can be initiated.<sup>2,10,19,20</sup> For the milder presentations of heat illness treatment is fairly straightforward and typically involves removal of the athlete from the hot environment, resting the patient in the side lying recovery position, then a gradual cooling of the patient by utilizing cool, wet towels or ice packs placed in the athletes underarms (axillae), groin, base of neck, or forehead.<sup>19</sup> It is hypothesized that the application of cool compresses to areas where large arteries are relatively superficial in addition to the head and neck help to maximize the heat dissipation mechanism of conduction. However, to this author's knowledge no study has been conducted to confirm the benefits of one area of cool compress application over another. Once cooling has been initiated, the athlete can slowly begin to consume cool carbohydrate/electrolyte fluids, while recovery and vitals are further monitored.<sup>2,19</sup> It is recommended that following a mild heat related illness, athletes should be protected from heat exposure for 24 to 48 hours.<sup>2</sup>

The initial treatment of athletes presenting with heat exhaustion involves prompt recognition and stabilization in a cool area.<sup>2</sup> If the patient is not stabilized, and the factors leading to the patient's condition are not corrected swiftly, a progression to heatstroke may occur.<sup>2</sup> The patient's vital statistics, including blood pressure, heart rate, body temperature, and cognitive/central nervous system (CNS) functioning, should be determined and monitored.<sup>2,10</sup> The patient should be placed in the recovery position and cooling should be immediately initiated.<sup>2,10</sup> The skin can be wetted to start evaporative cooling in combination with cool, wet towel application and ice packs applied to the aforementioned areas.<sup>2</sup> Once cooling has begun, hydration can also be initialized.<sup>2,19</sup> Should symptoms fail to abate within 20-30 minutes, or if the patient's vitals deteriorate, advanced medical care should be obtained and added cooling methods undertaken.<sup>2,10,19,20</sup> Athletes diag-

nosed with heat exhaustion must be protected from heat exposure for a minimum of 48 hours after injury.<sup>2</sup>

Heatstroke is an emergency situation. Therefore prompt and accurate recognition is imperative. As mentioned previously, the diagnosis of heatstroke, either classical or exertional, rests on two critical factors, hyperthermia in excess of 40°C (104°F), and central nervous system dysfunction.<sup>1,2,8,10</sup> The American College of Sports Medicine states that “mortality rate and organ damage due to heatstroke are proportional to the length of time between core temperature elevation and initiation of cooling therapy.”<sup>10</sup> Consequently the initial stage of treatment for someone suspected of having heatstroke should be rapid and aggressive body cooling.<sup>10</sup> Because rapid, aggressive cooling is the key to preventing mortality in patients diagnosed with heatstroke, several different cooling methods have been investigated and studied.<sup>2,10,19,20</sup> Methods include; body immersion in iced water, evaporative cooling water spray and fans, immersing the hands and forearms in cold water, the use of ice or cold packs in the neck, groin, and axillae, invasive methods of iced gastric, bladder, or peritoneal lavage, and chemically assisted cooling.<sup>2,10,19,20</sup> Evidence for and against these methods comes in the form of controlled trials, several case series, and experimental cooling method protocols. However, conclusive recommendations are generally lacking.<sup>2,10,19,20</sup> A review of cooling methods for heatstroke by Hadad et al., in 2004, concluded that the majority of data, based on experimental models or healthy subjects, suggests that evaporative cooling is the best method to rapidly and safely lower core body temperature.<sup>20</sup> However, in cases of actual heatstroke, cold water immersion was found to be the best for rapid cooling and a reduction in mortality.<sup>20</sup> Yet, Haddad et al., (2004) also state that for field use, both methods were determined to be impractical, and that where immediate cooling is imperative, splashing copious amounts of cool water (1°C–16°C, 33.8°F–60.8°F) over the patient together with air fanning is strongly recommended.<sup>20</sup> In 2005, a review by Smith concluded that the main predictor of outcome in exercise induced heatstroke is the duration and degree of hyperthermia, and that patients should be cooled using iced water immersion, or a combination of other techniques where iced water is not possible.<sup>19</sup> Smith (2005) further stated that there was no evidence to support chemically induced cooling, and that further controlled trials are necessary to strengthen the

overall recommendations.<sup>19</sup> The consensus for practical emergency field care cooling methods at athletic events, are a combination of cool water spraying, fanning, cool wet towel application, and ice pack application to the neck, groin, and axillae.<sup>2,10,19,20</sup> Regardless of the cooling method utilized, vital signs must be monitored during cooling, aggressive cooling should be stopped once core rectal temperature reaches 38°C (100.5°F), and the athlete should be transported for continued monitoring and/or advanced medical care as soon as possible.<sup>2,10,19,20</sup>

Many sunburn treatment methods have been proposed and investigated.<sup>12</sup> However, conclusive evidence for any single treatment is lacking.<sup>12,14</sup> A review of the management of acute sunburn by Han and Maibach in 2004, concluded that regardless of the treatment modality, the damage to epidermal cells after sunburn is the same and cannot be reversed.<sup>12</sup> They further concluded that corticosteroids have minimal effect on the pain and tissue injury associated with sunburn, and that non-steroidal-anti-inflammatory drugs (NSAIDs) may have an effect on pain and erythema, but the effect tends to diminish after 24–36 hours.<sup>12,14</sup> Antihistamines have been proven to be ineffective.<sup>12</sup> Emollients (aloe vera, etc.) may be helpful for controlling pain and decreasing sunburn associated symptoms, but studies do not support the idea that emollients decrease the recovery time from sunburn.<sup>12</sup> Han and Maibach (2004), state that based on published evidence, the most logical treatment of sunburn is symptomatic relief with emollients, and pain control via medications if needed.<sup>12</sup> Included in this regimen would be cool compresses and oatmeal soaks in cool water for relief.<sup>12</sup>

## Conclusions

Exercise related heat illness and sunburns, particularly the milder forms, are very common problems for athletes training or competing in hot climates or during the hotter seasons of the year. The best treatment approach, as with all injuries, is prevention. The major modifiable risk factors for heat illness are exercising in high heat and humidity, dehydration, and acclimatization, while the modifiable risk factor for sunburn is sun exposure. For the mild to moderate forms of heat illness, quick identification of signs and symptoms, followed by rapid cooling and proper re-hydration comprises the basic principle for emergency treatment. For the emergency situation of heat stroke, rapid and aggressive cooling is essential to reduce



mortality. Best evidence treatment of sunburn seems to be symptomatic relief with emollients and pain control via medications. Ultimately, both exercise related heat illness and sunburn are preventable injuries. Consequently, it is the responsibility of those caring for athletes, the parents, coaches, trainers, and team doctors, to ensure that athletes are educated in preventative strategies and are properly monitored during training or competition in the heat. Chiropractors, as primary contact health care providers, are ideally suited to provide this type of education and care to athletes, physically active patients, and to the general population.

