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The necessity of strength training for the older patient

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Muscle strength is considered to be the most physiologically limiting factor of the older patient and a determinant of their functional status. The physiological benefits of exercise in general are well documented. Over the past five years research has shown that exercise, particularly strength training, is not only important, but necessary for successful aging.

The literature indicates that there are many deleterious changes in the muscloskeletal system during the normal process of aging. Investigations into the area of functional independence has shown strength training can mitigate or even reverse a spiraling decline in activities of daily living (ADLs), even among the frail elderly. Functional gains observed include improvements in gait, gait speed, balance, mobility tasks and a decrease in the risk of falling.

Traditional geriatric studies have emphasized the "Five I's" that challenge the older patient (intellectual impairment, incontinence, immobility, instability and iatrogenic drug reactions). Strength training is a benefit to all five of the "Five I's".

With the aging of the Canadian population, it is expected that persons over the age of 65 will comprise at least 30% of a chiropractor's patient portfolio. It therefore seems appropriate to inform the chiropractic

La force musculaire est considérée comme le principal facteur de limitation physiologique chez les personnes âgées et un déterminant de leur état fonctionnel. Les bienfaits physiologiques des exercices sont, en général, bien documentés. Au cours des cinq dernières années, la recherche a montré que les exercices, notamment l'entraînement de la force, sont non seulement importants mais nécessaires au vieillissement en santé.

La documentation scientifique fait état de nombreux changements nuisibles qui se produisent dans le système musculo-squelettique au cours du processus normal de vieillissement. Les recherches menées dans le domaine de l'autonomie fonctionnelle montrent que l'entraînement de la force peut ralentir et même renverser le déclin en spirale des activités quotidiennes, et ce, même chez les personnes âgées toutes frêles. Parmi les avantages observés, notons une amélioration de la marche, de la vitesse de marche, de l'équilibre, de la mobilité et une diminution du risque de chute.

*Les études traditionnelles en gériatrie ont surtout porté sur les cinq dangers qui guettent les personnes âgées, aussi appelés les « cinq I » : la détérioration **i**ntellectuelle, l'**i**ncontinence, l'**i**mmobilité, l'**i**nstabilité et les réactions **i**atrogènes aux médicaments. L'entraînement de la force a une incidence favorable sur chacun des « cinq I ».*

Étant donné le vieillissement de la population au Canada, il est à prévoir que les personnes de plus de 65 ans formeront au moins 30 % de la clientèle en

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profession of the importance as well as the necessity of strength training for the older patient.
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chiropratique. Il semble donc pertinent d'informer les professionnels du domaine de l'importance, voire de la nécessité, de l'entraînement de la force chez les personnes âgées.
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MOTS CLÉS : chiropratique, gériatrie, entraînement de la force.

Introduction

Muscle strength is considered to be the most physiologically limiting factor of the older patient and a determinant of health status.[1,2] The physiological benefits of exercise in general are well documented (Table 1).[3–5] Over the past five years, research has now shown that exercise, particularly strength training, is not only important but necessary for successful aging. Successful aging is best defined as the optimalization of a person's health while minimizing any physiological decline as the result of the aging process.[4,5]

During the normal aging process, there is an associated reduction in the individual's physical activity, intake of energy, and lean body mass. The loss of lean body mass particularly affects the skeletal muscle compartment (sarcopenia). This loss of muscle mass and strength is accompanied by a decrease in the number of muscle fibers, (especially Type II fibers), and a decrease in muscle fiber size.[6] Other changes have been observed relating to the remodeling of the neuromuscular junction by way of a decrease in the number of motor neuron units.[6] This decline is partially compensated for by the collateral reinnervation of adjacent muscle fibers by neighboring neurons. This results in an increase in motor neuron size and an associated decline in muscle control.[6,7]

