High frequency of McKenzie's postural syndrome in young population of non-care seeking individuals

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Objectives: The role of postural loads as a risk factor for back pain and musculoskeletal symptoms is unclear. McKenzie proposed in his classification of mechanical syndromes a postural syndrome, in which people only develop symptoms from sustained loading, which is relieved by a change in position and has no effect on movement or function. Because of the low level disability with postural syndrome, it was suggested that few seek healthcare for this problem.

Methods: This study used a two-stage process first to give a questionnaire to 100 students and staff from a university to determine who appeared to have postural syndrome, and then applied a physical examination to those who consented.

Results: One hundred and thirty-eight were approached, of who 100 completed questionnaires and 66% appeared to have postural syndrome. Of the 66 who appeared to have postural syndrome, 37 consented to have a physical examination. Of the 37, 31 met the criteria for postural syndrome, with postural syndrome being significantly associated with pain on sustained loading and pain abolition on posture correction. Most postural syndrome was in the lumbar spine and associated with sitting, but other sites and causes were also noted.

Discussion: This study lends credibility to McKenzie's postural syndrome, but also suggests this as a possible precursor for future more disabling or painful problems. Postural syndrome may not feature in those seeking professional healthcare, but is clearly highly prevalent in a young population.

Keywords: Posture, Backache, McKenzie syndromes, Prevalence, Sustained postures

Introduction

Low back pain (LBP) remains a leading cause of disability and is one of the most prevalent and costly conditions treated in primary care.¹ In the UK, the total direct and indirect costs have been estimated at between £5 and £10 billion, with the majority of this being absorbed by indirect societal costs.² The main risk factors for LBP are classified as individual, mechanical or psychosocial factors. The evidence for mechanical factors has been negative or contradictory,³ but there was evidence for an effect of work-related psychosocial factors.⁴ Previous episodes have been identified as the strongest risk factor for further episodes, and for poor recovery.⁵⁻⁹

Sustained postures could theoretically be a risk factor for LBP and other musculoskeletal symptoms as prolonged physiological loads might precipitate symptoms through mechanical stress.¹⁰ A number of studies have documented a link between sustained

flexed postures and back and neck pain in populations both with and without existing back pain.¹¹⁻²¹ Although some of the above studies are relatively weak in study design, much of the other literature on sustained loading on spinal tissues has either been conducted on individuals without symptoms,²²⁻²⁴ on cadavers,²⁵⁻²⁹ or on animals.³⁰⁻³² These studies do provide evidence about the possible deleterious effect on tissue of sustained loading, but do not provide evidence about the symptom response to sustained loading in humans.

Systematic reviews have failed to support sustained sitting posture as a risk factor for LBP.^{33,34} Two systematic reviews found that there was no strong evidence for any association between any particular spinal posture and spine pain.^{35,36} Thus, the association between sustained postures and LBP is uncertain. Individual studies, such as case-control studies, demonstrate more back pain among those who maintain more flexed postures and more periods of sustained and uninterrupted sitting,^{11,21} but systematic reviews have failed to identify sitting as a risk factor for LBP.

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McKenzie described three mechanical syndromes, which were based on clinical presentations and response to repeated movements and sustained postures.³⁷ One of these is the postural syndrome, in which prolonged static loading of normal soft tissues results in discomfort triggered by sustained mechanical stress.³⁷ The clinical presentation is usually a young person who maintains sustained postures for long periods, most commonly sitting, which provoke transient symptoms that are abolished with the resumption of an upright posture. Symptoms are only provoked after sustained loading, and so the syndrome is not associated with impairment or disability. Because of the relatively trivial and transient nature of symptoms, healthcare is rarely sought.³⁷ For instance, in a reliability study of 45 back patients, only one patient (2.2%) was thought to be classified with postural syndrome.³⁸ In two surveys with a combined total of 947 patients in care with spine pain and data from multiple therapists, only ~1% were classified with postural syndrome.^{39,40} However, among a student population, 50% reported previous transient and mild postural-related backache.²¹ None had sought treatment, but over a 3-day period, they reported 46 backache episodes, all triggered by sitting activities, most commonly when studying. Compared with a no backache control group, there were significant differences in the amount of time sat sustained without interruption and the amount of lumbar flexion when sitting relaxed. The numbers in this study were small, although these individuals appeared to have McKenzie's postural syndrome a physical examination was not conducted to confirm this, and this study has not been replicated.

The aims of the present study were to replicate the previous study in a larger student population to establish the frequency of postural musculoskeletal symptoms, and also to conduct a mechanical evaluation of those with symptoms to confirm that they were actually classified as McKenzie's postural syndrome. Another aim was to find any factors that correlated with the presence of postural syndrome.

