

The Tampa Scale of Kinesiophobia and neck pain, disability and range of motion: a narrative review of the literature

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Background: *The Tampa Scale of Kinesiophobia (TSK) that was developed in 1990 is a 17 item scale originally developed to measure the fear of movement related to chronic lower back pain.*

Objective: *To review the literature regarding TSK and neck pain, perceived disability and range of motion of the cervical spine.*

Methods: *Medline, MANTIS, Index to Chiropractic Literature and CINAHL were searched.*

Results: *A total of 16 related articles were found and divided into four categories: TSK and Neck Pain; TSK, Neck Pain and Disability; TSK, Neck Pain, Disability and Strength; and TSK, Neck Pain and Surface Electromyography.*

Conclusion: *The fear avoidance model can be applied to neck pain sufferers and there is value from a psychometric perspective in using the TSK to assess kinesiophobia. Future research should investigate if, and to what extent, other measureable factors commonly associated with neck pain, such as decreased range of motion, correlate with kinesiophobia.*
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KEY WORDS: kinesiophobia, neck pain, cervical spine

Introduction

The persistence of pain (or chronic pain) can lead to changes in behaviour for both physical and psychological reasons. The International Association for the Study of Pain has defined chronic pain as "... that which persists be-

Historique : *l'Échelle de kinésiophobie de Tampa (TSK) fut élaborée en 1990 à titre d'échelle de 17 éléments dont le but consistait à mesurer la crainte du mouvement lié aux douleurs lombaires chroniques.*

Objectif : *lire la documentation concernant la TSK et les douleurs au cou, l'invalidité perçue et la portée du mouvement de la colonne cervicale.*

Méthodes : *recherche dans Medline, MANTIS, l'index de la documentation sur la chiropratique, et CINAHL.*

Résultats : *16 articles ont été trouvés, puis divisés en quatre catégories : TSK et douleur au cou ; TSK, douleur au cou et invalidité ; TSK, douleur au cou, invalidité et force ; et TSK, douleur au cou et électromyographie de surface.*

Conclusion : *le modèle d'évitement de la peur peut être appliqué à ceux qui souffrent de douleurs au cou, et d'un point de vue psychométrique, il peut être utile de recourir à la TSK pour évaluer la kinésiophobie. Des recherches plus approfondies pourraient servir à déterminer si et dans quelle mesure d'autres facteurs quantifiables communément associés à la douleur au cou, tels que la portée de mouvement diminuée, ont un lien avec la kinésiophobie.*
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MOTS CLÉS : kinésiophobie, douleur au cou, colonne cervicale

yond the normal time of healing."¹ One source reported that up to 80% of the population will have musculoskeletal pain and that it is a major cause of disability and limitation of activity.¹ In 1983 a concept known as the fear avoidance model was introduced by Lethem, Slade,

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Troup and Bentley which attempts to “explain how and why some individuals develop a more significant psychological overlay than others do.”^{1,2} The model explains that avoidance of pain because of fear and the avoidance of painful activities (cognitive and behavioural avoidance) lead to physical and psychological consequences.¹ This model has been widely used and supported.

Kinesiophobia is a term that was introduced by Miller, Kori and Todd in 1990 at the Ninth Annual Scientific Meeting of the American Pain Society and describes a situation where “a patient has an excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or reinjury.”^{1,3} The Tampa Scale for Kinesiophobia (TSK) is a 17 item questionnaire used to assess the subjective rating of kinesiophobia or fear of movement.^{1,4,5} The original questionnaire was developed to “discriminate between non-excessive fear and phobia among patients with chronic musculoskeletal pain.”^{3,4} Several studies have found the scale to be a valid and reliable psychometric measure.^{1,4,5} Initially used to measure fear of movement related to chronic low back pain, the TSK has been used increasingly for pain related to different body parts including the cervical spine.⁶ The TSK is a self-completed questionnaire and the range of scores are from 17 to 68 where the higher scores indicate an increasing degree of kinesiophobia.⁶

Initial research has concluded that the fear avoidance model may be predictive after acute whiplash injury regarding the transition to chronic whiplash symptoms.⁷ For the practitioner who regularly treats patients with this type of injury, it would be helpful to identify specific, easy and inexpensive tools to use to identify patients who are at higher risk of developing chronic symptoms and kinesiophobia. The purpose of this narrative review of the literature was to review, and summarize the literature regarding the use of the Tampa Scale of Kinesiophobia and its relationship to neck pain, perceived disability and range of motion of the cervical spine.

