A NEW METHOD OF MEASURING THE DEGREE OF LUMBAR SPINE CURVATURE IN PREGNANT WOMEN

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SUMMARY
There are very few studies which record measurements of the degree of lumbar spine curvature. This study reports a new method of measuring the angle of curvature of the lumbar spine in pregnant women, using photography. It is a simple, cost-effective and non-invasive method which can be used in the laboratory or the clinical situation. The study sample consisted of 13 healthy, middle-class, English-speaking, South African, Caucasian women, aged between 20 and 40 years, in the third trimester of pregnancy. A mean angle of 33,9 ± 3,6 (SD) degrees, representing the degree of lumbar spine curvature, was obtained.

OPSOMMING
Baie min studies is gedoen met betrekking tot die meting van die lumbale werwelkolom buiging. Hierdie studie bespreek 'n nuwe metode vir die meting van die lumbale werwelkolom buiging vir swanger vroue met die gebruikmaking van fotografie. Dit is 'n eenvoudige, goedkoop en nie-binnedringende metode wat in die laboratorium of die kliniese situasie gebruik kan word. Die studie groep bestaan uit 13 gesonde, middelklas, Engelssprekende, Suid-Afrikaanse, Kaukasiese vroue, tussen 20 en 40 jaar oud, in die derde trimester van swangerskap. 'n Gemiddeld van 33,9 ± 3,6 (SD) grade, wat die metings van die lumbale werwelkolom buiging verteenwoordig, was gemeet.

Key words: lumbar spine curvature; pregnancy; photographic method.

INTRODUCTION

Lumbar spine curvature has been measured in a number of ways, with the subject moving from flexion to extension of the spine; side-lying, and standing in the erect position[1,2,3,4]. The measuring instrument has included the standard tape measure, kyphometer, goniometer and diasonograph ultrasound[1]; the flexicurve[2]; the radiograph[3], and the cliniometer[4].

The accurate measurement of lumbar spine curvature in pregnant women has posed a problem for some time. The radiographic method used by Fernand & Fox[3], for example, cannot be used because of the teratogenic properties of X-rays. The diasonograph ultrasound proposed by Salisbury & Porter[1] is not easily available to many researchers. The inherent inaccuracies in the surface measurements of spinal curvatures using the flexicurve[2], and the tape measure, kyphometer and goniometer[1], preclude these instruments too.

Bullock *et al*[4] were able to measure the curvature of the lumbar spine and the angle of lordosis in pregnant women successfully, using the cliniometer. This is the best measure of this variable reported in the current literature to date.

Apart from this study by Bullock *et al*[4], there is a lack of normative data on the degree of lumbar spine curvature, particularly in pregnant women, but in other population groups too. Such data would be of value not only for comparative studies but for use as a base-line in the clinical diagnoses of conditions, such as low back pain, which may be related to poor posture or to musculo-skeletal pathology.

Thus, in the course of study of third trimester pregnant women, we developed a simple method of measuring the lumbar spine curvature, which has not been reported in the literature to date. This method involves photographing the women in side-view and measuring the degree of spinal curvature on the photographs. This method, we feel, is cost-effective, non-invasive and easy to carry out quickly and with a good degree of accuracy. It also offers normative data from a group of healthy, third trimester pregnant women in South Africa. This paper reports the procedure and results of such measurements made on a sample of 13 subjects.

MATERIALS AND METHOD

Sample selection

A population of 130 women attending antenatal classes was interviewed for a study of third trimester pregnant women. Of this number, which included second and third trimester pregnancies, 13 (10%), who were all in the third trimester of their pregnancies, were prepared to participate in the study to measure lumbar spine curvatures by means of photographs of the women. Informed consent was obtained from each of the women.

The study sample, therefore, consisted of 13 Caucasian, middle-class, English-speaking, South African women, aged between 20 and 40 years, with a mean age of 31,5 ± 5,1 years (Table I). The subjects had no history of musculoskeletal disease and all pregnancies had progressed normally to the third trimester stage.