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# Outcome measures and their everyday use in chiropractic practice

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**Objectives:** *To describe the extent to which chiropractors utilize standardized outcome and various clinical measures to systematically document patients' baseline health status and responses to treatment, with particular consideration being given towards quantifiable outcome instruments.*

**Study design:** *Cross-sectional mailed survey.*

**Participants:** *Registered chiropractors in the province of Saskatchewan.*

**Methods:** *A survey was mailed to all registrants of the Chiropractors' Association of Saskatchewan. Respondents graded their frequency of using various standardized pencil-and-paper instruments and functional chiropractic, orthopaedic and neurological tests in the contexts of both the initial intake assessment ('always,' 'commonly,' 'occasionally,' or 'never') and the course of subsequent treatment (after 'each visit,' after '9-12 visits,' 'annually,' when patient 'not responding,' on 'dismissal/discharge,' 'never' or for some 'other' reason). Data were tabulated for all item and response category combinations as frequencies and percentages using the total sample size as the denominator.*

**Results:** *Of 164 registered chiropractors, 62 (38%) returned a completed questionnaire. A pain diagram was the most commonly used subjective outcome measure and was administered routinely (either "always" or "commonly") by 75% of respondents, at either the initial consultation or during a subsequent visit. Numerical rating and visual analogue scales were less popular (routinely used by 59% and 42% respectively). The majority of respondents (80%) seldom ("occasionally" or "never") used spine pain-specific disability*

**Objectif :** *Décrire l'étendue de l'utilisation d'indicateurs de résultats standardisés et de mesures cliniques variées par les chiropraticiens afin de documenter systématiquement le niveau de l'état de santé initial des patients et leur réponse au traitement, en mettant l'évidence sur les instruments de mesure des résultats.*

**Type d'étude :** *Enquête transversale expédiée par la poste.*

**Participants :** *Chiropraticiens enregistrés en Saskatchewan.*

**Méthodologie :** *Un sondage a été expédié par la poste à tous les membres de la Chiropractors' Association of Saskatchewan. Les répondants ont noté leur fréquence d'utilisation de divers instruments papier-crayon standardisés et de tests fonctionnels chiropratiques, orthopédiques et neurologiques standardisés dans les contextes de l'évaluation initiale (« toujours », « souvent », « à l'occasion » ou « jamais ») et au cours du traitement subséquent (après « chaque visite », après « de 9 à 12 visites », « annuellement », lorsque le patient « ne répond pas », lors de l'« abandon », « jamais » ou pour une « autre » raison). Les données ont été totalisées pour tous les articles et toutes les combinaisons de catégories de réponses sous forme de fréquence et de pourcentages en utilisant en tant que dénominateur la taille totale de l'échantillon.*

**Résultats :** *Des 164 chiropraticiens enregistrés, 62 (38 %) nous ont rendu un questionnaire rempli. Un diagramme de la douleur était l'outil de mesure subjectif le plus communément utilisé et était administré couramment (soit « toujours » ou « communément »)*

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indices such as the Low Back Revised Oswestry, Neck Disability Index or the Roland-Morris Questionnaire. As well, they did not use standardized psychosocial instruments such as the Beck Depression Index, or general health assessment measures such as the SF-36 or SF-12 questionnaire. Neurological testing was the most commonly used objective outcome measure. Most respondents (84% to 95%) indicated that they continually monitored neurological status through dermatomal, manual muscle strength and deep tendon reflex testing. Ranges of motion were routinely measured by 95% of respondents, usually visually (96%) rather than goniometrically or by some other specialized device (7%).

Conclusions: Our findings suggest that the majority of chiropractors do not use psychosocial questionnaires or condition-specific disability indices to document baseline or subsequent changes in health status. Chiropractors are more likely to rely on medical history taking and pain drawings during an initial intake assessment, as well as neurological and visually estimated range of motion testing during both initial intake and subsequent treatment visits.

(JCCA 2010; 54(2):118–131)

KEY WORDS: outcome measure, survey, Saskatchewan, chiropractor.

## Introduction

There is a continuing trend in the health care industry towards a consumer driven market. Government health insurance plans, private health insurance carriers, employers and unions all have a vested interest in controlling spiraling costs and understanding treatment efficacy.<sup>1,2</sup> To

par 75 % des répondants, soit lors de la consultation initiale ou au courant de l'une des visites subséquentes. L'évaluation chiffrée et les échelles analogues visuelles étaient moins populaires (couramment utilisées par respectivement 59 % et 42 % des répondants). La majorité des répondants (80 %) utilisaient rarement (« à l'occasion » ou « jamais ») des indices d'invalidité spécifiques à la douleur de la colonne vertébrale comme le Low Back Revised Oswestry, l'index d'invalidité au cou ou le questionnaire Roland-Morris. De plus, ils n'utilisaient pas d'instruments psychosociaux standardisés tels que l'inventaire de dépression de Beck, ou d'outils servant à évaluer l'état de santé général comme les questionnaires SF-36 ou SF-12. L'évaluation neurologique était l'indicateur des résultats le plus communément utilisé. La plupart des répondants (de 84 % à 95 %) ont indiqué qu'ils surveillaient de façon continue l'état neurologique par l'évaluation au niveau des dermatomes, de la force musculaire manuelle et des réflexes tendineux. L'amplitude des mouvements était couramment mesurée par 95 % des répondants, habituellement de manière visuelle (96 %) plutôt que de manière goniométrique ou par un autre appareil spécialisé (7 %).

Conclusion : Nos résultats suggèrent que la majorité des chiropraticiens n'emploient pas de questionnaires psychosociaux ou d'indices d'invalidités spécifiques au problème afin de documenter le niveau de base ou les changements subséquents dans l'état de santé. Les chiropraticiens ont plus tendance à se fier à l'historique médical et aux diagrammes de la douleur lors de l'évaluation initiale, ainsi qu'aux tests neurologiques et à l'amplitude des mouvements estimée à l'œil lors de l'évaluation initiale et des traitements subséquents.

(JCCA 2010; 54(2):118–131)

MOTS CLÉS : indicateur des résultats, enquête, Saskatchewan, chiropraticien.

help them in their decisions, third party payers such as Workers' Compensation boards and automobile insurance corporations presently require the attending clinician to provide documented evidence of a patient's response to care over time. There was a time when the expressed opinion of a doctor was all the evidence that was required.

However, as health care moves forward, there is an ever increasing challenge facing every health profession to provide (quantifiable) documented evidence of biological as well as psychosocial dysfunction and to provide proof that these factors improve more favorably with care than without.<sup>3</sup>

The use of outcome assessments is essential in modern health care to assess quality of care and contain costs.<sup>1p.147</sup> Usually during the initial consultation a clinician will use various outcome measures to establish baselines and then monitor these defined parameters as a gauge of progress. In recent years the Canadian Chiropractic Association has promoted the utilization of outcome measures by providing its membership with specific examples and guidelines.

There are two general types of outcome measures used in chiropractic practice: (1) patient-administered self-reporting instruments, and (2) clinician-administered functional assessment methods. Self-reporting measures rely on the patient's own assessment of their current health status.<sup>4</sup> Throughout most of the history of health care the patient and the health care provider determined whether the patient was making satisfactory improvement through simple conversation.<sup>5p.226</sup> Over the past few decades there has been a shift towards self-reporting instruments that are practical, reliable, valid and responsive to changes in clinical status. There are an enormous number of patient self-reporting outcome measures available to all health and social science disciplines. The MAPI Research Trust in Lyon France has developed a database which contains descriptions of over 470 validated patient-reporting outcome and quality of life instruments (PROQOLID).<sup>6</sup> Within that database, they are organized into three basic categories: (1) pathology or disease specific, (2) population and (3) generic. The PROQOLID data base was created to present an overview of existing Patient Reported Outcome (PRO) instruments as well as relevant and updated information on each. The Oswestry Low Back Disability Index (OLBDI),<sup>7</sup> Roland Morris Disability Questionnaire (RMDQ),<sup>8</sup> Neck Disability Index (NDI)<sup>9</sup> and the Bournemouth Back Questionnaire (BBQ)<sup>10</sup> are but a few of the instruments that consist of scales covering pain intensity, disability in activities of daily living, and social life and fear-avoidance behavior specifically due to neck or back pain. Their utilization is designed to enhance doctor-patient communication and improve goal setting and decision making.

