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ORIGINAL ARTICLE

Occurrence of common lumbar posture types in the student sporting population: an initial investigation

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SUMMARY. This study was an initial investigation of the occurrence of four posture types in the student sporting population. A Plumbline Posture Assessment was used to determine pelvic alignment, shape of the lumbar lordosis and position of the hip joint axis in standing in 26 normal subjects. Sub-optimal postural alignment was demonstrated by 76.9% of the subjects, with the most common posture encountered being the swayback. All subjects who reported having experienced pain during sport had a lordotic posture, while 84% of those with an optimal posture had experienced no pain. Comparison between pain occurrence and optimal/sub-optimal posture was non significant ($\chi^2 = 2.10$, $P = 0.15$). Plumbline Posture Assessment is inexpensive and relatively simple to apply, but may require experience and skill to develop reliability.

INTRODUCTION

Backpain has been shown to impose an annual cost to industry in excess of £1000 million, resulting from a loss of over 46 million working days each year.[1] Posture is known to be closely related to both the development of back pain and its management, both in sport and everyday activities.[2] In sport particularly, the combination of sustained body positions and repetitive flexion activities is associated with changes in static postural alignment.[3] Posture has been defined as the relative arrangement of the different parts of the body, and a good posture is one which can be maintained by a minimum amount of muscle work.[4,5]

Posture is commonly assessed with reference to a gravity line or plumbline, both in physiotherapy and sport.[6,7] There is a strong correlation between the resting position of the lumbar spine and the lumbar position during functional activities such as gait.[8] Using a plumbline assessment in the sagittal plane, Kendall et al described an optimal posture (Fig. 1).[6] With the subject positioned with their lateral malleolus 5 cm behind a plumbline, the line should pass just anterior to the midline of the knee, and then through the greater trochanter, bodies of the lumbar vertebrae, shoulder joint, bodies of the cervical vertebrae and the lobe of the ear.

Four deviations from the optimal posture are common clinically (Fig. 2). In each case, the position of the pelvis is a critical factor. In the lordotic posture, the pelvis is anteriorly tilted, increasing the lumbar lordosis, whereas in the swayback posture the pelvis remains level, but the hip joint is thrust forward of the posture line, effectively pressing the femur into extension. In the flatback, the lordosis is reduced through posterior tilting of the pelvis and a

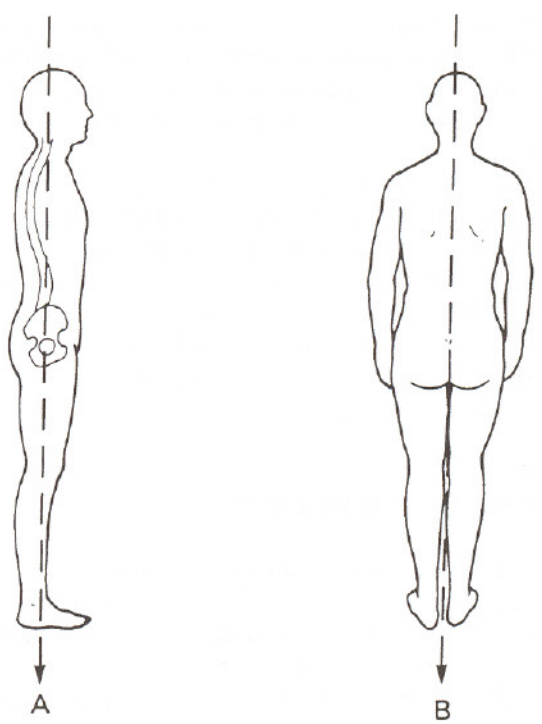

Fig. 1 Optimal postural alignment

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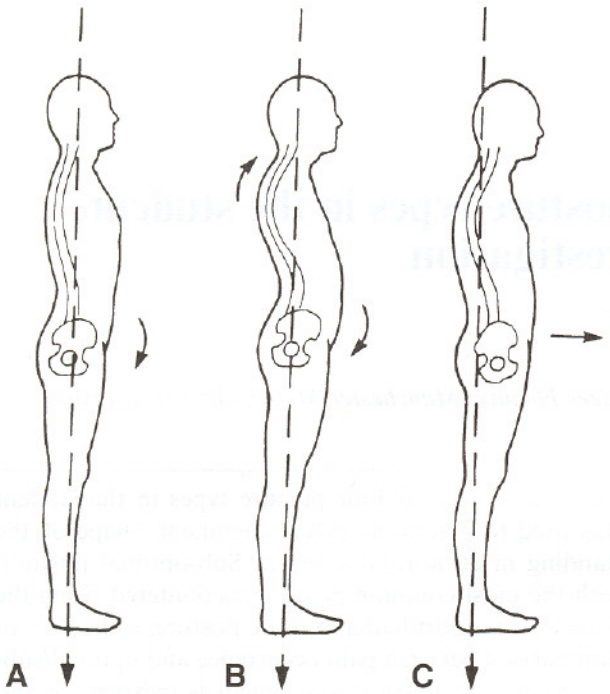