Methods

An initial search was performed on July 13, 2010 of Medline, MANTIS and the Index to Chiropractic Literature (ICL). CINAHL was searched on August 17, 2010 and these databases were searched for a second time to determine if the searches yielded any new arti-

cles. The following MeSH terms were used in the CINAHL, Medline and ICL searches: “Pain Measurement,” “Questionnaires,” “Severity of Illness Index,” “pain and Psychology,” “Avoidance Learning,” “Fear/Psychology,” “Neck Injuries,” “Neck Pain,” and “Cervical Vertebrae.” The following keywords were also used: “Tampa Scale of Kinesiophobia.” The only limiter used was English Language only articles in the searches.

Results

Numerous studies were identified regarding the TSK and musculoskeletal pain. Far fewer were found regarding TSK in relation specifically to cervical spine pain. A total of 16 studies, including one review of the literature, were found using these inclusion criteria. These studies fell into four distinct categories. The first category was TSK and neck pain which includes a total of 4 studies including the review mentioned above spanning from 2006 through 2008. The second category is TSK, neck pain and disability (using the Neck Disability Index (NDI) or other measure) and includes 10 studies spanning 2004 through 2009. The last two categories are TSK, neck pain, disability and strength and TSK, neck pain and surface EMG, each of which include one study in 2009 and 2006 respectively.

Discussion

Each of the 16 studies identified are discussed and summarized below (Table 1).

TSK and Neck Pain

The first study in this section and one of the first studies using the TSK on neck pain patients was conducted by Buitenhuis, Jaspers and Fidler and published in 2006.⁸ Using the Dutch version of the TSK (TSK-DV) this one year prospective cohort study sent out 889 questionnaires to whiplash sufferers with neck symptoms from motor vehicle accidents from a Dutch insurance company. Sixty-six percent of the studies were returned and 367 were used for analysis. The purpose of the study was to investigate the “predictive value of early kinesiophobia on the duration of neck symptoms after a motor vehicle accident.”⁸ It was found that a higher score on the TSK-DV was associated with longer duration of neck symptoms but that information on “early kinesiophobia does not improve prediction of duration of neck symptoms after a motor vehicle accident.”⁸ Although this was the conclusion for

Table 1 Study summary

Study reference number(#), Publication date and Authors	Sample size	Type of Study	Objective	Results and conclusion	Limitations
(6) September 2009 Pool et. al.	13	Inception cohort with baseline assessment	To determine the applicability of the TSK to neck pain	– Supports the use of the fear avoidance model for neck pain	– use of the 'think aloud' method to fill in questionnaire may confound results
(7) 2007 Vangronsveld et. al.	N/A	Topical review	Review of a few studies that investigated the applying the fear avoidance model to chronic whiplash syndrome	– Supports the use of the fear avoidance model for neck pain	– narrow focus of topical review regarding the use of the fear avoidance model for neck pain.
(8) March/April 2006 Buitenhuis et. al.	367	Questionnaire	investigate the "predictive value of early kinesiophobia on the duration of neck symptoms after a motor vehicle accident	– Higher TSK scores predicted increased symptom duration. – Early Kinesiophobia does not improve symptom prediction	– used mailed questionnaires therefore no control over situation in which questionnaire was completed. – participants contacted through insurer (MVA) which may influence scoring on questionnaires.
(9) November 2007 Feleus et. al.	679	Prospective cohort	"determine if mean scores of kinesiophobia change over time" in those patients that they considered 'non-recovered'	– Unrecovered subjects do not exhibit changing TSK scores over time	– no previous reports of value of TSK and neck, shoulder and arm pain. – number of variables may confound study results.
(10) March 2004 Nederhand et. al.	82	Prospective longitudinal	Investigate if fear avoidance variables increase prediction of chronic neck pain	– The use of the NDI along with TSK can predict future neck pain outcomes	– recruitment method and facility of research may cause selection bias and/or symptom magnification.
(11) 2005 Sterling et. al.	80		Determine predictive capacity of the TSK measured early at long term follow up.	– Higher NDI scores (with decreased ROM (9)) and increased psychological distress/PTSD can predict the persistence of symptoms/poor outcomes	– recruitment method may cause selection bias and/or symptom magnification. – first study of its kind therefore results have yet to be confirmed.
(12) 2006 Bunketorp et. al.	47	RCT	To determine the effect of individualized supervised physical training vs. home self exercise on patients with subacute whiplash	– Self efficacy is an important factor in persistent neck pain disability	– differences in exercise programs to supervised patients may exist as different practitioners were used which may confound results. – Blinding not possible on patients or treating physiotherapists which may produce bias – increased contact with treating physiotherapists in supervised group would increase level of patient education and may confound results.
(13) March 2006 Bunketorp et. al.	49	RCT	To analyze the effects on disability of subacute whiplash patients from the different factors of pain(sensory, cognitive, affective)	– Self efficacy is an important factor in persistent neck pain disability	– differences in exercise programs to supervised patients may exist as different practitioners were used which may confound results. – Blinding not possible on patients or treating physiotherapists which may produce bias – increased contact with treating physiotherapists in supervised group would increase level of patient education and may confound results. – unclear if patients matched appropriately in consideration of this study