Pain scales and pain drawings are also accepted methods of patient self reporting. Measuring pain intensity can be accomplished by using verbal rating scales, visual analog scales and numerical rating scales. The pain drawing or diagram is perhaps the best way to obtain the patient's perception of the location of their symptoms.<sup>11</sup>

Patient self-reporting using standardized questionnaires of physical function has clinical usefulness but may not be a valid reflection of a patient's actual functional status.<sup>1p.261</sup> Despite the fact that there is variability in the reliability between patient-driven subjective measures and clinician-driven objective measures there is no excuse to ignore the utilization of objective measures.<sup>12</sup> The physical medicine rehabilitation field has long been the leader in developing clinically sensitive, objective functional outcome measures that can be used in typical clinical settings. A clinician-directed functional outcome measure should provide a baseline by which to measure a physical impairment or loss of some ability of the body as a pathological, anatomical or physiological abnormality in structure of function.<sup>3</sup> Ideally the functional outcome measure should be quick, simple and most important be able to quantitatively determine a patient's baseline level of physical function. Established baseline levels are necessary for identifying and classifying the severity of functional deficits, which in turn help clinicians to define subsequent treatment targets and therapeutic goals. A favorable change in status not only reassures patient but also provides diagnostic and treatment justification for both the clinician<sup>12</sup> and third party payors. Ultimately functional outcome measures should provide an objective quantifiable baseline that will influence treatment decisions and provide a meaningful end point of care. The clinician should focus on assessing physical function that identifies movement difficulties that relate to activities of daily living (ADL).

One of the most basic functional assessments is simply measuring the patient's active and passive range of motion.<sup>13,14</sup> The presence or absence of normal motion and whether pain was present or increased during the motion evaluation should be of interest to the clinician. Movement difficulties could also reflect deficiencies with muscle strength and endurance. The first line of defense to protect a joint complex is the muscles that surround it. While Biering-Sorensen showed that decreased torso extensor endurance predicts those who are a greater risk

of future back pain, recent work by McGill suggested that the balance of endurance among the torso flexors, extensors and lateral musculature better discriminates those who have had back problems from those who have not.<sup>15</sup> There are standardized performance tests that provide normative values for strength and endurance, which allow practitioners to more accurately assess each patient's performance in relation to other members of the general population who are similar in terms of age, gender and vocation (blue collar versus white collar).<sup>1p.229,16,17</sup>

The combined usage of patient-administered and clinician-administered outcome measures should be viewed as the expected standard of care as this protects the patient from ill-defined treatment thresholds and needless costs, particularly when there is no established end point of care.

It is not known whether individual chiropractors are incorporating such outcome measures into their case management. The purpose of this study was to determine the extent to which a range of relatively common outcome instruments applicable to chiropractic practice were being utilized by chiropractors.

## Methods

The study design was a cross-sectional mailed survey. The target population was practicing Canadian chiropractors. However, the sample frame was all practitioners currently registered with the Chiropractors' Association of Saskatchewan (CAS). This frame was chosen as a manageable representative sample of Canadian chiropractors.

Membership in the CAS is a mandatory requirement for practice in Saskatchewan. For this study, all of the 164 registered members were invited to participate in the survey via a mail-out invitation. Their responses were to be either mailed or faxed back to the researchers.

### Questionnaire design

The choice of outcome instruments to inquire about in this survey was challenging. One data base alone yielded several hundred different pen and paper instruments. We elected to inquire about instruments which tended to be commonly cited within the rehabilitation community, and that would also be likely to be familiar to and/or be perceived as being a "gold standard" within the chiropractic community at large. As one of the purposes of systematically assessing outcomes is the communication of subsequently collected data to third parties (both within and

outside of the chiropractic profession) we did not restrict our choice of instruments to those that were necessarily specific to chiropractic patients or conditions. Only one lesser known instrument (the Patient-Rated Wrist Evaluation [PRWE]) was inquired about in our survey simply because it was going to be described at length at an upcoming Saskatchewan Worker's Compensation seminar. However, even though this instrument was "on the desktop" as it were, we do not feel its inclusion biased the results of this study. (We feel this position is supported by the overall lack of utilization of this instrument despite it's having had a current advocate in the SWC.) In general, although we included some common diagnostic procedures, our primary purpose was twofold; principally to see if practitioners were utilizing quantifiable studies and secondly, are they performing regular monitoring (re-evaluations) of their relevant intake findings.

The survey was subdivided into seven categories (Appendix 1). Four of these categories (General Health, Pain Scales, Disability Indexes and Psycho-Social) were considered subjective patient self-reporting measures. The other three (Postural Evaluation, Ranges of Motion and Neurological Assessment) were considered functional outcome measures. Each category included an "other" option for the respondent to specify any additional instrument(s) of their choice.

The first category entitled "General Health" listed the following outcome measure instruments:

- Medical Review (patient history)
- SF 36/12

The next category was "Pain Scales," for which the following four methods were listed:

- Patient description
- Visual analogue scale (sliding scale 0 to 100)
- Numerical rating scale (Borg digital 0 to 10)
- Pain diagram

The third category, "Disability Indexes" consisted of eight instruments.<sup>7,8,9,18,19,20,21</sup>

- Low Back Revised Oswestry
- Roland Morris Questionnaire
- Neck Disability Index

- Functional Rating Index
- Disabilities of the Arm Shoulder Hand (DASH)
- EPIC Function Hand Sort
- Patient-Rated Wrist Evaluation (PRWE)
- Lower Extremity Functional Scale (LEFS)

Under the fourth category, the following “Posture Assessment” methods were listed:

- Visual inspection/screening
- Leg length assessment
- Posturometer
- Photographs
- X-rays

The fifth category, ‘Ranges of Motion,’ involved the following assessment methods:

- Clinician/visual estimation
- Goniomet/mechanical inclinometer
- Cervical range of motion (CROM) device
- Back range of motion (BROM) device
- Single digital inclinometer
- Dual digital inclinometer

Neurological testing, the sixth category of measures, involved the following methods:

- Patient-reported pain referral pattern
- Sensory dermatomal testing
- Reflex testing
- Manual muscle testing
- Instrument-based muscle testing
- Surface electromyography (EMG)
- Thermography

The seventh and final category of methods involved ‘Psychosocial’ measures, of which the following four ascertainment methods were specifically asked about:

- Minnesota Multiphasic Personality Inventory (MMPI)
- Beck Depression Index II (BDI-II)
- Fear Avoidance Questionnaire
- Waddell’s behavioral signs

The respondents were instructed to indicate whether any or all of the listed examples of outcome measure in-

struments were *always*, *commonly*, *occasionally* or *never* used at the patient intake. This response was then compared to the utilization of the same outcome measure instruments during the course of treatment and the frequency of repeat testing was specified by choosing from one or more of the following response items: “each visit,” “every 9–12 visits” (approximately once a month during active treatment), “annually,” “when patient not responding,” “at dismissal,” or alternatively, “never.”

The survey focused on quantifying the rate of utilization of various outcome measures at the time of intake assessment and during the course of treatment. A blank space was provided so that survey participants could also characterize their use of other instruments not specifically listed in our survey. The questionnaire was kept short so the completion time would be approximately five minutes.

The survey was pilot-tested on 30 chiropractors registered and actively practicing in the province of British Columbia. Twenty-six responded without expressing any concerns about the length or overall acceptability of the survey and therefore no changes were made to the original survey. The responses of this sample group were not included in our study results.

The first group of Saskatchewan chiropractors who participated in completing the questionnaire were those attending a Workers’ Compensation Seminar. Two weeks later the survey was mailed out along with other information being disseminated by the Chiropractors’ Association of Saskatchewan. The responses were to be mailed or faxed to one of two provided addresses. The collected survey results were tabulated at a chiropractic office in Calgary, Alberta. To ensure the confidentiality of the respondents, survey participants were kept anonymous by blinding the participant tracking and tabulation members from each others data.