Fig. 2 Posture types. (A) Lordotic; (B) Kypholordotic; (C) Swayback.

reduction in mobility of the lumbar spine. The kyphotic posture (often coexisting with the lordotic) results from scapular abduction, through a combination of postural lengthening of the shoulder retractor muscles, and tightening of the shoulder protractors.[4,9,10]

The purpose of this study was to determine the incidence of the four posture types within the student sporting population, using the plumbline assessment method. Determining the most common posture types within this population will help clinicians and exercise instructors more accurately prescribe exercise for the trunk, by identifying the need for correction of sub-optimal posture.

SUBJECTS AND METHODS

This study used a plumbline assessment to determine the posture type of 26 subjects (14 men and 12 women, age range 18–28 years) who were full time students on exercise-related courses at the Manchester Metropolitan University. Before commencement of the study, each subject signed an informed consent form and faculty-based ethics approval was obtained.

A questionnaire was administered which sought information about activity level (hours per week), sports experience (number of years participating and at what level) type of sports participation, history of backpain (diagnosis and any current symptoms), timing of backpain with relevance to sport (pain occurring during or after sport) and perception of posture (ranging from very good to very poor).

Body height (m), body weight (kg) and hip to waist ratio measurements were taken. Skinfold thickness measurements (mm) were also taken at biceps, triceps, subscapular and suprailiac sites to determine percent bodyfat, as obesity is associated with change of pelvic alignment.[5,11] Bony landmarks of the anterior superior iliac spine, posterior superior iliac spine, greater trochanter, lateral epicondyle of the femur and the centre of the shoulder joint were marked using white adhesive labels.

Subjects were positioned with their lateral malleolus 5 cm behind the plumbline. Subjects were then instructed to take 10 paces, by walking on the spot, leading with the right leg and then to stop and remain in the resulting body position. Postural position was then recorded, noting pelvic alignment, sagittal position of the hip joint axis and shape of the lumbar lordosis. A posture grid (Fig. 3) was used to improve visual assessment of body segment position. The grid consisted of a board marked with horizontal and vertical lines, each 15 cm apart. The board was placed 1 m behind the plumbline.

Spinal shrinkage has been shown to result from diurnal variation and through sporting participation.[12,13] For this reason, postural assessment must be tested and re-tested at consistent times of the day. In this study, all postural assessments were performed before midday, and not within 2 h of sporting participation.

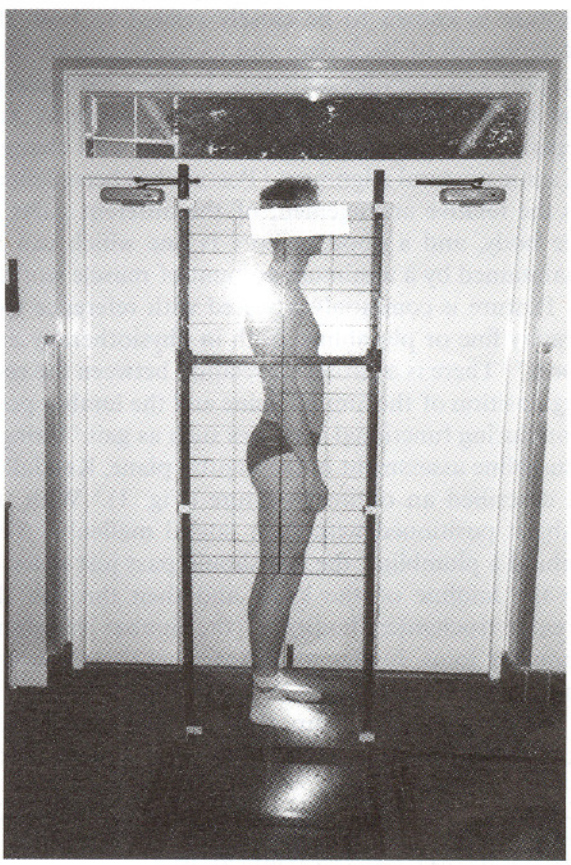

Fig. 3 Experimental set up.

Table 1 Physical characteristics of subjects (mean SD)

	Age (years)	Height (m)	Weight (kg)	Hip:waist (cm)	Skinfold (%)
Whole group	21 (1.9)	1.74 (0.1)	69.2 (10.9)	0.79 (0.0)	19.4 (5.4)
Female	20 (1.2)	1.67 (0.0)	61.7 (6.6)	0.75 (0.0)	24.1 (3.3)
Male	21 (2.2)	1.80 (0.1)	75.7 (9.7)	0.82 (0.0)	15.3 (2.6)

Posture was categorized into one of the four standard types and the data was recorded as frequency of posture type; for male subjects; female subjects; and total subjects. Posture frequency was then compared to occurrence of pain during activity and activity type. Where appropriate χ^2 analyses were performed on the data using Statistica software (Statsoft Ltd, Tulsa, Oklahoma, USA).