Methods

The study used a two-stage process; first, 100 participants were recruited to complete a questionnaire that identified the presence of mild musculoskeletal symptoms. Those who were 'positive' to the questionnaire were then approached for consent for the second stage in which the physical examination was conducted to confirm the presence of postural syndrome. Recruitment and process were conducted over a 5-week period in October to November 2009.

Subjects

The study was approved by the Health and Social Care Sheffield Hallam University Ethics Committee, and all subjects were provided with information sheets and signed consent to participate in the physical examination. Willingness to complete the initial questionnaire was considered to represent informed consent. Completion of the questionnaire took about 10–15 minutes. Staff and students were approached at random in the reception area of the Health and Social Care Campus to attempt recruitment; thus, a random sample of convenience was recruited. Inclusion and exclusion criteria were as follows: staff or students at Sheffield Hallam University, less than 30 years of age, as the appropriate age for postural syndrome, no serious present or past musculoskeletal symptoms, and no medical or surgical conditions or interventions affecting their posture.

Questionnaire

The questionnaire was developed specifically for this study, and included sections on demographics, levels of daily activity, self-reported maximally performed activity, existence of postural pains and their characteristics, and any reporting of pain to a general practitioner. After development of the questionnaire, it was completed in a pilot study on seven participants not involved in the main study. Amendments were made to the questionnaire in response to feedback, and the final questionnaire is in the appendix.

Procedure

If the participant reported postural-related musculoskeletal symptoms, an attempt was made to recruit them to the second part of the study. If consent was gained, an appointment time was made with the participant to suit their availability, and the physical examination was conducted in a technical laboratory on the campus. The evaluation took about 30–40 minutes to complete. The physical examination was conducted using a standard lumbar, thoracic, or cervical McKenzie assessment sheet, in which on the first page a series of standard history questions were asked, and on the second the examination itself was conducted. Five main components were assessed: posture, effect of static loading, effect of posture correction, range of movement, and effect of repeated movements. Positive static loading was operationally defined as when sustained positioning in the participant's aggravating posture provoked symptoms, the length of time it took to produce symptoms was recorded. Positive posture correction was operationally defined as when posture correction abolished symptoms. One researcher conducted the examination. The other observed, but did not speak with the

Figure 1 Flow diagram of participants.

participant; they both independently recorded these responses and classified participants, as either postural syndrome or non-postural syndrome (derangement or dysfunction).

For this study, postural syndrome was operationally defined as when the following applied:

- pain on sustained loading;
- abolition of pain, if present, on posture correction;
- no restriction of range of movement;
- no pain on repeated movements.

Data analysis

The data were entered into SPSS/PASW version 17.0 (SPSS Inc., Chicago, IL, USA), where analysis was conducted. In the first part of the study demographic, activity and pain variables were correlated with the presence of McKenzie's postural syndrome. In the second part of the study demographic variables, pain duration, site and characteristics, and response to static tests and posture correction were correlated with the presence of McKenzie's postural syndrome. Data were non-parametric and so correlation was tested with phi and Cramer's V coefficients for nominal and ordinal data. *P* value was set at 0.05. Following the physical examination, agreement between the two researchers was calculated using kappa scores.

Results

One hundred and thirty-eight staff and students were approached, and 100 agreed to complete the questionnaire (see Fig. 1 for flowchart of participants).

Figure 2 Site of pain and maximally performed activity in 66 reporting pain in questionnaire: Count=number; SOP=site of pain; MPActivity=maximally performed activity.

The population mostly identified their activity level as low to moderate and the majority identified their maximally performed activity as sitting (Table 1). Of the 100 who completed the questionnaire, 66 (66%) were suspected of having postural syndrome out of 69 who reported pain. Three with back pain were excluded as response to questionnaire made clear that pain was non-postural in origin; pain was constant or persisted after sustained activity. Postural pain was predominantly spinal, with lumbar more than cervical, more than thoracic; much smaller numbers had postural pain in the lower and upper extremities. The aggravating activity was predominantly sitting in all spinal symptoms, much less commonly with standing or lying; whereas standing was the commonest cause of postural pains in the lower extremity (Fig. 2). Mean pain intensity was 3.8 (SD: 1.6) on an 11-point scale; pain had been present for a mean of 2 years (SD: 1.8). Only six of 66 (9%) had reported backache to a healthcare professional.