## Results

Of the 164 registered chiropractors contacted in person or by a mail-out there were 62 (38%) respondents (Table 1).

### *Use of General Health Measures*

Of the 62 respondents, 85% (n = 53) indicated that at the patient entry level they *always* performed a medical review, 10% performed a medical review *commonly* and 2% of the respondents *occasionally* performed a medical review. Another 2% of the respondents indicated that they

Table 1 Compilation of survey results received from chiropractic practitioners (N = 62).

Research Paper Survey Results for CMCC Rehabilitation Certification

Number of Responses = 62	At Intake					Observed Totals	Frequency of repeating test							
	Always	Commonly	Occasionally	Never	Did Not Answer		Each Visit	9-12 visits	Annually	No Response	Dismissal	Never	Other	Did Not Answer
<b>General Health</b>														
Medical Review	53	6	1	1	1	100%	2	19	28	11	1	2	2	7
SF36/12	0	0	5	37	20	100%	0	0	1	1	16	0	43	
Other	2	0	1	17	42	100%	0	0	0	0	1	8	1	
<b>Pain Scales</b>														
Patient Description	55	3	0	1	3	100%	43	12	1	5	1	1	0	7
Visual Analogue	16	10	14	12	10	100%	8	14	3	9	0	7	1	23
Numerical Rating	25	12	13	5	7	100%	10	24	5	8	2	6	2	12
Pain Diagram	41	6	3	7	5	100%	2	8	12	7	2	11	1	22
Other	1	0	0	9	52	100%	1	0	0	0	0	5	0	56
<b>Disability Index</b>														
Low Back Revised Oswestry	0	8	26	23	5	100%	1	15	1	10	6	14	5	19
Roland-Morris	0	2	11	38	11	100%	0	4	0	5	5	15	3	34
Neck Disability Index (Vernon - Mior)	0	7	24	23	8	100%	0	12	1	8	5	14	5	25
Functional Rating Index	4	2	10	37	9	100%	0	3	1	8	4	15	3	33
DASH	0	0	8	43	11	100%	0	1	0	3	3	19	2	36
EPIC Function Hand Sort	0	0	2	48	12	100%	0	0	0	0	3	20	0	39
PRWE	0	0	1	49	12	100%	0	0	0	0	2	18	0	42
LEFS	0	0	1	49	12	100%	0	0	0	0	3	20	0	39
Other	0	0	1	19	42	100%	0	1	0	0	1	8	0	52
<b>Postural</b>														
Visual Screen	49	7	2	0	4	100%	33	15	4	3	0	0	2	8
Leg Length	24	17	12	3	6	100%	25	9	2	4	0	3	3	18
Posturometer	1	0	1	45	15	100%	1	0	0	1	1	25	0	35
Photographs	0	0	5	41	16	100%	0	1	1	1	1	26	0	32
X-Rays	0	14	39	2	7	100%	0	0	0	24	1	7	6	28
Other	0	0	0	5	57	100%	1	0	0	0	0	2	0	59
<b>Ranges of Motion</b>														
Clinician Estimate	50	9	1	0	2	100%	26	23	2	9	2	0	4	7
Goniometer	0	2	14	34	12	100%	0	2	0	0	0	19	3	38
CROM	4	1	6	35	16	100%	2	1	1	3	1	23	0	33
BROM	4	0	4	37	17	100%	2	1	1	3	1	22	0	34
Mechanical	0	2	3	44	13	100%	1	0	1	0	1	23	1	35
Single Digit	0	0	1	46	15	100%	0	0	1	0	0	23	0	38
Dual Digital	0	0	1	46	15	100%	0	0	1	0	0	23	0	38
Other	0	0	0	15	47	100%	0	0	0	0	0	8	0	54
<b>Neurological</b>														
Subjective Pain Referral	50	9	0	1	2	100%	48	6	1	4	0	1	0	8
Dermatome Testing	21	29	6	1	5	100%	4	26	4	15	0	0	2	15
Reflex Testing	33	19	4	1	5	100%	5	23	5	15	0	0	3	14
Muscle Testing (manual)	20	32	6	0	4	100%	9	26	1	12	0	0	2	13
Muscle Testing (instrumental)	0	3	5	39	15	100%	2	3	1	1	1	24	0	30
sEMG	0	3	2	41	16	100%	0	2	1	0	2	27	0	31
Thermography	0	3	1	41	17	100%	0	2	1	0	1	26	0	33
Other	1	1	0	9	51	100%	2	2	0	0	0	10	0	49
<b>Psycho-social</b>														
Minnesota Multiphasic Inventory	0	0	1	49	12	100%	0	1	0	1	1	28	0	32
Beck Depression Index - II	0	2	2	47	11	100%	0	1	0	2	0	26	0	33
Fear Avoidance Questionnaire	0	0	1	47	14	100%	0	0	0	1	0	27	0	34
Waddell's Behavioural Signs	4	9	12	30	7	100%	2	7	0	11	1	18	3	21
Other	3	2	2	15	40	100%	2	1	1	2	0	9	1	46

never performed a medical review at the patient entry level. In regard to the frequency at which a medical review is repeated 45% (n = 28) indicated that it was done annually (n = 19), 31% indicated they repeated a medical review after 9–12 visits and 18% (n = 11) repeated a medical review if there was no favorable response to treatment.

The SF 36/12 health status questionnaire was utilized

occasionally by 8% (n = 5) of the respondents. None of the 62 respondents indicated that they always or commonly used the SF 36/12 health status questionnaires. Two respondents of the 62 (3%) indicated that they utilized some other method to assess a patient's general health.

Use of Pain Scales

At patient entry, the patient's own pain description was

the most utilized assessment method that was *always* recorded by the practitioner 89% (n = 55). The pain diagram was *always* used by 66% (n = 41) of the respondents and numerical rating was *always* utilized by 40% (n = 25). A visual analogue scale was used in an ongoing manner by 25% (n = 16) of the 62 respondents. The numerical rating pain scale was the second-most commonly “always” used measure over the course of treatment, again after the patient’s own description.

### Use of Disability Indexes

The percentages of respondents who *Never* utilized each of these disability indices are as follows: Low Back Revised Oswestry: 37%; Roland Morris Questionnaire: 61%; Neck Disability Index: 37%; Functional Rating Index: 60%; Disabilities of the Arm Shoulder Hand (DASH): 68%; EPIC Function Hand Sort: 77%; Patient-Rated Wrist Evaluation (PRWE): 79%; and the Lower Extremity Functional Scale (LEFS): 79%.

The only disability index that any of the respondents used *always* at entry level was the Functional Rating Index, however even then, only four out of the 62 respondents (6.5%) indicated that they used this particular instrument so frequently. No other disability indices were routinely utilized at entry level. The Low Back Revised Oswestry and the Neck Disability Index were the two indices that were employed to the greatest extent either *commonly* or *occasionally* at patient intake. The Roland-Morris and Functional Rating Index were utilized *commonly* by only 3% of the respondents and *occasionally* by 17% of the respondents at patient intake.

During the course of treatment the Low Back Revised Oswestry and the Neck Disability Index were again utilized to the greatest extent. These two disability indices were mostly used after 9 to 12 visits. They were less commonly used when there was *no response* to treatment and they were employed the least at *dismissal* or discharge. For many of the disability indexes, more than 25% of respondents indicated that they *never* used them during the course of subsequent treatment.

### Use of Posture Assessment

At the patient intake entry level 79% of the respondents indicated that they *always* documented the findings of a visual screen assessment of the patient’s posture, and 39% (n = 24) indicated that they *always* documented leg length

differences. Also at the entry level, X-rays were *commonly* utilized by 22% of the respondents and *occasionally* by 63%. Seventy percent of the respondents indicated that they *never* used either a posturometer or took photographs at the intake entry level.

