Human Interaction with Car Seat: As A Predisposing Factor to Low Back Pain

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ABSTRACT

The purpose of this study was to investigate the human interaction with the car seat, and weather the resultant posture adopted has any effect on, or links to predisposition to low back pain. To carry this investigation a questionnaire was specifically designed to include questions pertaining to personal demographic data, history of back pain, features of seating design, effect that driving had upon the car user. Out of sixty questionnaires forwarded to car drivers, only fifty persons responded. Analysis of the collected data revealed that the design of car seating does have an influence upon the symptoms experienced by subjects suffering from low back pain. However, the study did not established if the seat design was the primary cause of the back problems.

INTRODUCTION

Low back pain is an important public health problem in all industrialized nations. One definition of low back pain (LBP) is any pain felt between the ribs and the top of the leg, due to any cause. Often the painful conditions are predisposed by poor postural habits. Due to the alterations in man behavioral pattern from that of a hunter and cultivator to a sedentary life, bent over books and machines[16].

Because work environments have become increasingly automated and computerized, many workers may be living spending a greater proportion of their lives sitting. This position is often uncomfortable for individuals with back pain. Volinn[17] included prolonged sitting as one of the common risk factors associated with low back pain.

Due to the increasing number of back problems occurring in association with poor postural behavior, there has been rising interest in the prevention of such problems by the means of ergonomic studies. Particular interest has been expressed toward the stresses on the spine and its associated soft tissues, induced by sitting. Numerous studies have been carried out to investigate the sitting postures in the work place and at school[2,18]. However, there is little available published literature on car seating.

The potential problems involved in the sitting posture, is a backward rotation of the pelvis due to the tension generated in the posterior thigh muscles. This rotation is compensated by a flattening or flexion of the lumbar spine. The degree of the pelvic rotation and its resultant alteration in the lumbar spine will determine the posture of the remaining body segments[15]. When a person undertakes a

position of sitting his/her body tissues (inter-vertebral disc, spinal ligament and para vertebral muscles) are subjected to various changes in stresses. These stresses not only lead to changes in structure, but also on function[1].

With recent development in the economic and standard of living, it can be assumed that a high proportion of the general public either own or have access to a car and that it is used for a number of hours per week. This being the case, therefore it is crucial to study the postural habits of car drivers and the potentially detrimental effects that these postures may have. The present study was designed to investigate, for how-far, car seating provide adequate postural support to enable the driver to maintain a healthy sitting posture, and prevent the predisposition to low back pain.

SUBJECTS AND METHOD

Subjects:

A survey study was conducted on employees working in two governmental establishments in Cairo. For the purpose of the study, a questionnaire form was specifically designed and forwarded through the social worker of every establishment among employees who own or drive a car. Of sixty questionnaires forwarded only 50 were completed and returned, giving a response rate of 83%. They were 21 female (42%) of an average age of 33.5 4 years, and 29 male (58%) of an average age of 37 7 years. Fifty four percent of the respondents had a history of low back pain. They were 13 female and 14 male. The average car age 7.71 3.31 years for male and 3.98 3.08 years for male.

Table (1): Average age, height, and weight of fifty respondents

Variable	Female (n = 21)	Male (n = 29)
Age (yr)	33.5 ± 4	37 ± 7
Height (cm)	165.61 ± 7.72	178.93 ± 5.8
Weight (kg)	57.1 ± 6.81	77.86 ± 10.4

Procedure:

A questionnaire (see appendix) was designed to obtain personal demographic data pertaining to their ownership and use of the car e.g.the make of the car they use and the period of their ownership to it. Overall and specific body area comfort ratings were included in the questionnaire, along with questions requiring subjective analysis with regards to features of seating design. A section was also included for those subjects who had a history of back pain. In this section the subjects were asked to complete questions with regard to the effects that driving had upon their condition.

The comfort rating scale used, was unipolar and had a five point scale (A = extreme comfort, E = Extreme discomfort). The unipolar comfort scale was as follows:

A: extremely comfortable
B: comfortable
C: no noticeable discomfort
D: uncomfortable
E: extremely uncomfortable.

A total of sixty questionnaires were printed and divided equally between two social workers who handed them in their respective establishment. Each one was asked to randomly hand out the questionnaires among working colleagues who own and drive a car. The subjects were requested to complete and return the questionnaires within one week.

RESULTS

The data of each section in the questionnaire was sorted out for each subject individually and then analysed for all the respondents using descriptive statistics. However, this study was not intended to compare between specific car design. So, finding on specific car make could not be drawn.