Table 1 (Concluded)

Study references number(#), Publication date and Author	Sample size	Type of Study	Objective	Results and conclusion	Limitations
(14) 2006 Sterling et. al.	80	Prospective longitudinal	Analyze the predictive capacity of higher levels of certain variables (older age, pain, disability, cold hyperalgesia, impaired sympathetic vasoconstriction and moderate PTSD symptoms) at long term follow up of whiplash injury.	<ul style="list-style-type: none"> Higher NDI scores (with decreased ROM (9)) and increased psychological distress/PTSD can predict the persistence of symptoms/poor outcomes 	<ul style="list-style-type: none"> recruitment method and facility of research may cause selection bias and/or symptom magnification. unknown if findings can be extrapolated to other populations
(15) February 2008 Cleland et. al.	78	Cohort	Determine the value of using the FABQ and TSK in neck pain patients	<ul style="list-style-type: none"> Supports the use of the fear avoidance model for neck pain 	<ul style="list-style-type: none"> recruitment method and facility of research may cause selection bias and/or symptom magnification. test-retesting may have been done too close together promoting bias.
(16) 2006 Gustavsson, C and von Koch, L.	37	RCT	To examine the usefulness of this particular study design (RCT) in evaluating patients with long term neck pain and compare the effects of treatment.	<ul style="list-style-type: none"> Applied relaxation group had better perceived control over pain Self efficacy is an important factor in persistent neck pain disability 	<ul style="list-style-type: none"> preliminary study therefore small sample size
(17) May 2008 De Loose et. al.	629	Questionnaire (cross sectional)	Estimate the prevalence and identify risk factors of neck pain in military office workers	<ul style="list-style-type: none"> neck pain is prevalent in military office workers and psychosocial factors are more important in the short term 	<ul style="list-style-type: none"> used mailed questionnaires therefore no control over situation in which questionnaire was completed. population may have a reluctance to admit to pain and disability/fear.
(18) 2009 Nieto et. al.	147	Questionnaire	Identify if fear of movement and pain catastrophizing predict disability and depression in subacute whiplash patients.	<ul style="list-style-type: none"> Supports the use of the fear avoidance model for neck pain 	<ul style="list-style-type: none"> recruitment method and facility of research may cause selection bias and/or symptom magnification. long term follow up needed.
(19) 2009 Vernon et. al.	107	Cross sectional design	Used chronic whiplash patients to determine if fear avoidance behaviour and pain amplification along with several factors (age, gender, duration and pain severity) correlate with perceived disability.	<ul style="list-style-type: none"> Supports the use of the fear avoidance model for neck pain 	<ul style="list-style-type: none"> focused on chronic neck pain and subjects entered study after referral for third party specialist assessment which may produce selection bias.
(20) March 2009 Pearson et. al.	14 WAD 28 healthy patients	Cross sectional repeated measures design	To determine if there is a link between neck strength measurements and pain, kinesiophobia and catastrophizing in WAD patients	<ul style="list-style-type: none"> No significant association was found between TSK/NDI and neck strength 3 of 6 muscles tested in chronic WAD showed decreased strength compared to healthy subjects. 	<ul style="list-style-type: none"> recruitment method and facility of research may cause selection bias and/or symptom magnification. most WAD sufferers were in driver's side collisions which may produce bias to which muscles affected
(21) August 2006 Nederhand et. al.	92	Prospective longitudinal design	To determine the influence of pain and fear of movement on activation patterns of the upper trapezius muscle during the transition from acute to chronic neck pain	<ul style="list-style-type: none"> Supports the use of the fear avoidance model for neck pain Supports the use of the pain adaptation model for neck pain 	<ul style="list-style-type: none"> use of sEMG which is currently classified as an experimental assessment technique by the American Academy of Neurologists. recruitment method and facility of research may cause selection bias and/or symptom magnification.