At each visit during the course of treatment visual screening of the patient’s posture was monitored by 53% of the respondents and leg length differences was monitored by 40% of the respondents. When there was *no response* to treatment, 39% (n = 24) of the practitioners indicated that they utilized X-rays.

### Use of Ranges of Motion Assessment

At the patient intake examination, visual estimation was used to assess ranges of motion *always* by 81%, *commonly* by 15% and *occasionally* by 2% of respondents. In contrast, a goniometer or mechanical inclinometer was used only *occasionally* by 23% (n = 14) of respondents at the initial patient intake. Spinal range of motion devices (CROM and BROM) were used *occasionally* by less than 10% of respondents.

Over the course of subsequent treatment visual estimation of ranges of motion was utilized far more than any other method. Twenty-six of the 62 respondents (42%) used this method during each visit and 37% reevaluated ranges of motion visually later in the course of treatment (after 9 to 12 visits). Although the CROM, BROM and digital inclinometer are quite accurate in documenting changes in ranges of motion, they were rarely utilized by this group of practitioners.

### Use of Neurological Testing

The vast majority of respondents performed a complete neurological assessment routinely at the patient intake. The actual percentages of respondents who either *always* or *commonly* utilized each assessment measure are as follows: patient-reported pain referral pattern: 95%; dermatomal testing: 86%; reflex testing: 83%; and manual muscle testing: 84%.

Instrument-based muscle testing, surface EMG and thermography were utilized *commonly* by only 5% of the respondents at the time of patient intake. A slightly larger percentage of respondents (8%) *occasionally* utilized instrumental muscle testing at intake.

Forty-eight of the sixty-two respondents (77%) recorded the subjective pain referral pattern as stated by the pa-



tient at each visit. Dermatome testing, reflex testing and manual muscle testing were *usually* performed (by 40% of respondents) after 9 to 12 visits. Approximately 23% of respondents indicated that they employed these same three neurological evaluations if there was *no response* to their care. A small percentage (4%) of respondents utilized either instrumental muscle testing, surface EMG or thermography after 9 to 12 visits.

### Use of Psychosocial Measures

Overall, chiropractors seldom used instruments in this category. More than 75% of respondents indicated that they *never* used the MMPI, BDI-II or Fear Avoidance Questionnaire during intake assessments. Waddell's behavioral signs was the only specifically listed tool that was used at intake (either *always or commonly* by 21.4% and *occasionally* by 19%), and also the most frequently used measure in this category when patients subsequently exhibited *no response* to treatment (18%).

### Discussion

We attempted to inquire about a broad spectrum of outcomes or clinical tests that chiropractors are utilizing in everyday practice. It was beyond the scope of this study to assess the actual clinical usefulness of such instruments as our primary focus was to describe patterns of utilization of the various measures. We also sought to explore how chiropractors assessed the baseline intake status of their patients as well as how they subsequently gauged changes in this baseline status during subsequent management.

This study also revealed that pain scales were routinely used by chiropractors at patient intake and throughout the course of subsequent care. The three most valid and accepted pain scales – the visual analogue scale, numerical rating scale and the pain diagram – were commonly used. Even so, the patient's subjective verbal description of pain was still the most widely used method of documenting the patient's status. While pain scales are a sensitive outcome measure of changes in pain intensity, chiropractors still often require ongoing information as to the pain location, radiation and quality. Pain is largely subjective and is perceived and interpreted differently by each individual patient, in which case, suffering due to pain is as much an emotional experience as it is a physical experience. A major limitation with unstructured patient self-reports as

well as structured pain intensity scales is that they inadequately characterize pain *behavior* or the psychological responses to pain.<sup>11</sup> Therefore, although chiropractors appear to favour the use of pain scales and the patient's verbal descriptions of pain to document treatment response, such approaches should be combined with the use of condition-specific as well as general health status questionnaires.<sup>4</sup>

This study revealed that condition-specific disability indices such as the Low Back Revised Oswestry and the Neck Disability Index are being utilized only occasionally (by less than half of the respondents). The majority (60%) indicated that these indices are never used at the patient intake entry level in their practices. Usage of the general health questionnaire such as the SF 36 and condition-specific disability indices would complete the battery of self-reporting instruments that paint a holistic portrait of a patient.<sup>22</sup> Yet, the results of this study show that even though the majority of respondents reportedly performed a general health medical review during an initial consultation, neither the SF-36 nor SF-12 general health status questionnaires were utilized by any of our respondents.

General health status questionnaires are designed to measure the impact of health conditions in general on a patient's quality of life.<sup>22</sup> They are intentionally broad in scope so that they can be used to assess patients with virtually any health complaint. They are potentially valuable tools for everyday practice as they can provide practitioners with insights into a patient's general health perceptions as well as the limitations of health conditions on both physical and social functioning.<sup>22</sup>

The SF 36 is a short form general health questionnaire that consists of 36 questions that measure eight health attributes. Upon completion by the patient, the clinician scores the responses to each of the eight health sections and a numerical value is assigned. By repeating the SF 36 general health questionnaire at a subsequent timepoints, changes in baseline status can be validly obtained. While not completely interchangeable with the SF-36, the SF 12 is similar in scope to the SF-36, but utilizes only 12 of the original questionnaire items with the aim of reducing the burden of completion and assessment on respondents and investigators, respectively.

The Saskatchewan Workers' Compensation Board has subsequent to and independent from this study initiated a policy requiring that, for *full* payment of fees for initial re-

ports and progress reports (on every sixth visit) an injury area-specific disability index be completed. The disability indexes which they have chosen are the Roland Morris Questionnaire, Neck Disability Index, Disabilities of the Arm Shoulder and Hand (DASH) Questionnaire, and the Lower Extremity Functional Scale (LEFS). A logical subsequent study will be to determine if utilization of these indexes increases among Saskatchewan chiropractors as a result of this new financial incentive. A comparison of the frequency of their use for workers' compensation claimants versus non-workers' compensation beneficiaries would also be of interest.

The monitoring of the patient's functional neurological status was consistently performed by the majority of the respondents at the initial examination and again throughout the course of treatment. The routine "low technology" neurological evaluation consisting of deep tendon reflexes, manual muscle strength testing, dermatomal pinwheel testing and light touch perception is taught as a fundamental standard of chiropractic practice. The results from this survey suggest that this conclusion is shared by the majority of respondents. More technologically advanced equipment such as surface EMG and thermograph had relatively low utilization by these respondents.

The assessment of a patient's posture and the visualization of their full spines on a radiograph have mesmerized many chiropractors for the past century. Despite little clinical relevance between spinal pain and many structural variants, including leg length differences, such parameters were commonly monitored by respondents. The visual inspection of a patient's posture when viewed in the context of muscular dysfunctions accords well with the work originated by Alois Brugger and Vladamir Janda, both of whom were European-trained neurologists with keen interests in posture and gait and the effects of CNS central motor regulation on static posture and locomotion.<sup>23,24</sup> Ideal erect posture (sagittal plane function) requires the well balanced muscular co-activation of all the deep "intrinsic" stabilizers acting as a functional unit to achieve optimal loading of the spine (Sherrington's law of reciprocal inhibition). A strictly localized dysfunction does not exist in isolation of its ramifications on the tonic postural muscles that stabilize the spine as a whole and the phasic muscles producing motion. An abnormality of the spine in the sagittal plane reflects faulty CNS control of the tonic postural muscles, which has adverse conse-

quences on the phasic muscles that generate all peripheral movement patterns.<sup>24</sup>

The clinician's visual estimation of range of motion at the patient intake level and throughout the course of treatment was the method most favored by the respondents to this survey. Despite the fact that this method has poor reliability and validity as an outcome measure, it remains the most utilized approach, probably because of its simplicity and ease of use. The visual estimation of range of motion is adequate if the intent is to test for pain generation or gross asymmetry in regional movements. The chiropractor then garners information as to the location and quality of pain associated with certain movements, especially if there is a painful arc or pain only at end-range. However, measurement devices are required to perform an accurate assessment of range of motion when it pertains to reliably documenting improvement, rating permanent impairment or determining a plateau in healing. The trend shown from the current study is that measurement devices to assess ranges of motion are not routinely used by the chiropractors.