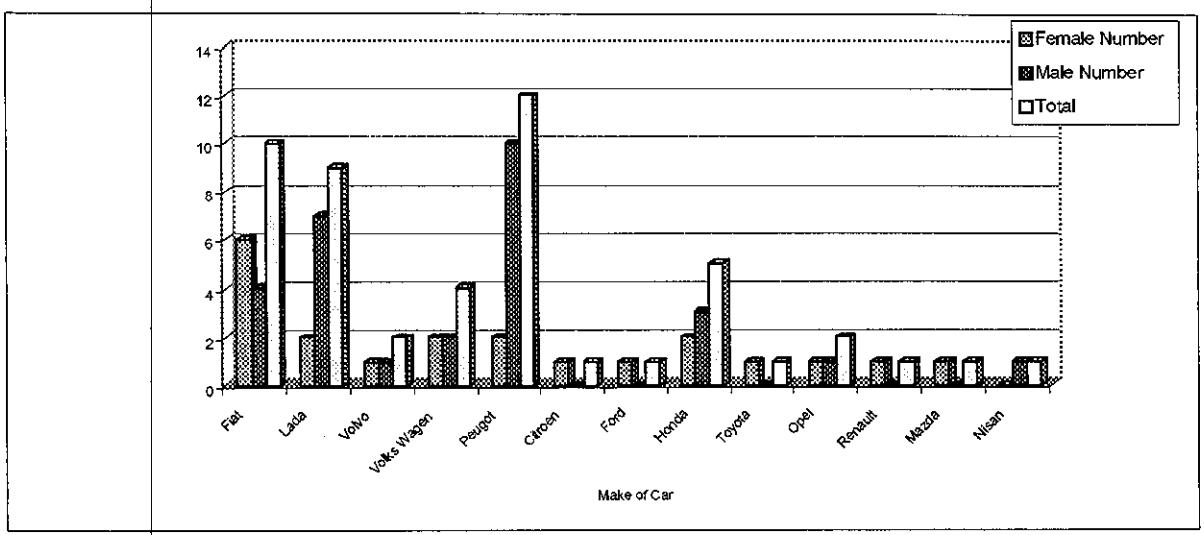


Figure (1) Graphic representation of the distribution in ownership of different makes of car by female and male respondents.

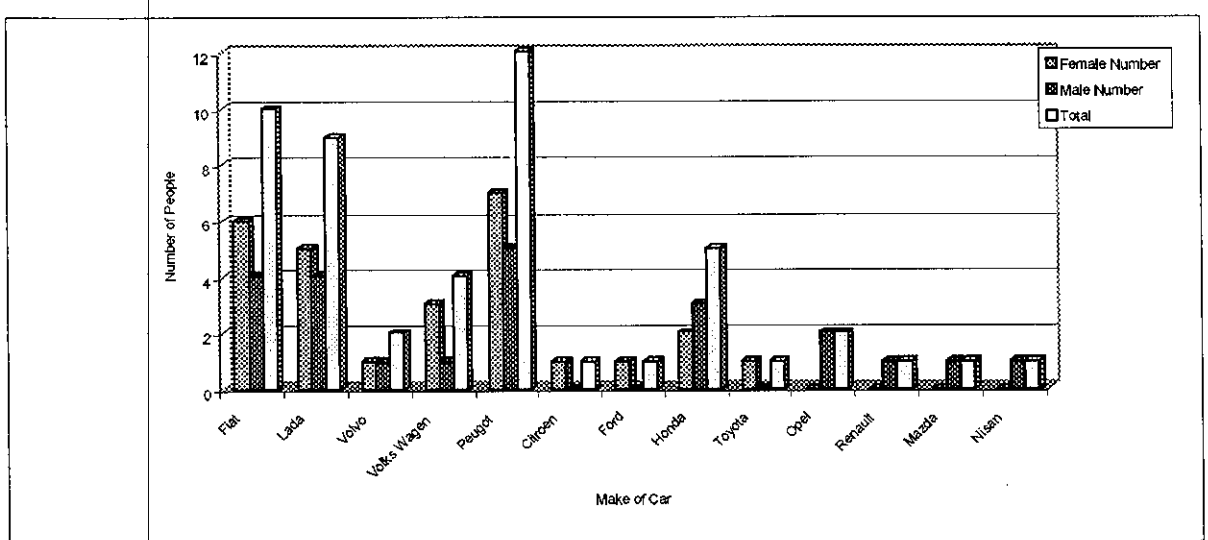


Figure (2) Graphic representation of the number of people suffering from back pain compared to the number of non-back pain suffers in relation to a specific make of car.

Table (2): Details of time spent by subjects in their car.

Variable	Female	Male
Time spent in car per week (hrs)	7.05 ± 3.32	14.14 ± 4.46
Average journey time (mins)	27.62 ± 9.71	47.59 ± 30.9
Percentage journy for work/business	54.76% ± 26.88%	65.55% ± 19.49%
Percentage of time for social / domestic	45.24% ± 26.88%	34.45% ± 19.49%

Table (3): Car seat comfort in retation to the time spent in the car (female / male).