As a person ages, sarcopenia does not occur uniformly throughout the musculoskeletal system.[6,8,9] Certain muscles are negatively affected while others are relatively preserved. Research conducted at the University of Western Ontario, London, Canada has shown that the quadriceps muscles atrophy to a much lesser extent than the biceps of the upper limb and the tibialis anterior of the lower limb.[7,8] This finding is attributed to the fact that the quadriceps muscles are usually involved in everyday activities such as walking, household work and gardening.[7,9] The decline in the strength of the biceps muscle and the tibialis anterior muscle groups has a potentially significant impact on the Activities of Daily Living (ADLs). This is due to their use in such activities as lifting, cleaning, manipulating household objects (i.e. opening a can) while using the biceps muscle. There is also an associated risk of falls and subsequent fractures as a result of a weak tibialis anterior muscle.[8,9]

An increase in the risk of falling and subsequent fracture

Table 1 The Physiological Benefits of Exercise

Increase in blood flow	Decrease in blood pressure
Increase in endurance	Decrease in resting heart rate
Increase in flexibility	Decrease in bone loss
Increase in range of motion	Decrease in loss of strength
Increase in oxygen uptake	Decrease in peripheral body fat
Increase in neurological function	

has significant clinical and economic impact. Falls and fractures are a leading cause of morbidity in the elderly patient.[4] Falls account for 90% of hip, forearm and pelvic fractures. Twenty percent of persons who sustain a pelvic fracture die within one year and 20% never walk again.[4]

Several studies have shown a direct correlation between a lack of muscle strength and disability. The more an individual leads an inactive and sedentary lifestyle, the more disabled he/she becomes.[2,10,11] Such a disability can be classified as disuse atrophy. The existence of two detrimental factors in the same person, such as loss of muscle strength and a disturbance in balance, has been shown to result in a more significant disability than if these factors existed separately. This is termed co-impairment and has been shown to have a compounding effect.[10,12]

Uncompensated loss of muscle strength can result in a spiraling decline of functional independence.[2,10] Investigation in this area of functional independence has shown that this can be mitigated or even reversed with a moderate degree of strength training, even among the frail elderly.[2,7,13,14] Related research has found that measurable gains in strength can be discerned in as little as six weeks with resistive strength training.[1] It has also been shown that such gains can be partially maintained at least up to one year after the participants under went a period of detraining (no exercise).[11] Strength acquisition has been observed in the very old and in the frail elderly, but investigators are quick to point out that permanent gains were contingent on the older patient maintaining a schedule of training.[1, 7]

Many researchers have demonstrated the relationship between strength gains and functional improvements. Functional gains include improvement in gait, balance and an associated decrease in the risk of falling.[14–19] Krebs, for example, concluded that participants who underwent strength training exercises demonstrated improvements in gait stability, especially medio-lateral steadiness.[20] He went on to conclude that even moderate strength gains benefit gait performance in the elderly.[20]

Lower limb strength gains have been associated with gains in chair rising abilities, gait speed, mobility tasks (transferring, stooping and stair climbing) and in the person's overall confidence in mobility.[18–20]

The importance of strength training was first proposed by Young (1986) in a concept called the *threshold value*.[1] This concept purports that even minor improvements in strength can result in remarkable gains of functional abilities. An increase in quadriceps strength, for example, may enable a once chair bound person to now rise out of the chair on his/her own. This may allow these persons to now toilet themselves and to become increasingly more mobile in their own homes.

Table 2 Examples of Side Effects From Prescription Medication

Adverse Reaction	Common Cause
Sedation	Narcotic-analgesics
Confusion	Anti-depresants narcotic-analgesics, anticholinergics
Orthostatic hypotension	Anti-hypertensives, anginals
Dizziness	Sedatives, anti-psychotics, narcotic-analgesics, antihistamines

Table 3 Example of Prescription Cascade

Initial Pharmacological drug	Adverse Reaction	Subsequent Treatment
NSAIDs	Rise in blood pressure	Anti-hypertensives
Thiazide diuretics	Hyperuricemia	Treatment for gout