the study, it was noted that a relationship does exist between the TSK score and the duration of neck symptoms. However, when other variables were accounted for such as sex and age, the significance was lost. These variables have been previously shown to have a relationship to neck pain duration.⁸ It was also noted that there was a relationship between TSK score and symptom intensity as well as difficulty with concentration and initiation of sleep. This study utilized mailed questionnaires to victims of motor vehicle accidents and were contacted through a Dutch insurance company. Although the authors maintain that it was made clear on the letter of invitation to the study that involvement would be independent of compensation from the insurer regarding the claim, one cannot be sure that symptom exaggeration was not present in responses. In addition, as the study was mailed, the authors identified that there was no control of the environment under which the questionnaires were completed.

In 2007, Feleus, van Dalen, Bierma-Zeinstra, Bernsen, Verhaar, Koes and Miedema used a prospective cohort design to describe the degree of kinesiophobia in patients with non-traumatic complaints of arm, neck and shoulder in general practice.⁹ The study used the 13 item adjusted Dutch version of the TSK (TSK-AV). The aim was to “determine if mean scores of kinesiophobia change over time” in those patients that they considered “non-recovered.”⁹ Additionally they sought to evaluate variables including age, gender, educational level, work, sports participation, duration of complaint, severity of complaint, as well as psychosocial characteristics and their association with kinesiophobia at baseline. The category of recurrent complaint was also included and accounted for not only recurrent complaints, but also multiple complaints and complaint location. The study evaluated 36 patients with a new complaint or episode of neck, upper back, shoulder, upper arm, elbow, forearm, wrist or hand pain aged 18 to 64 years. Excluded from the study were those with pain that could be explained. The patients completed an initial questionnaire and then again at 6 and 12 month follow up. It was found that the degree of kinesiophobia was unchanged in patients who did not recover during the 12 month follow up. Limitations include the lack of previous reports of the psychometric value of the TSK with respect to neck, shoulder and arm pain, the lack of measurement of depression in the patients and the use of one question to give an indication of “health locus of control.” Relation-

ships were noted between baseline scores of kinesiophobia and catastrophizing, disability and other musculoskeletal complaints/comorbidities. This said, it was noted that this made it unclear if the origin of kinesiophobia was rooted in the other comorbidities (low back pain) or a previous bad experience. Although the authors reported that these comorbidities did not modify the association, the high number of variables in this study could have confounded results. In addition, the study was not limited to neck pain only patients and included patients with arm and shoulder complaints. This could artificially inflate relationships between kinesiophobia and neck pain as patients frequently have difficulty separating these types of symptoms and their effects.

In 2007 Vangronsveld, Peters, Goossens, Linton and Vlaeyen published a topical review “Applying the fear-avoidance model to the chronic whiplash syndrome.”⁷ This review sought to review what the authors considered to be relevant studies that examined whether the fear avoidance model can be applied to chronic whiplash syndrome. All of the studies examined in this review will be examined in detail in this paper. It was concluded that the fear avoidance model “may offer a novel framework to explain the transition from acute whiplash injury to chronic whiplash syndrome.”⁷ It was suggested that future research should include multiple outcome measures as patients who suffer an acute whiplash not only are at risk of developing high pain levels and disability but also mood disorders and post traumatic stress disorder. Suggestions for future research include determining if high levels of catastrophizing soon after a whiplash injury lead to more complaints at final follow up, as well as studying other potential predictors (anxiety sensitivity and acute traumatic stress symptoms). This review included only a few studies as it was a topical review. The limitation is primarily that by its nature, a topical review provides a small window into the research.

Pool, Hiralal, Ostelo, van der Veer, Vlaeyen, Bouter and de Vet published a study regarding “The applicability of the Tampa Scale of Kinesiophobia for patients with sub-acute neck pain” in 2009.⁶ This study sought to “qualitatively evaluate patients” understanding and interpretation of the wording in test items of the TSK” which was initially developed to measure fear of movement of patients suffering from low back pain. It attempted to elicit or discover problems that patients with sub-acute neck pain may have in filling out the TSK. Thirteen

patients (7 women and 6 men) aged 18 to 70 were evaluated using the Three-Step Test Interview (TSTI) which aims to identify problems with self-administered questionnaires. It was reported that two problems were identified including the use and meaning of specific words such as “dangerous” and “injury” as well as that implicit assumptions within some items make it difficult for some respondents to answer these questions. The authors concluded that in the “development and validation of questionnaires such as the TSK not only qualitative psychometric properties are important, but also qualitative research has an important contribution to enhance applicability.”⁶ Questionnaires in this study were filled out using a “think aloud” method which the authors reported proved difficult for some participants. By its nature, this method may cause participants to become uncomfortable if they feel they are being judged by the study investigators which may influence their verbalizations. It was reported that some participants answered quickly while others did so slowly but it was not reported if any specific participant characteristic (age, gender) was related to this.

TSK, Neck Pain and Disability

In 2004 Nederhand, IJzerman, Hermens, Turk and Zilvold attempted to determine the “Predictive value of fear Avoidance in developing chronic neck pain disability.”¹⁰ Using an inception cohort design with a baseline assessment one week post trauma and outcome assessment at 24 weeks post trauma, the purpose of this study was to improve clinical decision making in patients with post traumatic neck pain by investigating fear avoidance in predicting neck pain disability.¹⁰ Ninety-one percent of the 90 participants between the ages of 18 and 70 in the study completed the follow up outcome. It was found that by using a combination of baseline NDI and TSK scores it was possible to predict chronic disability with a probability of 54.2% after using NDI alone and 83.3% when using a combination of NDI and TSK scores. The authors concluded that a “rating of neck pain disability within a week of trauma used separately or in combination with a test for fear of movement can be used to predict future outcomes.”¹⁰ This finding is opposite to the first study discussed above by Buitenhuis in 2006. However, unlike the previously discussed study this study excluded patients with neurologic signs and focused on head and neck pain alone. Limitations of this study include recruitment

method (patients admitted to the emergency department of a hospital) and the fact that the study was conducted at a well known rehabilitation and research facility. These characteristics may well lend to symptom magnification and/or have a tendency towards selection bias of those more prone to catastrophizing or symptom magnification.

In 2004, Sterling, Jull, Vicenzino, Kenardy and Darnell investigated “physical and psychological factors (that) predict outcome following whiplash injury.”¹¹ This prospective longitudinal designed study investigated 80 patients with a mean age of 36.27+/-12.69 years that reported neck pain as a result of a motor vehicle accident. The purpose of this study was to determine the predictive capacity of the combined comprehensive set of measures that included motor, sensory and psychological measures encompassing the broad biopsychosocial model of musculoskeletal pain. Measures used included motor functioning (range of motion, kinesthetic sense, and activity of superficial neck flexors on EMG), sensory testing, vasoconstrictor responses, psychological distress (including various measures along with the TSK) and the NDI. The outcome measure was persistent pain at six months post injury. It was concluded that “higher NDI scores, greater psychological distress and decreased range of motion predicted subjects with persistent milder symptoms from those who fully recovered.”¹¹ The authors suggested that both “physical and psychological factors play a role in recovery or non-recovery from whiplash injury.”¹¹ When a combination of the variables was used, the predictive value was better than when compared to previous models that did not use all of these variables. The authors reported that they could account for 67% of the variation in pain and disability using this model compared to 35% when using a combination of age, gender, psychological factors or age, gender and accident features. As this study was the first of its kind, that being the first to show that physical and psychological factors when added to previously known factors (age and initial symptom intensity) are important in predicting outcomes of whiplash injuries, confirmation of results are needed. Interestingly, higher pain reports were predicted by cervical range of motion loss. This was the only motor function that predicted long term outcomes while EMG activity in flexion of the cervical spine and joint position error were not isolated to only WAD sufferers with higher level of pain symptoms. The limitation for this study is similar to that of the study

published in 2004 by Nederhand et. al. above as patients were recruited following a motor vehicle accident in hospital emergency rooms; however, this effect is lessened as people were also recruited from primary care practice, and advertisement.

Bunketorp, Lindh, Carlsson and Stener-Victorin first used the results of their randomized controlled trial using 40 subjects in a publication in 2005.¹² The purpose of the study was to evaluate if a tailored and supervised physical training program had a greater influence on self efficacy, fear of movement and re-injury than a self administered home exercise program. The study used the Self Efficacy Scale and the TSK as primary measures and the Pain Disability Index as a secondary measure. It was reported that the supervised training was significantly more effective than the home training program” with a more rapid improvement in self efficacy and fear of movement at three months and that the results were partially maintained at nine months.” This was the only study elicited in the literature search that measured the outcomes of treatment with the TSK for neck pain. Improvement in kinesiophobia, perceived disability due to pain, self efficacy and analgesic use was noted to be significant in the group that received a tailored supervised exercise program compared to the home exercise group. Although the investigator performing measurements was blinded to the group the patient was in, due to the nature of the study, the five treating physiotherapists and the patients could not be blinded which may have influenced outcomes. As five different physiotherapists were used to provide treatment, and the group getting tailored treatment each had different programs, it is unclear if each patient in the supervised training group was provided with equally effective programs. In addition, the added contact between the supervised group and physiotherapists would provide increased education levels to these patients as it would be near impossible for the practitioner not to continue to educate the patients. It is therefore a confounding factor as it cannot be definitively said that the exercise program differences account for the significant differences in groups as patient education would also be a likely factor in the differences seen.

In 2006, the same investigators (Bunketorp et. al.) used the data collected in for their 2005 study to “clarify relations between sensory, affective and cognitive dimensions of pain and to analyze what influence these components

have on persistent disability in patients with sub-acute whiplash associated disorder.”¹³ It was reported that “self efficacy was the most important predictor of persistent disability.”¹³ Additionally the following factors were found to correspond to lower self efficacy: high pain intensity and pain affect, widespread pain and fear of movement. As the same data was used as in the previous study, it begs the question were the investigators planning this component of the research prior to the investigation or did they use existing data because a relationship was noted. If the latter is the case, bias may be present as the groups may not have been matched effectively to investigate this portion of the research. In addition, all of the same limitations listed above would also apply to this study.

The predictive value of variables including initial higher levels of pain and disability, older age, cold hyperalgesia, impaired sympathetic vasoconstriction and moderate post-traumatic stress symptoms were investigated in a study published in 2006 by Sterling, Jull and Kenardy.¹⁴ The investigators noted that while these variables have been shown to be associated with poor outcomes at 6 months post whiplash, investigation of associations at long term follow up was lacking. This study used a prospective longitudinal design to follow and assess 80 acute whiplash patients to 2, 3, and 6 months post injury and again at 2–3 years post injury. The study employed the TSK and NDI as well as cervical range of motion, joint position error, pressure pain and thermal thresholds and measures of the sympathetic nervous system function (sympathetic vasoconstrictor response). It was concluded that “higher initial NDI scores, older age, cold hyperalgesia and post traumatic stress symptoms were significant predictors of poor outcome at long term follow up”¹⁴ When the TSK along with Impact of Events Scale and the General Health Questionnaire 28 were used it was found that there was a “significant group effect for the group with moderate/severe symptoms at 2–3 years when compared to groups with milder symptoms.”¹⁴ As it was noted that the physical and psychological characteristics of those who did not recover at 6 months and long term follow up were present at one month post injury, it was implied that this poses significant implications for early management of this type of patient. The authors suggest that this group of patients may benefit from early multidisciplinary management to include adequate pain control using pharmacotherapy, physical and psychological therapy. Subjects were re-

cruited from emergency departments following a motor vehicle accident (as well as their primary care physicians and advertisements) which may produce a bias towards those with symptom magnification. It was reported by the authors that the findings in a small group of whiplash patients may not extrapolate to expand to other populations.

In 2008 Cleland, Fritz and Childs attempted to examine “the psychometric properties of the Fear Avoidance Beliefs Questionnaire (FABQ) and the TSK in Patients with neck pain.”¹⁵ Using a cohort design, 78 subjects were asked to complete the Fear Avoidance Beliefs Questionnaire Work (FABQW) and Physical Activity (FABQPA) as well as the TSK at baseline and 2 day follow up. It was reported that “the FABQW and FABQPA had subset test-retest reliability and the TSK was moderately reliable for neck pain patients.”¹⁵ Consistency was found for all measures. The authors concluded that this study suggested a “weaker relationship between measures of fear and avoidance and pain/disability in patients with mechanical neck pain than has been reported among patients with lower back pain.”¹⁵ The authors identified limitations of the study including the inclusion of sub-acute neck pain patients which they felt may have influenced the results as well as the fact that the dimensionality of the scales were not assessed. This factor affects the statistical tool they used (Cronbach’s alpha), which they felt may account for lower TSK scores in comparison to the other measures they used. It was also noted that subjects included were consecutive patients presenting to a hospital physiotherapy department with history of a whiplash injury within 6 weeks. This may present a bias towards patients with symptom magnification. The follow up testing was done only 2 days following initial testing which may not prove to be a significant enough amount of time between tests as patients may have a tendency to recall what they scored only two days prior. It would be interesting to have repeated this measure a more significant amount of time later such as one to three months.

Gustavsson and von Koch used measures of neck pain, TSK and NDI to “evaluate the feasibility of study design and method for evaluating effects of interventions on patients with long lasting neck pain and to compare the treatment effects of (i) a pain and stress management group intervention with applied relaxation and (ii) individual physiotherapy treatment as usual.”¹⁶ Using a randomized controlled pilot study, the authors evaluated

37 patients with long lasting neck pain. Patients were assigned to either an applied relaxation group which received 7 group sessions over 7 weeks or the “as usual” group who had an average of 11 physiotherapy sessions over 20 weeks. Using the NDI, Coping Strategies Questionnaire, Hospital Anxiety and Depression Scale, TSK and questions regarding neck pain, analgesic use, sleep, sick leave and health care utilization, it was found that the applied relaxation group had “better perceived control of pain” at 20 week follow up compared to the “as usual” group. The authors concluded that “this design and methods would be suitable for a larger RCT study.”¹⁶ The limitations of this study is that of its preliminary nature and small sample size for each group.

In 2008 De Loose, Burnotte, Cagnie, Stevens, Van Tiggelen and Defense used a cross sectional questionnaire study of 942 office workers of the Belgian Defense to attempt to identify short and long term risk factors in the occurrence of neck pain in military office workers.¹⁷ Using the NDI and TSK to assess the impact of neck pain on the respondent’s life and pain-related fear avoidance it was concluded by the authors that the results “supported the role of physical and psychosocial job characteristics in the etiology of neck pain in military office workers.”¹⁷ It was noted that in those that did respond (147 of 942) neck pain is common. As this was a questionnaire that was sent out, the study could not control the environment in which the questionnaire was filled out which may have influenced results. In addition, as it was sent to military workers, the population may have a reluctance to admit to pain, fear and disability.

Using a stepwise regression analysis, Nieto, Miro and Huguet analyzed the “fear-avoidance model in whiplash injuries” in a publication in the European Journal of Pain in 2009.¹⁸ The purpose of the study was to determine if “fear of movement and pain catastrophizing predict pain related disability and depression in sub-acute whiplash patients.” While controlling for descriptive variable and pain characteristics, 147 sub-acute whiplash patients between the ages of 18 and 65 completed the Pain Catastrophizing Scale (PCS), TSK, NDI and the Beck Depression Inventory (BDI) and current neck pain was recorded on an 11 point numeric scale where 0 is “no pain” and 10 was “pain as bad as could be.” It was found that “catastrophizing and fear of movement were predictors of disability and depression” and that “pain intensity was a predictor of dis-

ability but not depression.”¹⁶ The authors concluded that as the fear avoidance model suggests, fear of movement and catastrophizing are important factors with respect to developing disability and depression in whiplash patients. The study used whiplash sufferers who were involved in a car accident with pain of less than three months duration who were seeking treatment in rehabilitation facilities. As these participants were already seeking treatment, there is the possibility that this population may have a bias toward symptom magnification. This study provides data for a small period of time, namely whiplash of less than three months duration. Further study is required to determine if the relationships identified continue over time.

Vernon, Guerriero, Kavanaugh, Soave and Moreton attempted to “determine if fear avoidance behavior and pain amplification along with age, gender, duration and pain severity correlate with sources of self rated disability in chronic whiplash sufferers.”¹⁹ Published in 2009, this study used a cross sectional clinical study design examined 107 subjects with a mean age of 45.5 years who completed the NDI, TSK, pain visual analogue scale and pain diagram. It was concluded by the authors that “important psychological factors including fear avoidance beliefs and pain amplification have some influence on self rated disability in chronic whiplash sufferers, (though this influence was not) larger than that found in studies of acute/sub-acute patients.”¹⁹ The authors report that it is not yet clear how fear avoidance behaviour and pain amplification influence perceived disability in chronic Whiplash Associated Disorder (WAD) though they have influence on its development. The study focused on chronic patients at least three months post WAD who were referred to the study after presentation for a third party specialist assessment. This may have produced a selection bias.

TSK, Neck Pain, Disability and Strength

The only study found in the literature to be included in this section was published in 2009 by Pearson, Reichert, De Serres, Dumas and Cote.²⁰ In this controlled laboratory cross-sectional, repeated measures design 14 subjects with chronic whiplash grades I and II were age matched with a healthy group and cervical strength was measured in 6 directions with a Multi-Cervical Unit. Pain was measured using a Visual Analog Scale and the WAD group completed the NDI, TSK and Pain Catastrophizing Scale (PCS). It was found that the WAD group had

“significant deficits in strength” compared to the healthy group especially in extension and lateral flexion but that “no significant association between neck strength and NDI, TSK and PCS was found.”²⁰ The study did identify strength deficits in WAD sufferers ranging from 52% to 72% in extension, retraction and left lateral flexion. The authors had difficulty explaining the reason behind deficits in left lateral flexion and reported that the majority of the sample had driver’s side collisions. This study should therefore be repeated with subjects who were in various positions of the car with various types of impacts as different muscles may be affected depending on position, seat belt position and direction of impact. The study also recruited chronic WAD sufferers from rehabilitation and return-to-work program which may have caused a selection bias.

TSK, Neck Pain and Surface Electromyography

The last study to be reviewed, and the only one in this section was published by Nederhand, Hermens, Ijzerman, Groothuis and Turk in 2006.²¹ The purpose of this study was “to evaluate the role of pain and fear of movement in the muscle activation pattern of the upper trapezius muscle during the transition of acute to chronic post traumatic neck pain.” Using a prospective longitudinal design 92 subjects with acute traumatic neck injury after MVA were followed up for 24 weeks. Using a Visual Analog scale rating of pain, TSK and surface Electromyography (sEMG) during sub-maximal isometric activation of the trapezius muscle. Subjects were evaluated at 1, 2, 8, 12, and 24 weeks. The results indicated that lower levels of muscle activity was independently associated with both the increase in fear of movement and pain intensity. Interestingly, it was reported that patients reporting higher pain intensity had a stronger association between fear of movement and decreased muscle activity which appears to decrease as time passed since the injury. The authors concluded that both the pain adaptation and fear avoidance models were supported by their results. This study used sEMG which is currently classified as an experimental assessment technique by the American Academy of Neurologists. While less invasive than needle EMG, needle EMG remains the gold standard for this type of testing. The sample of patients was recruited from a hospital emergency room after a motor vehicle accident, which, like in many of the other studies may produce a

Table 2 *Summary of study findings or conclusions*

Findings or Conclusions	Study reference
Higher TSK scores predicted increased symptom duration	8
Early Kinesiophobia does not improve symptom prediction	8
Unrecovered subjects do not exhibit changing TSK scores over time	9
Supports the use of the fear avoidance model for neck pain	7, 15, 18, 19, 21
The use of the NDI along with TSK can predict future neck pain outcomes	10
Higher NDI scores (with decreased ROM (9)) and increased psychological distress/PTSD can predict the persistence of symptoms/poor outcomes	11, 14
Self efficacy is an important factor in persistent neck pain disability	12, 14
No significant association was found between TSK/NDI and neck strength	20
Supports the use of the pain adaptation model for neck pain	21

selection bias towards those with tendencies for pain amplification or catastrophizing. The authors report that as a result of this study, reclassification of the Quebec Task Force injury severity classification system is required as they found that WAD II “is not characterized by muscle spasm but rather by muscle recoordination.” Further study and confirmation possibly using needle EMG is required prior to the implementation of this recommendation.

The findings or conclusions from the studies reviewed have been summarized in table 2.

Conclusion

The TSK was originally developed to measure the fear of movement with respect to low back pain sufferers. As previously stated, the TSK has been used more recently to measure kinesiophobia in different body parts including the neck. There have been only 16 studies conducted regarding neck pain and the TSK in general that were found during the research phase for this review. Despite this, preliminary research has shown that there is value from a psychometric perspective in using the TSK with neck pain patients. It also seems that the fear avoidance model can be applied to neck pain sufferers from the initial research conducted. The TSK has been used with measures of perceived disability including the NDI to measure how

kinesiophobia and neck pain are related to perceived disability. Further research is needed to determine if, and to what extent, other measureable factors commonly associated with neck pain, such as decreased range of motion, correlate with kinesiophobia. Several of the studies currently available used recruitment methods that may have induced a bias. Although WAD is a common cause of neck pain, it is not the only cause of neck pain. The studies reviewed have a heavy bias towards the use of WAD sufferers in their research. It would be advisable that future research use neck pain sufferers from other causes as well. This review has identified some areas of research including neck range of motion, strength, and muscle activation with regard to fear of movement and the TSK that require further study.

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