Measurement procedure

In order to demarcate the lumbar spine of each subject, the spinous processes of the twelfth thoracic vertebra (T12), the first and fifth lumbar vertebrae (L1 and L5) and the first sacral vertebra (S1) were carefully palpated, with the subject sitting on a high stool, and marked by means of a skin marking pen. An adhesive pointer was placed exactly over each of these processes. Once the pointers were in place, their positions were checked with the subject standing, to ensure that each lay directly over the spinous processes of T12, L1, L5 and S1 respectively.

Each adhesive pointer was made from a disposable EEG electrode (type R-00-S), 4,5 cms in diameter, the one side of which is adhesive. A strip of cardboard, 1 cm wide by 10 cms long, was firmly taped at right angles to the non-adhesive side of each disc.

Each subject was photographed in side-view while standing erect (Fig 1). The feet were placed on a fixed foot-board, so that the heels were against the restraining blocks and 1 cm apart. The photographic procedure was repeated three times, the subject slumping forwards in a relaxed posture and then resuming the erect standing position before each photograph was taken. All photographs were taken in the mid-morning period of the day.

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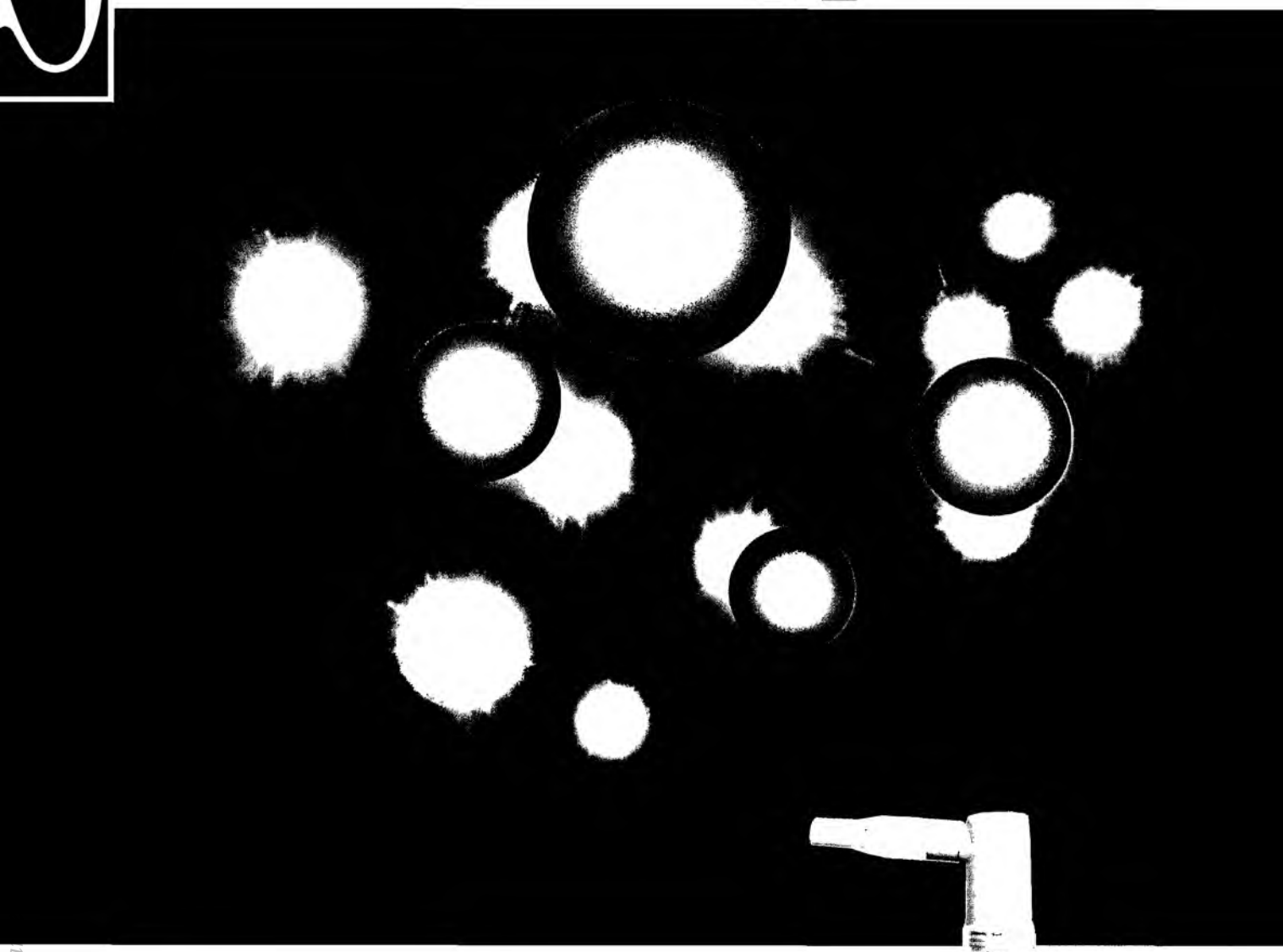