Our survey did not address the respondent's perceptions as to the clinical relevance of their observations. There still exists a trend to continually monitor leg length differences and perform some sort of a visual postural screen assessment during each visit.

Most respondents (75%) indicated that they never use any of the listed psycho-social outcome measures. Waddell's Behavioral Signs was practically the only tool in this category that chiropractors used (18%). There are eight tests that make up the five Waddell signs. Traditionally, the presence of three of five of these signs is interpreted to reflect the presence of non-organic pain. However results from a relatively recent systematic review of the relevant literature suggest that the association between Waddell's signs and outright malingering (and secondary gain) are inconclusive.<sup>25</sup> In the meantime, anecdotally at least, Waddell signs are commonly utilized in the compensation setting.

The Fear-Avoidance Beliefs Questionnaire (FABQ), which was developed by Waddell, also depicts patient's fears about pain and work, and about pain and physical activity. As a single factor, 'fear-avoidance beliefs' appear to best predict the patient's willingness to partake in any form of active care.<sup>26,27</sup> The fear of pain becomes cyclic where activity avoidance leads to further de-conditioning and later on to chronic sensitization, which in turn reinfor-

ces the notion that pain equates to harm and additional tissue damage.<sup>27,28</sup> The detrimental effect of fear avoidance on patient activity can be substantial and therefore this instrument could be very useful in assisting chiropractors to identify, monitor, and appropriately manage workers with legitimate non-physical return-to-work barriers.

The Beck Depression Index (BDI) is advocated only as a screening (rather than diagnostic) tool for underlying depression. Among respondents in this study, it was not a routinely administered questionnaire at the initial consultation. The BDI contains questions concerning very sensitive and personal issues. For this reason alone, it should only be administered when an attending chiropractor has gained an appropriate level of trust from the patient. It is beyond the scope of a chiropractor to establish a diagnosis of depression from the simple administration of the BDI. Again, this inventory is only meant to be a screening tool intended to facilitate discussion between patients and their chiropractor about possible depression and, if necessary, prompt a referral to a mental health professional that will then more accurately assess the patient's condition.<sup>5,29</sup> Ultimately, by being cognizant of the potential influences of psychosocial dysfunction chiropractors can modify their clinical approach to reduce the impact of such factors on their treatment outcomes.

The Minnesota Multiphasic Personality Inventory (MMPI) is one of the most widely used assessment tools at pain clinics specializing in the treatment of chronic pain. In its full length there are 566 true/false items and it can take up to 1 to 2 hours to complete. There is a shorter version of the 168 items however interpretation of either MMPI should be done by someone well trained in a mental health discipline and with specific training in the administration and scoring of the MMPI.<sup>30</sup> This being the case, we were not surprised to find that all but one respondent indicated not using this instrument in any capacity in his/her practice.

### Study Limitations

Unfortunately, even though we attempted to minimize selection bias by polling an entire provincial practitioner population, this survey may reflect an unintentional responder bias in that 164 chiropractors were eligible but only 62 (38%) returned the questionnaires in the allotted time. These respondents may be those with a passing interest in the topic of outcome measures and are therefore

unlikely to constitute a representative cross-section of the chiropractic profession in the province of Saskatchewan, let alone across Canada as a whole. Furthermore, as we neglected to collect specific demographic and practice pattern data from respondents, we were unable to determine whether utilization of specific questionnaires was associated with factors such as the presence or absence of university-affiliated or multidisciplinary-based practice, underlying chiropractic philosophical orientation, preferred technique (e.g. activator).

A further bias is possible in the design of the questionnaire itself. We felt that the time commitment for the respondents needed to be minimal but also that the questionnaire should inquire about a relatively comprehensive spectrum of instruments. The final form included inquiries regarding patient reported information (2 items [medical review being a substantial undertaking]), clinician assessments (7 items), pen and paper instruments (12 items), device instrumentation (13 items) and allowances for "other" entries to be specified by respondents themselves (although this option was seldom selected and perhaps under utilized). These factors notwithstanding, all authors/investigators for this study were rehabilitation fellows, and therefore our choice of – and interest in – particular instruments to inquire about may have been influenced by our specialty education and/or related clinical experience.

Given our low response rate, our study results do not necessarily represent the prevailing attitudes of the chiropractic profession in the province of Saskatchewan, let alone the rest of Canada.

### Conclusions

This study was able to determine general trends in the utilization of outcome measures by the survey respondents in their daily chiropractic practices. There is a trend that self reporting pain scales are routinely being performed at patient intake and during the course of treatment. On the other hand, the well known Oswestry Disability, Roland Morris, and Neck Disability Indices are not routinely performed by chiropractors at patient entry level. Similarly, a trend is seen in the lack of use of psychosocial outcome measures by chiropractors. Greater utilization of back pain specific disability indices is encouraged among chiropractors to improve both the monitoring and documentation of patients' responses to care. Similarly, greater utilization of psychosocial measures is encouraged to im-

prove awareness of underlying conditions representing a substantial barrier to recovery and/or warranting a referral to another health care provider.<sup>4,11</sup>

Measures conducted most routinely by chiropractors during subsequent treatment are the neurological examination and range of motion assessment. The latter is usually performed only visually and not reliably by means of a goniometer or equivalent device. Similarly, visual assessments of posture and leg length are routinely conducted despite the lack of validity of their use in everyday practice.

The recently released CCA guidelines regarding the patient centered practice (Section 5) note that “Ongoing treatment of a patient should be based on clinical findings and consideration of objective and subjective improvement. The absence of re-assessment renders long term projections of care as conjecture.” While our study is not necessarily generalizable to the chiropractic membership at large in Saskatchewan or other Canadian provinces, our results suggest that chiropractors may not be doing a particularly exemplary job of incorporating objective outcome assessment measures into everyday practice. A broader survey with more representative sampling of members throughout Canada would be an informative follow-up to this study. In the meantime, we are inclined to recommend greater education on and promotion of the use of more objective assessment methods throughout the profession.

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### Appendix 1. Survey given to chiropractic practitioners in Saskatchewan.

Approximate time to do survey: 5 minutes

In the view that the evolving practice of chiropractic is moving in the direction of “evidence based” care and/or “best practice” delivery, this survey is being conducted to determine which outcome measures practitioners utilize to determine entry, baseline health status of patients, and to gauge changes from this baseline. The list provides some of the most common instruments but is by no means exhaustive.

Please note all answers will be blinded and absolutely confidential.

Most commonly, and where applicable, I use the following instruments;

	<u>At Intake</u>				<u>Frequency of repeating test</u> - check all that apply						
	Always	Commonly	Occasionally	Never	Each Visit	9-12 visits (~monthly)	Annually	Not Responding	Dismissal	Never	Other
<b>GENERAL HEALTH</b>											
Medical Review	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
SF36/12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>PAIN SCALES</b>											
Patient Description	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Visual Analogue	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Numerical Rating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Pain Diagram	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Appendix 1 Continued.

DISABILITY INDEX	Always	Commonly	Occasionally	Never	Each Visit	9-12 visits (~monthly)	Annually	Not Responding	Dismissal	Never	Other
Low Back Revised Oswestry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Roland-Morris	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Neck Disability Index (Vernon-Mior)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Functional Rating Index	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
DASH	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
EPIC Function Hand Sort	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
PRWE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
LEFS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>POSTURAL</b>	<b>Always</b>	<b>Commonly</b>	<b>Occasionally</b>	<b>Never</b>	<b>Each Visit</b>	<b>9-12 visits (~monthly)</b>	<b>Annually</b>	<b>Not Responding</b>	<b>Dismissal</b>	<b>Never</b>	<b>Other</b>
Visual Screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Leg Length	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Posturometer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Photographs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
X-Ray	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>RANGES OF MOTION</b>	<b>Always</b>	<b>Commonly</b>	<b>Occasionally</b>	<b>Never</b>	<b>Each Visit</b>	<b>9-12 visits (~monthly)</b>	<b>Annually</b>	<b>Not Responding</b>	<b>Dismissal</b>	<b>Never</b>	<b>Other</b>
Clinician Estimate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Goniometer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
CROM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
BROM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Mechanical Inclometer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Single Digital Inclometer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Double Digital Inclometer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Appendix 1 Concluded.

	NEUROLOGICAL				Each Visit	9-12 visits (~monthly)	Annually	Not Responding	Dismissal	Never	Other
	Always	Commonly	Occasionally	Never							
Subjective Pain Referral	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Dermatome Testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Reflex Testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Muscle Testing (manual)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Muscle Testing (instrument)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
sEMG	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Thermography	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	PSYCHO-SOCIAL										
	Always	Commonly	Occasionally	Never	Each Visit	9-12 visits (~monthly)	Annually	Not Responding	Dismissal	Never	Other
Minnesota Multiphasic Inventory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Beck Depression Index - II	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fear Avoidance Questionnaire	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Waddell's Behavioral Signs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

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## Book Reviews

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*Natural Health After Birth: The Complete Guide to Postpartum Wellness*

Romm, AJ

Healing Arts Press, One Park Street, Rochester, Vermont, 05767, USA; 2002.

Soft Cover, 260 pages, CAN \$24.95

ISBN 978-089281930-0

In *Natural Health After Birth*, Romm, a midwife and herbalist, gives a holistic perspective of the challenges and changes that occur postpartum. The format is written in simple terms over 8 chapters and is laid out in a chronological order, making it easy to follow for the “layperson.”

This text gives an open and honest perspective on physical, emotional and spiritual wellness after birth. Unfortunately, I find that it lacks good exercise prescription for this new phase of life. Romm initially suggests pelvic floor exercises and side lying and alternating leg lifts. Later she recommends abdominal re-activation, walking and gentle stretching. Finally, she relates advice on posture and provides photographs and instructions for relaxing yoga poses, abdominal exercises, leg stretches and pelvic tilts and lifts. These sections lack the necessary “back-safe” approach that has been shown to assist in rehabilitating core stability and endurance. Also, the author provided very few references for these areas.

I recommend this book as a useful and complementary guide that clinicians can recommend to new mothers on the many topics that relate to the postpartum stage. However, I suggest they seek postpartum exercise instruction from an additional source.

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*Patient Education in Rehabilitation*

Dreeben, O

Jones and Bartlett Publishers, 40 Tall Pine Drive, Sudbury, MA 01776, USA; 2010.

Soft Cover, 474 pages, CAN \$71.95

ISBN 978-0-7637-5544-7

O. Dreeben’s text is a comprehensive look into all subjects related to patient education. The format is orderly, detailed and reads much like a course textbook. It includes 5 sections divided into 19 chapters covering many topics, most importantly: significance and historical outlook; adherence predictors; communication and behavioural modifications; teaching and learning theories; developmental stages; ethical, legal and cultural variables; motor performance; older adults; and wellness, health promotion and disease prevention.

The text is written from the perspective of American physical and occupational therapists and does not cover manual therapists of other types or nationalities. There is some repetition in certain sections, including double introductions, sentence repetition and an overuse of tables.

The information provided on educational methods, patient motivation, adherence, and working with special populations is useful for most practitioners. Dreeben also includes internet based education and legal issues, making this textbook more currently applicable. Case studies, as well as clinical and classroom teaching examples aid the practitioner to use the information in a variety of settings. The author also emphasizes patient-centered and evidence based approaches, which is very important in today’s clinical climate.

Overall, I recommend this text to students and clinicians who aim to improve their patient teaching skills and therefore their clinical outcomes.

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*The ACP Evidence-Based Guide to Complementary and Alternative Medicine*  
 Jacobs BP, Gundling K  
 American College of Physicians 2009. 452 pp.,  
 CAN\$69.95  
 ISBN-13: 978-1-934465-04-2

The utilization of Complementary and Alternative Medicine (CAM) therapies is increasing, and the evidence on its effectiveness needs to be monitored for utilization in an evidence based paradigm.

“*The ACP Evidence Based Guide to Complementary and Alternative Medicine*” by Bradley P. Jacobs and Katherine Gundling accomplishes this task by providing a comprehensive and thorough reference guide for general practitioners. The authors provide an understanding of CAM therapies utilized by patients in conjunction with their pharmaceutical therapies, and the evidence to make recommendations about these practices.

The text is organized to allow the reader to completely understand and evaluate the evidence for CAM therapies. Part 1 provides an overview of the vocabulary commonly used in CAM therapies followed by a section that provides tips to facilitate the utilization of CAM in a general practice. Part 2 is a series of twelve chapters which highlight common conditions to which CAM therapies are often used.

Within each chapter, the prevalence of CAM utilization is identified followed by a review of the evidence. The authors also include “Evidence Summary Charts” which identify the evidence about specific therapies, strength of the evidence and recommendations. A caution should be made that much of the evidence included had conflicting statistical significance; and clinicians should evaluate the clinical significance of the evidence provided and weigh the potential risks and benefits when making recommendations.

Overall, this text is recommended to facilitate an understanding of CAM and to provide the evidence to make recommendations about CAM therapies.

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*Nerve and Vascular Injuries in Sports Medicine*  
 Edited by Venu Akuthota and Stanley A. Herring  
 290 pp, USD \$99.00, Hardcover  
 New York, Springer, 2009  
 ISBN: 978-0387-76599-0

While peripheral nerve and vascular injuries may be relatively uncommon in the athlete, they can potentially have significant ramifications on an athlete’s career or activities outside of sport. In *Nerve and Vascular Injuries in Sports Medicine*, the chiropractic practitioner is provided with an in-depth understanding of peripheral nerve and vascular anatomy and physiology directing the clinician to appropriate diagnosis, treatment, and prognosis of these injuries.

The 290 page text is divided into three sections. The first third of the text provides basic knowledge of neurovascular anatomy and pathophysiology and discusses appropriate evaluation of athletes with neurovascular complaints. The remainder of the text is devoted to region-specific neurovascular injuries (separated into upper and lower limb sections) with specific chapters on thoracic outlet syndrome, stingers, and lumbar radiculopathy.

The text as a whole is a worthwhile read. The chapters are well written and illustrated, organized, concise, and exceptionally referenced. From the perspective of a manual therapist however, this text is not without limitations and it is clearly targeted to the sports medicine doctor. Unfortunately while it is repeatedly cited throughout the text that neurovascular injuries are often amenable to conservative care, management strategies of the manual therapist such as muscle release techniques, nerve gliding exercises, joint manipulation and rehabilitation are discussed at the most basic level, if at all.

Despite its limitations I would recommend the text to chiropractic sports practitioners as it provides a thorough, yet practical approach to the diagnosis of neurovascular injuries. The text is a helpful resource and would complement any sports medicine library.

Kevin Sims, BHSc, DC  
 Sports Sciences Resident  
 Canadian Memorial Chiropractic College

*Musculoskeletal MRI*

Helms CA, Major NM, Anderson MW, Kaplan P, Dussault R  
2nd ed, 456 pp, CAN \$155.00, Hardcover  
Philadelphia, Pennsylvania, Saunders-Elsevier, 2008  
ISBN: 978-14160-5534-1

The second edition of *Musculoskeletal MRI* provides in depth understanding of MRI as it pertains to the musculoskeletal system albeit at a basic level. While the text is directed at the radiologist or radiology resident it is an exceptional resource for clinicians aiming to improve their ability to read special imaging or have a better understanding of the implications of a client's report to conservative care.

The text is divided into sixteen chapters each highlighting different topics in special imaging as they relate to the musculoskeletal system. Topics include: basic principles of MRI, marrow, tendons and muscles, peripheral nerves, musculoskeletal infections, arthritis and cartilage, tumors, osseous trauma, temporomandibular joint, shoulder, elbow, wrist and hand, spine, hips and pelvis, knee, foot and ankle. The text is loaded with more than 600 detailed images of normal anatomy and common musculoskeletal abnormalities and diseases. The images as well as the practical advice and clinical pearls provided in each chapter permit easy comprehension of a sometimes difficult topic. While the vast majority of the text is supported by up-to-date research, topics are also discussed in terms of the authors' clinical experience, which only adds to the breadth of the text. While some readers may lament that discussions of diagnosis and management of the conditions described in the text are overly simplistic, they should be reminded of the target audience and aforementioned purposes for reading the text and choose to read accordingly.

Somewhat surprisingly, this text succeeds both as a reference and as a textbook to be read from cover to cover. I recommend *Musculoskeletal MRI* unwaveringly to any clinician interested in enhancing their understanding of this field.

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*Skeletal Muscle Damage and Repair*

P.M Tiidus, Editor.  
*Human Kinetics*, 2008, 337pp., CAN \$93.95  
ISBN: 978-07360-5867-4

Dr. Tiidus, professor and chair of the department of kinesiology and physical education at Wilfred Laurier University in Waterloo, Ontario, Canada, has constructed a text book to convey topics related to exercise and overuse induced skeletal muscle damage and repair mechanisms and their application. This text book contains 21 chapters, divided into 3 main sections reviewing current research related to the mechanism and repair of muscle damage, muscle damage and repair as it relates to issues in specific populations and critical appraisal of specific interventions that have been utilized for the treatment of muscle damage. Each chapter was well represented and closed with summaries to consolidate the material presented.

Section one focused on the physiology of muscle damage and repair. Each chapter effectively described the pathophysiology and histology of muscle damage and repair. However, it is important to note that the majority of research presented focused on animal models and one should take caution when trying to extrapolate this information to humans.

Section two described the correlation between muscle damage and repair as it relates to diabetes, hormonal influences, Duchenne muscular dystrophy, changes with aging and workplace injuries. It provided a thorough understanding of the types of pathological and muscular overuse conditions which, can be applied clinically to help identify the mechanism of muscle injury.

Section three provided information regarding specific interventions used to treat muscle damage. It provided health practitioners with recent research regarding theory, application and effectiveness of interventions to guide treatment and rehabilitation protocols.

This text book provided a suitable description of muscle damage and repair in the format of a narrative literature review. It is advised that the reader should have a background in the topics of cellular biology, histology, immunology, muscle physiology and pathology as the authors assume readers possess basic science knowledge.

In conclusion, I would recommend this text to students and health practitioners as it is an efficient reference in understanding the pathophysiology of skeletal muscle

damage and repair. However, in terms of treatment modalities I would recommend using a different source as it does not include all aspects of conservative care.

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*The Physiotherapist's Pocket Guide to Exercise: Assessment, Prescription, and Training.*  
A. Glynn and H. Fiddler.  
Churchill Livingstone Elsevier. 2009.  
224 pp. Soft cover.  
Can \$44.95/US \$36.95/€30.99/£20.99.  
ISBN13: 978-0443-10269-1

This pocket guide was written to be a resource for professionals involved in delivering advice on physical activity and exercise. The goal was to create a quick reference manual for clinical practice and teaching. Written with physiotherapists in mind, this book contains information to support any healthcare practitioner in the prescription of therapeutic exercise.

The book includes thirteen chapters. Early chapters focus on the principles of exercise design, prescription, and physiology. Later chapters apply this knowledge to

certain patient populations for acute and chronic conditions. The final chapter, perhaps the best in the book, contains case study examples illustrating the application of exercise prescription. Black and white photographs, diagrams, and charts are used effectively throughout the book to show relevant exercises and important physiological concepts. References are listed at the end of each chapter, most being from 1990 to 2005.

The book is well cataloged with a table of contents, individual chapter content tables, and an alphabetized index at the back. The level of content on biomechanics and exercise physiology is adequate for the aims of the book. The authors have done a sufficient job of providing exercise theory and application for improving muscle strength, muscle endurance, and cardiovascular fitness. However, information is lacking on exercise prescription for specific injuries such as disc herniations or supraspinatus impingement. Thus, health professional specialists would likely find the amount of detail covered less than satisfactory. Instead a wellnessbased practitioner may find it useful when their patient's primary goal is improved fitness.

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Canadian Memorial Chiropractic College



# CMCC

*The Canadian Memorial Chiropractic College (CMCC) is a unique, charitable, not-for-profit educational institution that, for over half a century, has been dedicated to improving the health of society by advancing the art, science and philosophy of chiropractic, educating chiropractors and furthering the development of the chiropractic profession. Our state-of-the-art facilities are located in Toronto, Canada.*

### **Research Chair, Mechanobiology**

The Canadian Memorial Chiropractic College is pleased to announce the opening of a Research Chair position. The Chair will lead the development of research and scholarship in Spine Mechanobiology with a focus on study of instability, degeneration and models of subluxation/joint dysfunction. This is a full-time position in the Centre for Mechanobiology, Injury and Health, reporting to the Dean of Graduate Education and Research.

The Chair will lead the development and administration of research and scholarship to understand how mechanical stress acting on the spine contributes to the etiology and/or clinical presentation of conditions, known collectively as mechanotransduction disorders. She/He will develop and supervise a team of investigators and staff to carry out the related research projects.

The Chair will have access to an existing Biomechanics and Elastography laboratory equipped with optoelectronic, electromagnetic and accelerometer sensing systems for kinematics, small animal and spinal segment materials testing systems, myoelectric measures, tri-axial force plate and axial sensing technology, gait platform, ultrasound elastography and forward/inverse dynamics computer modeling capacity. An onsite mechanical shop facility is available for development and manufacture of custom materials.

Applicants will hold a Doctor of Chiropractic degree and a PhD in one of the following disciplines: Mechanical, Biomedical, Biomechanical Engineering, Applied Mechanics, Motor Control or a similar degree. The preferred candidate will have a successful track record of research/grantsmanship and demonstrate the leadership skills necessary to recruit and foster innovative scientific teams.

CMCC's salary is competitive and a significant seed-fund budget is available to support the successful applicant's interest for study in the target areas. Employees can participate in comprehensive benefits plans that include life, income protection, health, dental and travel accident insurance, RRSP contributions and an Employee Assistance Program.

Interested applicants should apply to CMCC's HR Division @ [hadmin@cmcc.ca](mailto:hadmin@cmcc.ca). Please include the position title in the subject line.

*CMCC is more than just a workplace, it is a community. We are active in both the chiropractic community as well as the community in which we live. CMCC also recognizes our employee's diverse personal and professional needs. We offer work-life balance opportunities such as paid personal days and flexible hours, plus an on-site fitness centre, gym and swimming pool.*