RESULTS

Table 1 demonstrates the physical characteristics of the subjects. As is to be expected, mean values show that male subjects were heavier and taller than female subjects. Skinfold values were within the average range for the age of subjects in this study, while hip to waist ratio was below the national average.[14]

Figure 4 shows the frequency of lumbo-pelvic postures encountered in the total population and the different incidences in male and female subjects. Of the total population, 76.9% of subjects showed sub-optimal static postural alignment. The most common posture encountered in the combined male and female population was the swayback. Small gender differences in posture were noted. An equal number of female subjects demonstrated the optimal and swayback postures (19.2% in each case), while more men demonstrated swayback (38.5%) than any other posture. The flatback posture was uncommon in both groups (3.8% male, 0% female).

Table 2 Pain and posture type

	No Pain	Pain
Optimal	5	1
Lordotic	0	4
Swayback	9	6
Flatback	1	0
Sub-optimal	10	10

Eleven subjects stated that they had experienced pain during sporting activities within the last year. A comparison of those subjects who experienced back-pain during activities with those who were pain free (Table 2) demonstrated an interesting trend, although not statistically significant ($\chi^2 = 2.10$, $P = 0.15$). Noticeably, all of those who had a lordotic posture reported having experienced pain during sport. Also 84% of those subjects with an optimal posture had experienced no pain. The subjects in the study participated in a total of 24 different sports.

DISCUSSION

The major findings of this study are firstly that the most common postural type of this population was the swayback, and secondly that those subjects with an optimal postural alignment on the whole experienced little back pain during sport. In addition, the lordotic posture may warrant further investigation as this posture type appeared to be more closely associated with pain.

The swayback posture is a relaxed posture often seen in the adolescent, and so the common occurrence of this posture type was to be expected, based on the mean subject age in this study. The swayback relies on the elastic recoil of the hip ligaments and

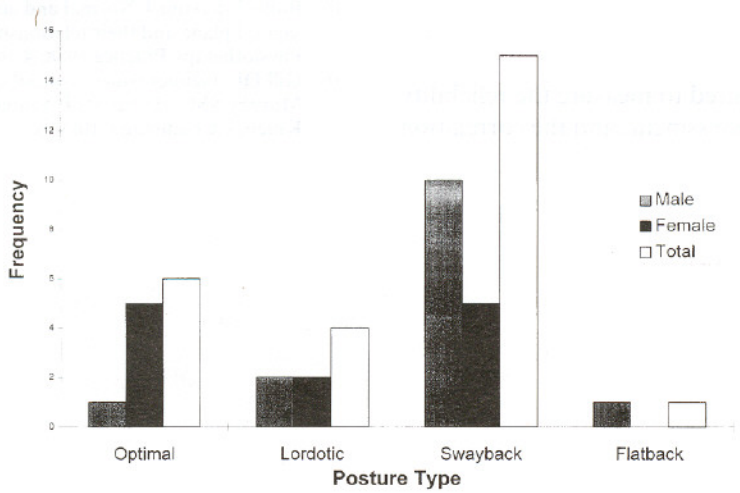

Fig. 4 Frequency of postural types encountered.

anterior capsule. Clinically, patients with a swayback posture often complain of pain in relaxed standing brought on with time. As the population of this study

between optimal and sub-optimal postures and pain. This preliminary study has shown a trend in the relationship between pain and optimal posture. A larger

posture type results from imbalance of muscle length, if pain is experienced it could be expected to occur equally during rest and activity. This tendency was shown in the study with all those subjects having a lordotic posture complaining of pain during activity.

The flatback posture is associated with prolonged inactivity and so would have been expected to be uncommon in the group assessed in this study.

The general trend that subjects who demonstrated a sub-optimal posture had more pain than those with an optimal alignment is important, and in line with the views of other authors.[6,15]

More females were found to have optimal postural alignment. This may be related to social anxiety of females within this age group, and/or media portrayal of the aesthetic qualities of confidence and style demonstrated by a posture which increases an individual's height and makes them 'stand tall'.[16]

The plumbline posture assessment used in this study provides information about static postural alignment only. As such it can provide only limited details concerning possible changes in dynamic postural performance, which would require video analysis and electrogoniometry. However, as an initial assessment tool prior to sporting participation it has value. Plumbline Posture Assessment is inexpensive, relatively simple to apply, and was able to distinguish between the four major posture types. Experience and skill are required for accurate use of Plumbline Posture Assessment, and inter/intratester reliability needs to be determined in a future study.

CONCLUSIONS

Further studies are required to measure the reliability of Plumbline Posture Assessment, and the correlation

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