Psycho-emotional gains have also been attributed to strength gains. Together with the increase in confidence and self-esteem that may accompany a person achieving independence, Singh concluded that progressive resistive training was an effective anti-depressant in depressed elderly people.[21]

Traditional geriatric studies have emphasized the *" Five I's"*.[4,5] These are ***I**ntellectual impairments* (dementia, delusions, and depression), ***I**ncontinence* (which includes functional inability to toilet oneself), ***I**nstability, **I**mmobility*, and ***I**atrogenic drug reactions*.[4,5] The latter is often the result of a pharmacological approach to a patient's symptoms or ailments. Dizziness, confusion, orthostatic hypotension, fatigue, and extra pyramidal symptoms may many times be attributed to what is termed *polypharmacy* (Table 2).[4] Another phenomenon, which is the result of a drug approach to an original problem followed by another drug to combat the side effects of the first drug, is called the *prescription cascade* (Table 3).[4] The occurrence of the prescription cascade is not surprising when one considers that the average number of prescription drugs, over-the-counter supplements and other home remedies the average older patient is consuming is approximately twelve (12) in total!

One of the major reasons why a health care provider may be hesitant in recommending a strength training program to an older patient is the possibility of injury or the detrimental increase of the physiological burden on an already frail person.[23] Research conducted at McMaster University in Hamilton, Ontario, concluded that subjects who engaged in strength training (weight lifting) were exposed to no more peak circulatory stress than that created by a few minutes of inclined walking.[22] The authors found no evidence in the literature to indicate that there is an increase in injury frequency for those patients undergoing supervised training. Concerns of the associated risks, as mentioned above, to the elderly that participate in either supervised or unsupervised strength training (with clear instruction), may be unfounded.

Strength training is a benefit to all five of the *Five I's* that challenge the older patient. The benefits to mobility and stability of the older person have been discussed. This improvement can obviously resolve a functional incontinence. Improvement in depression and an individual's confidence as related to his/her mobility have been observed consistently in the field, as well as, in controlled studies. Since strength training is a non-pharmacological solution to many presenting complaints or chronic illnesses in the older adult, iatrogenic drug reactions may be avoided (Table 4).[4]

Table 4 List of Clinical Conditions Treatable by a Non-pharmacological approach such as Exercise

Anxiety	Obesity
Stress	Depression
Sleep disorder	Hypertension
Diabetes	Hyperlipidemia
Coronary heart disease	Disturbances in gait and balance

One stumbling block for the use of exercise in the older adult is lack of motivation. Two of the more important factors involved in the adherence to an exercise program are the maintenance of health and social cohesiveness (exercising with others for similar reasons).[24] The motivation, for health reasons, to use a drugless approach parallels the chiropractic paradigm.

Conclusion

Demographic studies indicate that field practitioners can expect elderly patients to constitute a significantly greater percentage of their patient base in the near future.[26,27] More over, senior patients, like the population in general, often seek a drugless, hands-on approach to their clinical presentations. Since few, if any, chiropractors limit their practice exclusively to the treatment of geriatric patients, this could result in a potential under servicing of this group of patients by the profession. It is therefore imperative that the profession in general, as well as individual practitioners, prepare for the predicted surge in the number of older patients seeking care from the chiropractic profession in the early part of the next millennium.[28] Chiropractors must increase their management and assessment knowledge and skills of geriatric patients, and realize that, although seniors are essentially similar to younger people and are merely at a different, older stage of life, they do present with unique problems (and often atypical presentations) and present many challenges to the field practitioner.[29,30]

An interdisciplinary network must be developed in or-

der to better service older patients. This implies that the profession must continue in it's efforts to "build bridges" with medical practitioners and specialists, community groups and other allied complementary and alternative practitioners.

The "prescription" of exercise for health maintenance may be considered as primary, secondary and, to a limited extent, tertiary prevention.[23] As such, Jette et al. concluded that "home-based resistence exercise programs designed for the older patient with disabilities hold promise as an effective public health strategy".[25]

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