Respond	Initial	After 15 min	After 45 min	After 1 hr
Extremely comfortable	2/0	0/0	0/0	0/0
Comfortable	8/16	8/14	5/8	3/3
No noticeable discomfort	10/11	11/13	8/15	3/9
Uncomfortable	1/2	2/2	8/5	13/14
Extremely comfortable	0/0	0/0	0/1	2/3

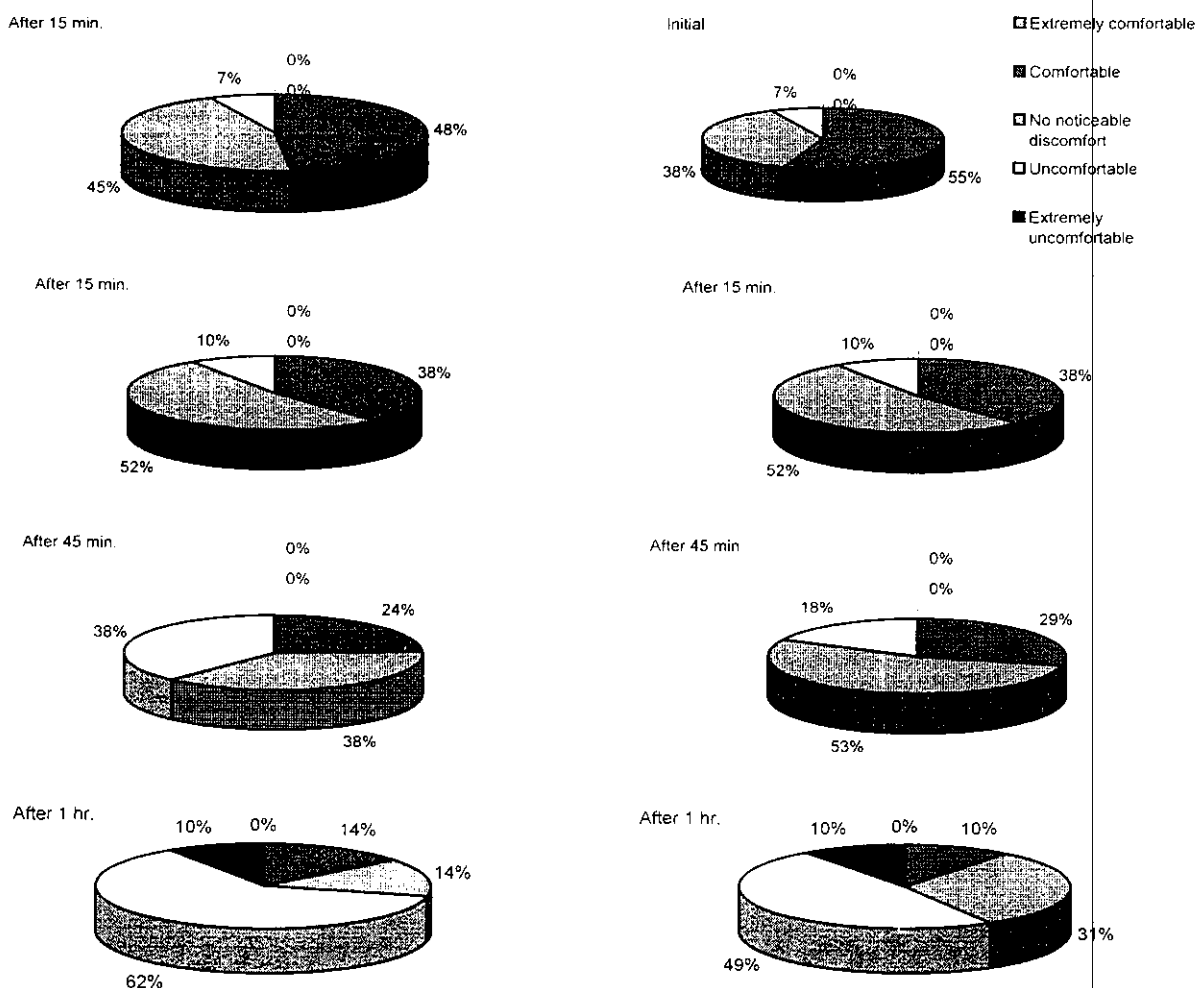


Figure (3): Show the distribution of comfort rating in relation to time for female (on the left) and for the male (on the right).

Table (4): Body parts comfort rating after a journey of one hour or more (female / male).

Respond	Head/Neck	Shoulder	Lower Back	Buttock	Thighs
Extremely comfortable	1/1	0/1	0/0	0/0	0/0
Comfortable	6/6	4/5	3/2	3/4	4/5
No noticeable discomfort	10/12	8/14	2/12	6/16	12/17
Uncomfortable	4/9	9/8	12/14	10/7	5/6
Extremely Uncomfortable	0/1	0/1	4/1	2/2	0/1

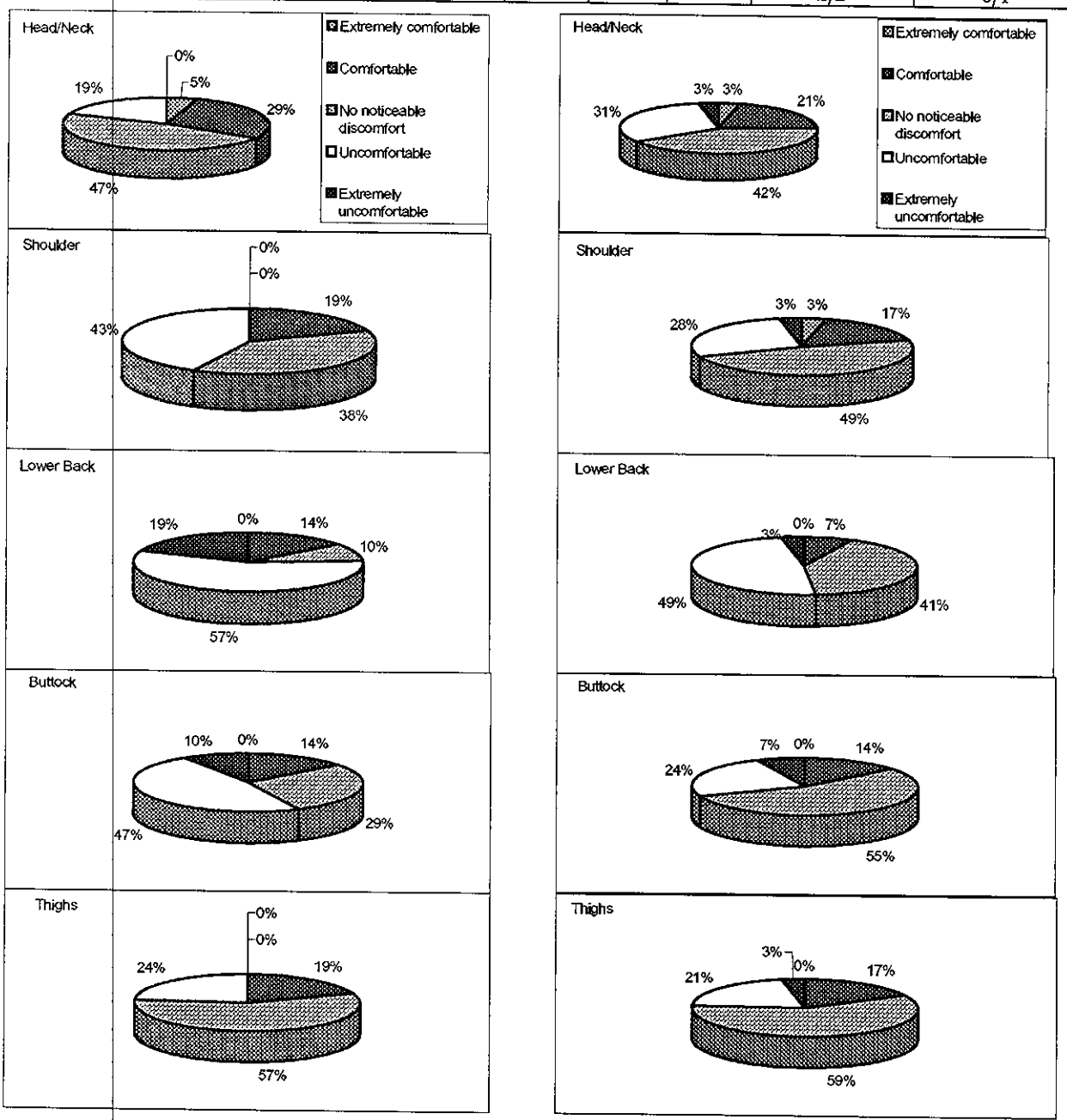


Figure (4): Showing the distribution of comfort rating forindividual body areas of female (on the left) and male (on the right) after a journey of one hour or more.

Analysis of the results obtained from the questionnaire showed that 27 (54%) of the 50 subjects who responded had a history of back pain. They were fourteen males and thirteen females. This result demonstrates a greater incidence of LBP in the number of the females population (62% of the total number of the females) in comparison with 42% of the total number of males. Twelve (92%) of the 13 females expressed that their symptoms are aggravated whilst driving, in comparison with 10 (71.5%) of the 14 males who are experiencing LBP during driving.

The mean age of cars driven by women was 7.71 years, in comparison the mean age of cars driven by men was 3.98 years. This may give some indication toward the change in the design of car seating in recent years. This suggestion is further reinforced when considering the time spent driving the vehicles. The mean time spent driving by men per week was 14.14 hours, some 7.09 hours more than the mean time spent by women (mean time being 7.05 hours). The mean average journey time for men was also greater by 19.97 minutes.

With regard to the car seat comfort in relation to the time spent in the car, the comfort ratings depicted by the subjects changed dramatically over time. In the female population (21 subjects) the rating scale showed the following:

- At the initial time of driving, 2 subjects reported that the seat was extremely comfortable, 8 subjects expressed that the seat was comfortable, 10 reported no noticeable discomfort, and 2 reported uncomfortable.
- After 15 minutes of driving, 8 subjects reported that they feel comfortable, 11 reported no noticeable discomfort and 2 reported uncomfortable.
- After 45 minutes of driving, 5 females reported that the car seat was felt comfortable, 8 reported no noticeable discomfort, and 8 subjects reported uncomfortable.
- After one hour driving, 3 subjects reported that the car seat was comfortable, 3 reported no noticeable discomfort, 13 reported uncomfortable and 2 reported extremely uncomfortable.

In the male population (29 respondents) the following was reported:

- At the initial driving, 16 subjects reported that the car seat felt comfortable, 11 reported no noticeable discomfort, and 2 reported uncomfortable.
- After 15 minutes of driving 14 subjects reported comfortable, 13 reported no noticeable discomfort, and 2 reported uncomfortable.
- After 45 minutes driving, 8 subjects reported comfortable, 15 reported no noticeable discomfort, 5 reported uncomfortable and one subject reported extremely uncomfortable.
- After one hour driving, 3 subjects reported comfortable, 9 reported no noticeable discomfort, 15 reported uncomfortable, 2 subjects reported that the seat felt extremely uncomfortable.

The overall rating of the 50 respondents surveyed that after an initial period of adjustment, 24 of the total number of subjects judged their seats to be comfortable, while only 2 judged their seat to be extremely comfortable. Of the remaining 24 subjects a total of 21 subjects perceived no noticeable discomfort. The remaining 4 subjects judged their seat to be uncomfortable even after only a short period of time. Over a period of one hour there is a gradual decrease in the number of subjects rating their seat as comfortable, and a

corresponding (although not proportional) increase in the number of subjects rating their seat as uncomfortable. After one hour a total of 27 subjects judged their seat to be uncomfortable, a further 5 expressing extreme discomfort. Throughout the time period a notable number of subjects regarded their seats with no noticeable discomfort (i.e.21 subjects initially, 24 after 15 minutes, 23 after 45 minutes and 12 after one hour).

The results of comfort ratings for the individual body areas again were varied. However, there was a greater number of subjects expressing discomfort and extreme discomfort for the individual areas after a period of one hour or more than there where subjects expressing comfort or extreme comfort (i.e. 38.4% of all questions answered related a feeling of discomfort or extreme discomfort compared with a total of only 18% expressing comfort or extreme comfort for the same areas). The area where most discomfort was expressed was in the lumbar or lower back region. 52% of all the subjects expressed a feeling of discomfort in this area (of this 54% where men, 46% where women). A further 10 % expressed a feeling of extreme discomfort (20% where men, 80 % where women). It can also be seen that 48.3% of the male subjects depicted their backrest as being too flat (42% of the female subjects said the same). From these results it seems that there is inadequate support provided by the seat in this area. This suggestion is further reinforced by the responses of subjects when asked to judge the support provided by their seat for the lumbar region. 70% of all subjects felt that inadequate support was provided in this area (54.3% of male subjects, 45.7% of female subjects). All the body areas examined by the questionnaire had ratings of discomfort or extreme discomfort without exception. In the case of the shoulders some 34% of subjects indicated a feeling of discomfort, and a further 2% a feeling of extreme discomfort.

With regard to the head and neck some 26% of subjects noted a feeling of discomfort, and a further 2% a feeling of extreme discomfort. A total of 27 subjects expressed a history of lower back pain. Of those 13 were women and 14 were men. Of this group a total of 81%expressed an increase in their back symptoms whilst driving (44% women, 37% men). Seven of the subjects (47%) who received treatment had advice concerning the use of a lumbar support or roll whilst driving. Six of these subjects reported a decrease in symptoms during use.

DISCUSSION

This study provided an overview of the design features of car seating and to link these features to the possible postural behaviour adopted whilst driving and the possible predisposition to low pack pain.

The present study revealed that the anthropometric data used in vehicle design has come from abroad, therefore, most designs based upon this data, lead to unsatisfactory manufacture of seats for the local driver. Moreover the quality of the car seat, its style and adjustability depends on where it is made, who made it and how much it cost to produce. It is therefore, hardly surprising that there are considerable design variations between different models. The great incidence of discomfort, noticed among our subject, was attributed to that seat did not provide adequately dampen of excessive vibration also not provide support to the necessary areas of the body without interfering with blood and nerve supply[12].

The results of comfort ratings, suggests that time plays an important role in the perceived comfort rating of the seat and the

incidence of ensuing back pain. Due to the nature in which the car seat is used, the posture that is adopted by the driver in the initial adjustment period, is the one he maintains, apart from minor changes through out the journey. This suggests that postures, which are judged to be comfortable over short time periods, become uncomfortable if maintained over prolonged period[13].

With regard to the support provided by the seat for the lumber region, the responds of studied subjects, lead us to question the possible postures, which are adopted as a result of the seat design. It was noted that, when siting the lumbar spine, its discs, muscles and ligaments undergo varying degrees of strain and pressure which increases if the lumbar lordosis is lost and the spine becomes flexed[8]. When the design of car seating is considered in relation to its affects upon the anatomical alignment of the spine it can be seen that the backward sloping of the seat squab, there is an increase in the posterior rotation of the pelvis. This rotation is also influenced by the posterior thigh muscles, thus, if the angle of the knees is less than 45 degrees tension in these muscles is increased leading to a flattening of the lumbar spine. If this is the case, it then suggests that this posture, if maintained for a period of one hour or more, may have detrimental affects upon the body tissues. This may lead to pain in the short term and disability in the long term[7,9].

The shape of the backrest may also influence the maintenance of lumbar lordosis. As previously stated 48.3% of all male subjects, and 42,9% of all female subjects questioned indicated that they felt their backrest to be too flat. This suggests that there is inadequate provision for lumbar support in seating design. However, it should be noted that some 28.5% of women and 6.9% of men indicated that they felt their backrest to be too flat. This suggests that there in inadequate provision for lumbar support in seating design. However, it should be noted that some 28.5% of women and 6.9% of men indicated that they felt their backrest to be too curved. From the authors own observations this may be the result of the inappropriate location of lumbar support in car seat in general. The author noted that the majority of car seats observed had a curved backrest, but the point at which the curvature of the seat is greatest is approximately level with the sacral region. As this relatively fixed within the pelvis the increased curvature of the back rest only serves to push the buttocks forward in the seat, thus causing a flattening of the lumbar spine in order for the support of the back rest to be taken up.

The angle of the backrest in relation to the seat squab will also influence the posture of the lumbar spine[14,18]. A position commonly observed by the author in general everyday use is one with the backrest set at an angle of between 90 and 100 degrees. In this position there is an approximation of the trunk/thigh angle making it almost impossible for the lumbar lordosis to be maintained. This right-angled sitting position is the greatest determinant in the obliteration of the lumbosacral curve, more so than the presence or absence of a low back support[9]. This position also causes considerable strain on the lumbosacral junction and may explain why this position can not be maintained for long periods buy anyone with low back symptoms caused by inter vertebral disc lesions in the lumbar region[2]. The right-angled sitting position may also contribute to the incidence of discomfort experienced in the buttock region[1] by 42% of the subjects questioned (24% expressing discomfort, 8% expressing extreme discomfort).

In standing the ischeal tuberosities are covered by fibres of the gluteus maximum muscle. When sitting, the fibres of the muscle rise up over the tuberosities. The ischeal tuberosities carry the majority of the weight of the trunk and, when sitting is only separated from the seat by the skin and a fat pad. Thus the main support provided by the seat should be anterior of the tuberosities to ensure comfort. If the pressure is distributed posterior to the tuberosities, as in the right-angled seating position, pressure is applied directly to the muscle fibers, which rapidly become painful[11].

All the body areas examined by the questionnaire had ratings of discomfort or extreme discomfort without exception. The possible reasons for this may be linked to the isometric muscle contractions involved in maintaining the focal viewing angle[5]. However, it may also be the result of a poorly designed or positioned head restraint, or the absence of such a feature. The scope of this study, however, did not include the examination of a head restraint if present or lack of one. Therefore, further comment is at present not possible.

The final body area examined was the thigh. Here feelings of discomfort were less than in any other area. However, 22% of subjects noted a feeling of discomfort and a further 2% extreme discomfort. Although there is a greater percentage of more pleasurable comfort ratings in this area, it still seems that the design is not optimum for all drivers. Reasons for this could be linked to inappropriate seat length, i.e. too long causing impingement upon the popliteal fossa, or too short causing the seat edge to dig into the posterior thigh muscles[6]. The actual upholstery of the seat may also have been inadequate. However, from this study the latter suggestion is only corroborated by 12% of subjects questioned. Who stated that their seat upholstery was too hard (84% correct, 4% too soft). Again further comment at present is not possible, as details of this feature of seating design were not available to the author.

A total of 27 subjects expressed a history of lower back pain. Of those 13 where women and 14 were men. Of this group a total of 81% expressed an increase in their back symptoms whilst driving (44% women, 37% men). As previously discussed the design features of the car seat have the potential to increase the symptoms of lower back pain, especially if the pain is the result of a prolapsed inter vertebral disc[10].

Of the 27 subjects expressing a history of back pain, only 15 (55%) had sought treatment. Treatment was received in various forms from self-exercise to manipulation. There were no reasons established for those subjects who did not seek treatment. Of those subjects who did seek treatment only 6 (40%) received advice concerning the importance of postural care and the prevention of further recurrence of symptoms. This suggests that the areas where treatment was sort did not provide full and appropriate treatment, or did not link poor habitual sitting postures to their patients back problems. In physiotherapy the practice of patient education in back care is common place, but this may not be so in other professions. Although the importance of prevention rather than cure is well accepted, it is not always put into practice as illustrated by these results[4].

Seven of the subjects (47%) who received treatment had advice concerning the use of a lumbar support or roll whilst driving. Six of these subjects reported a decrease in symptoms during use. This suggests that the maintenance of a lumbar lordosis be of the greatest importance in the prevention of lower back pain[3]. However, one subject noted that

the lumbar roll provided no improvement in symptoms. This may be the result of inappropriate use, thus support was not provided in the area in which it was required.

CONCLUSION

From the present study, it is apparent that the design of car seating does have an influence upon the symptoms experienced by subjects suffering from low back pain. However, the study did not establish if the seat design was the primary cause of the back problems. The science of ergonomics examines the interaction between man and the environmental interfaces and, therefore should play a vital role in the design of seating in general. Although it is appropriated to consider, the problems of car seat design which are highlighted by this study leads to the suggestion that it may be appropriate for the physiotherapist not only to assess the patient in the outpatient department treatment room, but also within the confines of their vehicle. Given that the drivers seat will be used every time the car is driven, it is essential that the seat be positioned to ensure that the driver adopts a "healthy" posture, without compromising his visual field or, his ability to maneuver the car safely. It should be remembered that every time a muscle is used unnecessarily as the result of poor posture or bad positioning the more tired, and potentially dangerous the driver becomes.

REFERENCES

1. Baar, M.E.; Dekker, J. and Bosveld, W.: A survey of physical therapy goals and interventions for patients with back and knee pain. Phys, Ther., 78: 33 – 42, 1998.
2. Bendix, T.; Winkel, J. and Jesson, F.: Comparison of office chairs with fixed forwards or backwards inclining or titable seats. Eur J Appl Physiol; 45: 378-385, 1985.
3. Bobbs, F.W.: Design layout method for relating seating to the occupant and vehicle. Ergonomics, 22; 227 – 234, 1979.
4. Delitto, A.; Erhard, R.E. and Bowling, R.W.: A treatment – based classification approach to low back syndrome: identifying and staging patients for conservative treatment. Phys. Ther., 75: 470–485, 1995.
5. Feuerstein, M. and Beattie, P.: Biobehavioral factors affecting pain and disability in low back pain: mechanisms and assessment. Phys. Ther. 75: 267 – 280, 1995.
6. Frank, J.W.; Kerr, M.S. and Brooker, A.: Disability resulting from occupational low back pain; I: What do we know about primary prevention? A review of the scientific evidence on prevention before disability begins. Spine; 21: 2908 – 2917, 1996.
7. Frey, J.K. and Tecklin, J.S.: Comparison of lumbar curves when sitting on the Westnofa Balans Multi-Chair, Sitting on a conventional Chair, and standing. Phys. Ther., 66: 1365–1369, 1986.
8. Grandjean, E. and Huenting, W.: Ergonomics of the home. Taylor and Francis. London. 1973.
9. Link, C.S.; Nicholson, G.G.; Shaddeau, S.A.; Birch, R. and Gossman, M.R.: Lumbar Curvature in standing and sitting in two types of chairs: Relationship of hamstring and hip flexor muscle length. Phys. Ther., 70: 611–618, 1990.
10. Merrian, W.F.; Qinnell, R.C. and Stockdale, H.R.: The effect of postural change on the inferred pressures within the nucleus pulposus during lumbar discograhy. Spine; 9: 405-408, 1984.
11. Minns, R.J. and Sutton, R.A.: Pressure under the ischium detected by pedobarogrph. Eng. Med.; 11: 111-115, 1982.
12. Moule, T.: Are you sitting comfortably? Autocar and Motor. 42–45, 1990.
13. Roach, K.E.; Brown, M.D.; Albin, R.D.; Delaney, K.G.; Lipprandt, H.M. and Rangelli: The sensitivity and specificity of pain response

to activity and position in categorizing patients with low back pain. Phys. Ther.; 77: 730 738, 1997.
14. Shields, R.K.; Cook, T.M. and Zacharkow, D.: Effect of lumbar support on seat buttock pressure. (Abstract), Phys Ther.; 66:761, 1986.
15. Shields, R.K. and Cook, T.M.: Effect of seat angle and lumbar support on seated buttock pressure. Phys. Ther.; 68:1682 1686, 1988.
16. Valk, R.W.; Dekker, J. and van Baar, M.E.: Physical therapy for patients with back pain: a description. Physiotherapy; 81: 345 354, 1995.
17. Volinn, E.: The epidemiology of low back pain in the rest of the world: a review of surveys in low and middle income countries. Spine; 22; 1747-1754, 1997.
18. Walker, M.I.; Rothstein, J.M. and Finucane, S.D.: Relationships between lumber lordosis, pelvic tilt and abdominal muscle performance. Phy Ther; 67:512-516, 1987.

Appendix
Car Seat Questionnaire

Please Completes the Following Questions with Regard to the car you use most frequently:
Sex: Male /female Age: Height:
Weight: Make of Car:
Model of Car: Registration Date/ Age of car:
Have you any History of lower back pain? yes/no.
(If yes please complete section 3 also).

Section 1:
Please Give An Estimate of the Time Spent in your car per week:
i- Percentage of this time for business/work use: -------
ii- Percentage of time for social/domestic use: ----------
iii- The Approximate time of your average journey: -----

Section 2:
A. Extremely comfortable.
B. Comfortable.
C. No noticeable discomfort.
D. Uncomfortable.
E. Extremely uncomfortable.

Using the above scale please answer the following questions:

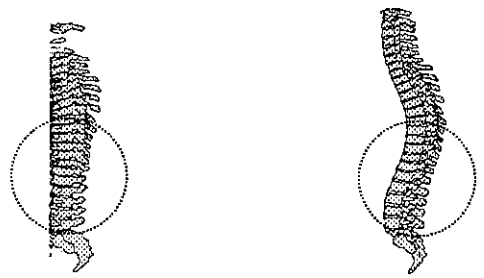
2.1. How comfortable do you find your car seat:
i- Following initial adjustment: A B C D or E.
ii- After a journey of 15 minutes: A B C D or E.
iii- After a journey of 45 minutes: A B C D or E.
iv- After a journey of 1 hour or more: A B C D or E.

2.2 At the end of a Journey of an hour or more give comfort ratings to the following body parts:
i- head/neck: A B C D or E.
ii- Shoulders and upper back: A B C D or E.
iii- Lower back: A B C D or E.

2.3. How would you rate the following aspects of your car seat:
i- Seat Upholstery: too soft /correct / too hard.
ii- Backrest: too flat /correct /too curved.

2.4. Do you feel that your current car seat provides adequate support for your Lumbar or lower back region? Yes/no.

2.5. Do you feel that the design of your current car seat provides Good Postural positioning ? (i.e. does it maintain a curvature of the lower back (see diagram). : Yes /no.



2.6. Do you feel that car seat design in general gives great enough consideration to postural support (as opposed to comfort)? Yes/no.

Section 3:
Please complete this section if you have a history of lower back pain:

3.1. Please give details (if known) of diagnosis of back problem/Complaint.

3.2. Have you received any treatment for the above condition? Yes/no.
If yes please give brief details of treatment received.
During your treatment did you receive any advice or information concerning postural care? Yes/no.
If yes did the information contain advice about appropriate sitting positions for the prevention of back pain? Yes/no.

3.3. Did /Do your back symptoms increase whilst Driving? yes/no.

3.4. Do you use an extra lumbar support whilst Driving? Yes/no.
Has It helped Reduce your back pain?

Thank you for completing this questionnaire.

الملخص العربي

تفاعل الإنسان مع مقعد السيارة: أحد العوامل المهيأة لآلم اسفل الظهر

تهدف هذه الدراسة إلى بحث تفاعل الإنسان مع مقعد السيارة وان كان له ارتباط أو يهيئ إلى آلام اسفل الظهر عند مستخدميه. وقد صممت استمارة استبيان لهذا الغرض . أجاب خمسون شخص على أسئلة الاستمارة . وتبين من تحليل الإجابات إن لمقعد السيارة تأثير في الشكوى الناتجة عن آلام اسفل الظهر. ولم توضح الدراسة إن كان قياده السيارة هو السبب الأساسي في مشاكل اسفل الظـــهر. وتوصـــي الدراسة بعمل دراسة مستقبلية عن تأثير المقاسات المختلفة لمقعد السيارة على قوام قائدها ، وعند تقييم المرضى الذين يعانون بآلام أســـفل الظهر يجب أن يأخذ المعالج في اعتباره تأثير مواصفات مقعد السيارة على سلامة الفقرات القطنية .