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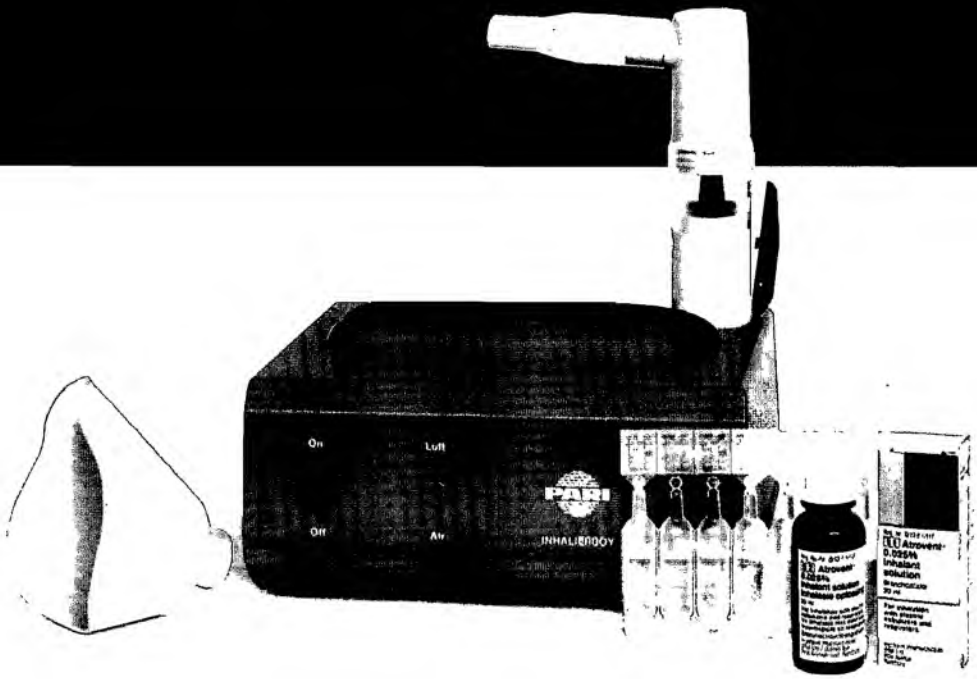

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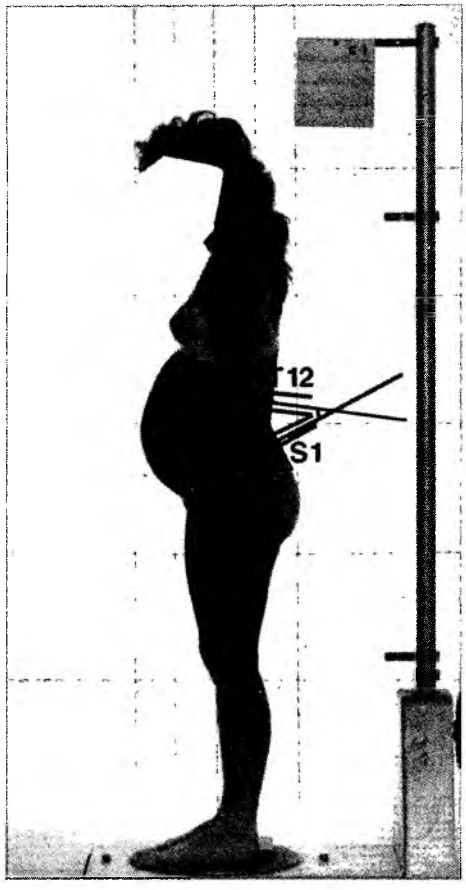

FIG 1: Measurement of the degree of lumbar spine curvature

The printed photographs were used to calculate the angles of lumbar spine curvature in each subject. The points marking the spinous processes of T12 and L1, then L5 and S1 were joined with straight lines on each of the photographs (Fig. 1). Perpendicular lines between the first two and the second two points were then extended posteriorly to bisect, and the angle thus formed was measured with a standard protractor. Each of these angles was taken to represent the angle, and therefore the degree of lumbar spine curvature for that particular subject.

This procedure was carried out three times for each subject and the mean measurement of the degree of lumbar spine curvature calculated.

RESULTS

The measured degree of lumbar spine curvature for each of the 13 subjects is shown in Table I.

These measurements ranged from 29 ± 0,6 degrees to 39 ± 0,6 degrees, with a mean of 33,9 ± 3,6 degrees.

DISCUSSION AND CONCLUSIONS

Although lumbar spine curvature has been measured successfully in the past [1,2,3,4], Bullock *et al*[4] are the only authors who have reported such measurements on a sample of pregnant women to date. However, their method requires the use of a cliniometer, which is not regarded as standard equipment for basic anthropomorphic measurements for research or as a clinical diagnostic tool.

We feel that although the method of measuring lumbar spine curvature in pregnant women reported in our study may require more time for the development of the photographs, it has the advantage of being easy to carry out in any clinical situation and in all anthropomorphic measurement laboratories, where the standard camera is usually basic equipment. There is less chance, with our method, of the variable of human error in measurement confounding the results than there is in those methods using any of the commonly known measuring instruments, such as the tape measure, the goniometer and the flexicurve[1,2].

TABLE I: Degree of lumbar spine curvature

CASE	AGE (years)	ANGLE OF CURVATURE (degrees) (i)	(ii)	(iii)	X ± SD
1	35,4	39	39	40	39 ± 0,6
2	30,6	37	37	36	37 ± 0,6
3	34,0	30	30	29	30 ± 0,6
4	34,0	34	34	35	34 ± 0,6
5	29,5	38	36	36	37 ± 1,2
6	22,4	41	37	37	38 ± 2,3
7	34,1	37	35	39	37 ± 2,0
8	40,7	33	29	29	30 ± 2,3
9	22,9	28	29	29	29 ± 0,6
10	34,1	28	28	31	29 ± 1,7
11	34,7	35	33	33	34 ± 1,2
12	28,4	30	32	32	31 ± 1,2
13	28,3	35	33	33	34 ± 1,2
X ± SD	31,5 ± 5,1	33,9 ± 3,6			

KEY: X = mean; SD = standard deviation

The results of our study cannot meaningfully be compared with those of Fernand & Fox[3], who measured the "normal lumbar lordotic angle" in 973 adults (males and non-pregnant women).

They also used two demarcations of the lumbar spine : from L2 to L5, when a mean angle of 29,96 ± 0,74 (SEM) was found, and from L2 to S1, giving a mean angle of 45,05 ± 0,85 (SEM). The subjects were measured in the "lateral recumbent position" or side-lying and not the erect standing position when the lumbar spine curvature is most obvious.

Both Salisbury & Porter[1] and Stokes *et al*[2] studied spinal motion, from full flexion to extension of the spine. Thus, these studies report on the range of motion of the spine and how it is measured, and no angles of spinal curvatures are given.

Our results compare most favourably, however, with those of Bullock *et al*[4]. We found, in our sample of 13 third trimester pregnant women, that the mean angle of lumbar spine curvature was 33,9 ± 3,6 degrees while Bullock *et al*[4] report a mean angle of 33,9 ± 10,9 (SD) degrees in 34 women in the last stage of pregnancy (third trimester). This suggests that the methods used in the two studies are comparable.

This study, as a pilot study, offers normative data for the degree of lumbar spine curvature, in the erect or standing position, in third trimester pregnant women.

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