In the questionnaire, most variables were not significantly related to the presence and severity of

Table 1 Details of population who completed questionnaire and examination

Variable		n (100)	n (37)
Gender	Male	51	17
	Female	49	20
Age	<20	22	0
	20–24	44	13
	25–30	34	24
Activity	Heavy	7	
	Moderate	36	
	Low	57	
MPA	Sitting	70	
	Standing	25	
	Lying	5	

Note: MPA=maximally performed activity.

symptoms, but two variables were. Maximally performed activity of sitting was significantly correlated with the presence of lumbar, thoracic, or cervical spine pain ($P < 0.001$). Symptom occurrence over less than 12 months was almost entirely counted as mild ($\leq 3/10$), whereas pain that had recurred over more than 24 months was much more likely to be graded as more severe ($> 6/10$) ($P < 0.001$). Age, gender, level of activity, and site and intensity of pain were not significantly correlated with the presence of postural syndrome.

Of the 66 with suspected postural syndrome, 37 (56%) consented to the physical examination. On physical examination, 31 (83%) were categorized with postural syndrome, whereas, 6 (17%) did not meet the criteria for postural syndrome, and were classified with derangement or dysfunction syndromes. Postural syndrome was present in all areas of the spine, and most commonly was aggravating by sitting (Table 2). Symptoms were provoked after between 2 and 30 minutes of sustained loading; mean 16.3 minutes (SD: 8.3). Postural syndrome was significantly related to positive static loading ($P < 0.001$) and positive postural correction ($P < 0.001$). Gender, age, site of pain, aggravating and easing activity, and duration of pain were not significantly correlated with the presence of postural syndrome.

Agreement between therapists about classification as postural or non-postural syndrome was perfect, kappa 1.00. For whether the non-postural syndrome was classified as derangement or dysfunction, kappa was 0.70.

Discussion

In a randomly recruited sample of convenience of individuals under the age of 30 years, at a university, a high prevalence rate of postural syndrome ($\sim 60\%$) was recorded. Out of a sample frame of 138, 100 participants provided information, of which 69 reported some musculoskeletal symptoms and 66 of who from description appeared to have postural syndrome. Out of 37 who were examined, 31 were confirmed to be postural syndrome, with 6 demonstrating responses in the physical examination of either derangement or dysfunction. Factors most

strongly associated with postural syndrome were aggravation on sustained loading and abolishment of symptoms on postural correction. Postural syndrome was commonest at the lumbar spine, but found at other sites as well. The commonest aggravating factor was sitting, but other causes were listed.

These findings support certain elements in the original description of postural syndrome,⁴¹ and confirm the high prevalence of postural syndrome in a young population found in an earlier study.²¹ As in the original description, lumbar backache was most common, but other areas of the spine were also named; the commonest aggravating factor was sitting; and symptoms on sustained loading relieved by posture correction were salient features of the physical examination. As suggested, seeking health-care among this group was rare,³⁷ which would explain the limited reporting of postural syndrome in clinical practice.³⁸⁻⁴⁰ This study was the first report of postural syndrome pains being found in the extremities, but obviously these tissues can be subjected to similar end-range sustained loads that are thought to be causative in the spine.³⁷

Given the low clinical prevalence of postural syndrome, it could be argued that it is not an important clinical issue. However, it is suggested that postural syndrome can later progress into derangement and dysfunction syndromes, which have a much greater impact on impairments and disability, especially derangement.³⁷ In the present study, six participants who on initial description sounded as if they had postural syndrome in fact on physical examination were classified as derangement or dysfunction syndrome. Although it would take a prospective study to absolutely verify a link between postural syndrome and later more serious back pain, these findings suggest a transition stage between the syndromes. However, prospective studies are costly and difficult to do, but a larger study with an extended age range using the right instrument might help to determine if this was statistically probable. It could certainly be hypothesized that pain initially due to over-loading of normal soft tissues that recovers quite quickly could over time progress to tissue pathology and sensitization of nociceptive pathways, which leads to more persistent symptoms. The association between greater pain intensity and longer duration of symptoms, which we found in this study, would support this hypothesis.

It is also important to recognize that postural loads, especially sitting and other flexed activities, are common aggravating factors in those with and without back pain.¹¹⁻²¹ In western countries, it has been estimated that 75% of work is now performed sitting.⁴² School children between 8 and 12 years

Table 2 Site of symptoms and aggravating factors of postural syndrome ($n=31$)

Variable		<i>n</i>
Site	Lumbar	18
	Cervical	10
	Thoracic	3
Worse on	Sitting	19
	Standing	8
	Bending	2
	Walking	1
	Lying	1

have been observed to spend 85% of classroom time sitting, of which 28% was flexed and 91% was static.¹³ Work and leisure activities are commonly performed sitting, for instance 87% of Australians over 15 watch more than 3 hours of television every day.⁴² Thus, given the high prevalence rate of back pain among adolescents,⁴³ and the sedentary nature of modern society, in which sitting for sustained and uninterrupted periods is a very common activity, it could be suggested that a key preventative healthcare message should relate to the interruption of sustained postural loads. A systematic review of 56 primary studies estimated lifetime prevalence rates in adolescents between 7 and 72%, approximating those of adults.⁴³

Although sitting and postural loads have not been identified as a risk factor for back pain in a number of systematic reviews,^{33–36} there is recent evidence that within sub-groups of back pain, there are different responses to postural loads. For instance, people with back pain who sit in more flexion are better with extension exercises; and those who sit in more extension are better with flexion exercises, and that their postures are different from asymptomatic controls.^{44,45} In other words, the same apparent symptoms in different individuals will respond differently to the same loading. Thus, sitting might make some worse, but some better; and thus an epidemiological perspective will fail to detect subtle differences in response between individuals. This would challenge the conclusion of these systematic reviews.

Limitations to the study should be recognized. Participants were recruited from a single site, and not everyone suspected of having postural syndrome consented to the physical examination, mostly because of other time commitments. However, obviously consent to participate had to be voluntary. The site housed students from a range of health subjects, who may have had particular perspectives about their spinal health. The age range of those recruited was quite limited; this reduced sample spectrum may have caused the age variable to be non-significant; whereas, a larger age range and greater sample size may have led to this variable being significant.

Conclusions

In a university population who were under 30 years old, who presented without any history of serious musculoskeletal symptoms, 66 out of 100 reported pains that appeared to be due to postural loads. The majority reported back pain and sitting as the commonest aggravating factor, but other sites and factors were noted. The majority of these were confirmed as postural syndrome on physical examination, with pain on sustained loading abolished by

postural correction being significantly associated with the syndrome, as in the original description.

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Appendix: Questionnaire

Following are a few questions regarding daily activities and musculoskeletal problems. Please answer all questions using a tick (✓) wherever appropriate.

1. Please give your age

- Less than 20 ☐
- 20–24 ☐
- 25–30 ☐

2. Gender:

- Male ☐
- Female ☐

3. Please give your profession

- Student ☐
- Teaching staff ☐
- Other Staff ☐

4. Do you have any past or existing known medical complaints?

Yes ☐ No ☐

5. If yes, please mention them

6. What is your level of physical activity in day to day life?

- Heavy (gym/running/playing a sport daily) ☐
- Moderate (playing a sport/gym few times a week) ☐
- Less active (walking daily) ☐
- Not active (prolonged sitting due to work) ☐

7. Activities that you perform in waking hours on a typical day. Please mention the number of hours in the box provided.

- Standing for long time while working/teaching ☐
- Sitting for long time during working on laptop/desktop ☐
- Sitting on a sofa while watching TV ☐
- Driving a car ☐
- Driving a bicycle/two wheeler ☐
- Lying on the bed to work/read ☐
- Any sports/leisure activities ☐
- Other, _____ please _____ specify

8. Do you experience any aching or discomfort (even simple and minor) after being in a particular position for long time?

Yes ☐ No ☐

If no, thank you for your time for participating in this study,

If yes, please go to question 9

9. If yes, which area(s) of the body is/are most affected?

Please mark on body chart on last page or specify

10. Which activity/(activities) according to you is/ (are) the cause of this ache?

Please specify _____

11. Can you please circle the level of your ache on the scale below, where, 0=no pain, 5=moderate pain, 10=severe pain.

Figure 3

12. How long does it take for the ache to come on during that activity?

- In half an hour ☐
- In 1 hour ☐
- In more than hour ☐

13. Does the ache persist after you change the *activity* or *position* which is the cause of your ache or discomfort?

Yes ☐ No ☐

If yes,

- (i) Does it persist for longer than 5–10 minutes Yes ☐ No ☐
- (ii) Does it interfere with any activities or movements? Yes ☐ No ☐

14. How long have you been experiencing this ache? Please mention the duration (in years or months) since you have experienced this ache.

Years ☐ Months ☐

15. What do you feel about your current ache/discomfort as compared to earlier? Is it

- Better ☐
- Worse ☐
- Not changed ☐

16. If it is worse than earlier, can you please explain in what way?

- Comes along quickly ☐
- Lasts more longer ☐

17. Do you take pain medication/home remedies for this problem?

- Yes ☐ if _____ yes, please specify _____
- No ☐

18. Have you ever visited your general practitioner (GP) for this problem?

Yes ☐ No ☐

19. If no, why have you not visited your GP?

- According to me, problem is not severe ☐

BODY CHART:

Figure 4

- I think self remedies relieve my ache ☐
- I alter my activities to avoid the ache ☐
- Others, please specify _____

20. If yes, what advice did you get from your GP?

- Prescribed me pain medication ☐
- Referred me to a specialist ☐
- GP referred me to physiotherapist ☐

What advice/treatment did physiotherapist give?

- Others please specify _____

Thank you very much for your time in completing the questionnaire.

BODY CHART: