

Are You Sitting Comfortably? Users' Perceptions of a Pelvic Tilt Chair

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SUMMARY

An evaluation of a "Pelvic Tilt Chair" is described. Twenty one volunteers were given a prototype chair to use in their own offices for a period of 1 month. Ergonomic and anthropometric data and data concerning the subjects' history of back pain and occupational sitting behaviour were obtained. The subjects were characterised as a heterogenous group of chronic low back sufferers. Subjective data concerning back pain, acceptability, comfort and preference demonstrated that a large percentage of the subjects reacted positively to the prototype chair. Future research directions are outlined on the basis of this. It is argued that the concept merits further attention from those concerned with the treatment and prevention of low back problems.

OPSOMMING

Die evaluasie van 'n "Bekken-Kanteling stoel" word beskryf. Een-en-twintig vrywilligers is elk 'n prototipe stoel gegee om in hul eie kantore te gebruik vir 'n periode van een maand. Ergonomiese en antropometriese inligting en inligting in verband met die persoon se geskiedenis van rugpyn en gedrag is verkry. Die persone word gekenmerk as 'n heterogeniese groep van kroniese laer rugpyn lyers. Subjektiewe inligting in verband met rugpyn, aanvaarbaarheid, gerieflikheid en voorkeur het getoon dat 'n groot persentasie van die persone positief oor die prototipe stoel gereageer het. Verdere navorsing word hierop baseer. Daar word geargumenteer dat die konsep verdere aandag verdien in die hantering en voorkoming van laer rug probleme.

INTRODUCTION

This article describes an evaluation of a chair with a forward sloping seat (hereafter a "pelvic tilt" chair (Fig. 1). Authors such as Mandal¹ have advocated the incorporation of forward sloping seats into chair design in order to improve the sitting postures of sedentary workers. Data derived from a radiographic study² indicated that a prototype chair, utilising a forward sloping seat, encouraged an improved lumbar posture in seated subjects. The criteria underpinning "improvement" are discussed by Bridger² and Keagan.³

Little research has been carried out on this type of chair. Drury and Franscher,⁴ using a commercially available pelvic tilt chair, found that subjects complained of discomfort in the lower limbs, experienced no decrease in back discomfort and exhibited a tendency to slump forward with a kyphotic lumbar spinal posture. The chair evaluated by them differed in a number of respects from the prototype discussed in this paper, particularly

with regard to the size, angle and placement of the seat and knee platforms. Additionally the chairs discussed here were mounted on castors, unlike the chairs evaluated by Drury and Franscher.

The question of user acceptability and comfort is however of importance. If users do not consider the pelvic tilt chair to be an appropriate and acceptable item of office furniture, they will not use it — irrespective of any putative benefits for sitting posture or the reduction of back pain. For this reason an investigation into back pain user acceptability, comfort and preference was undertaken. The purpose of the investigation was to document users' reactions to the chair when used by them in their own workplaces. Arguably, data from such a study would be pivotal in enabling decisions to be made about whether, and how to proceed with further evaluation or development of the concept.

METHOD

The overall approach was to obtain a heterogeneous sample of sedentary workers who claimed to suffer from chronic low back pain. Subjects were then interviewed in order to obtain data on the incidence, history and nature of any "aches and pains" that they commonly experienced. Relevant ergonomic and anthropometric

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Fig. 1. A "Pelvic Tilt" Chair.

measurements of the subjects and their workspaces were made and data on occupational sitting behaviour obtained. Since this study was an ergonomic, as opposed to a clinical one, detailed clinical and diagnostic information was not obtained, except when offered by the subjects.

Subjects were then given a prototype pelvic tilt chair to use at their desks for a trial period of one month. At the end of the trial period, they were again interviewed and data on back pain, general postural comfort, acceptability and preference were collected. As a precaution, the author arrived at the subjects' workplaces unannounced in order to ascertain that the prototype was, in fact, being used.

The rationale for using chronic back sufferers in the evaluation was twofold. Firstly, the pelvic tilt chair is supposed to encourage a dynamic, more upright sitting posture which, according to Mandal¹ would be beneficial both for low back sufferers and also in a preventive sense, for sedentary workers who do not suffer from low back pain. Secondly, authors such as Hall,⁵ have recommended the use of back sufferers as a design tool in the evaluation of prototype seating, since back sufferers will be more sensitive to design deficiencies which affect the back.

The sample of subjects was obtained by placing an advertisement in the Grootte Schuur Hospital Newsletter,

requesting the assistance of sedentary, low back sufferers in the evaluation of a prototype chair. Twenty one subjects responded. All subjects were questioned about the history and current status of any back problems, as well as any coping strategies that they commonly employed.

Subjects

Details of the characteristics of subjects are given in Table I. 20 (95%) of the subjects (of which four were male and seventeen were female) had recently visited doctors, surgeons, physiotherapists or chiropractors in order to obtain treatment for lower back ailments.

Table I. Subjects' Age and History of Lower back Pain

	Mean	Sd*	Range
Age (yrs)	40.4	11.5	19 to 60
Duration of back pain (yrs)	10.5	8.1	1.5 to 25

* Sd = Standard Deviation.

Occupational Groups

The sample contained subjects from the occupational categories given in Table 2.

All subjects estimated that they spent more than 3 hours per working day sitting (mean time sitting per day was 5.6 hours, standard deviation 1.3 hours, range 3-8 hours). Twelve subjects reported that they avoided sitting for long periods (longer than one hour) without getting up. The remaining subjects, from the secretarial and clerical groups, reported that they sat for periods longer than one hour every day.

Table 2. Occupational Categories of Subjects

Occupational Category	No. of Subjects
Professor	1
Senior Medical Superintendent	1
Nursing Administration	1
Radiologist	1
Control Radiographer	1
Tutor Radiographer	2
Computer Programmer	1
Lecturer	1
Cytologist	1
Nurse	2
Secretarial	4
Clerical	5
Total	21

Ergonomic and Anthropometric Measurements

The following measurements were taken for each subject, as depicted in Fig. 2.

1. Standing height and mass
2. Sitting elbow height
3. Popliteal height (including shoes)
4. Buttock knee length and at each workplace:
 1. Desk height
 2. Seat height
 3. Seat depth

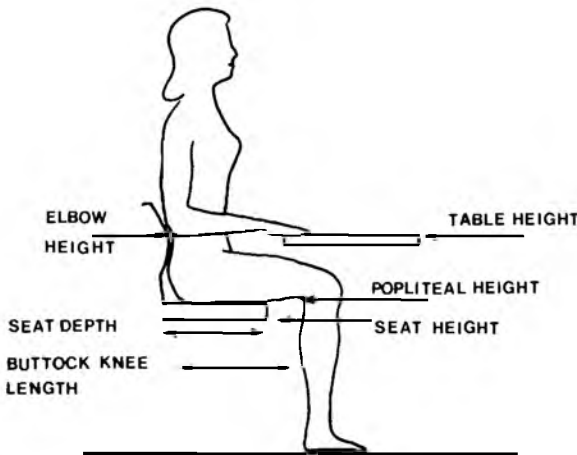


Fig. 2. Ergonomic and Anthropometric Measurements in Workspace Evaluation.

The purpose of taking these measurements was to evaluate the adequacy of the subjects' existing workplaces in terms of the degree of correspondence between the dimensions of the subjects and the dimensions of the furniture. Briefly, mismatches can occur as follows:

1. If the sitting elbow height is greater than the table height there is a tendency for subjects to slump over the desk while working. If it is less than the table height subjects exhibit increased elbow flexion and a tendency to elevate the shoulders while working.
2. If the functional popliteal height (shoes included) is less than the seat height, the legs will be unsupported, causing pressure under the thighs and possible impairment of blood flow in the legs.
3. If the depth of the seat is greater than the buttock — knee length, the subject will not be able to make correct use of the backrest whilst keeping the feet firmly on the floor.

These mismatches may occur in isolation or in combination with each other.

A fuller discussion of the above principles may be found in Floyd and Roberts.⁶

Back Pain, Comfort and User Acceptability

Subjects were interviewed in order to obtain information on the location of any musculoskeletal problems. This was achieved by having the subjects mark or shade appropriate areas of body maps. Problem areas were then rated by the subjects on a 7-point severity scale, where a score of 1 referred to "slight discomfort" and a score of 7 "unbearable pain". Information concerning the circumstances under which the pain occurred was also obtained.

Subjects were then given a pelvic tilt chair to use at work for one month. They were instructed how to adjust it and how to sit on it. At the end of the trial period they were again interviewed using the body maps and rating scales. Questions concerning acceptability, comfort and preference were kept "open-ended" in order to encourage subjects to comment spontaneously on any aspects of the chair about which they may have felt strongly.

RESULTS

Lower Back Pain

Ratings of lower back pain are summarised in Table 3. Statistical comparison of the distributions of the subjects' ratings revealed that the difference (before and after sitting on the chair) was significant (Wilcoxon matched pairs procedure, $T = 1$ $N = 19$, $p < 0,01$). Similarly, ratings for lower back pain experienced outside of working hours diminished from 2,9 to 1,5 after sitting on the chair for 1 month. Statistical comparison of the before and after scores was significant ($T = 13,5$ $N = 14$ $p < 0,01$).

Ergonomic and Anthropometric Measurements

Table 4 summarises the ergonomic and anthropometric measurements of the subjects and their work-

Table 3. Subjects' Ratings of the Severity of Low Back Pain Before and After Using the Pelvic Tilt Chair*

	Sitting at Work		Outside of Working Hours	
	Before	After	Before	After
Mean	3,1	0,9	2,9	1,5
Standard Deviation	1,5	1,4	1,9	1,8
Range	1-6	0-5	0-6	0-6

* The rating scale ranged from 1 (slight discomfort) to 7 (unbearable pain).

Table 4. Ergonomic and Anthropometric Measurements of Subjects and Workplaces

	Mean	Sd*	Range
Height (cm)	164,6	9,7	147,3 to 189,2
Weight (Kg)	61,8	13,9	37 to 94
Popliteal-Seat Height (cm)	-3,16	4,4	-11 to +5
Sitting elbow-Desk height (cm)	-4	4,4	-11 to +2
Buttock-knee — Seat depth (cm)	-4,47	6,9	-7 to 16

* Sd = Standard Deviation.

spaces. The measurements depicted in Figure 2, were analysed, for each subject, by subtracting the value of each ergonomic measurement from the corresponding anthropometric measurement. For example, seat heights were subtracted from popliteal heights. Table 4 shows the statistics of the distribution of this difference for the sample. These data illustrate a problem for short subjects in obtaining a seat height which permitted easy access to the desk whilst still being able to rest the feet on the floor.

User Acceptability and Preference

Subjects' responses to the open-ended questions, are summarised in Table 5. The data represent the subjects' likes and dislikes presented in terms of the number of subjects who expressed a particular point of view.

The most commonly encountered positive views concerned comfort, the upright sitting posture encouraged by the chair, manoeuvrability, relief of back pain and the absence of the backrest. The most frequently encountered negative views concerned knee discomfort and getting on and off the chair.

At the end of the interview, subjects were asked whether they would prefer to continue using the pelvic tilt chair at work, as opposed to some other type of conventional office chair. 15 subjects (71%) said they would definitely prefer the pelvic tilt chair, 4 subjects (19%) commented favourably on the concept but were undecided or would only accept the pelvic tilt chair with modification and 2 subjects (10%) preferred an alternative, conventional method of seating.

Table 5. Attitudes Towards the Pelvic Tilt Chair
(N = the number of Subjects Expressing a Given Viewpoint)

Likes	N	Dislikes	N
Upright posture	10	Knee discomfort	5
Relieves back pain	5	Have to stretch legs	1
Does not initiate back pain	2	Lack of under thigh support	1
Relieves neck pain	1	Pressure on varicose veins in leg	2
Permits postural change	1	Sore buttocks	1
No back support needed	5	Getting on and off	3
Easy to adjust	2	Seat doesn't swivel	2
Angle of seat	1	Too high for low tables	1
Use of knee pad	1	Can't lean back	2
Comfort	19	Felt unsupported	1
Manoeuvrability	10	Not manoeuvrable	1
Relaxing	3		
Improves access to desk	3	Can't operate dictaphone pedals	2
Save space in office	1	Can't hang jacket on back	2
Amusement it gives others	1	Creases clothes	1
		Can't sleep in it	1

DISCUSSION

The participants in this study represent a heterogenous group of sedentary workers from a variety of occupations and with different histories of chronic, but manageable, low back pain.

Ergonomic and anthropometric evaluation of the

existing workspaces indicated a variety of furniture design deficiencies, some of which may have contributed to, or exacerbated, existing back problems. Therefore benefits following the introduction of the pelvic tilt chair should not be attributed solely to the possible effects of the forward sloping seat on posture. Use of the chair brought about an improvement in the dimensional fit between users and their workspaces. It should be noted that when using a correctly designed pelvic tilt chair, the conventional requirements for back and under thigh support and the ability to rest the feet on the floor do not necessarily apply.

Chronic back sufferers may experience fluctuating levels of continuous or intermittent pain over time. Many factors may be involved. Despite this, most of the subjects reported significant reductions in lower back pain when sitting in the pelvic tilt chair (two subjects reported no difference and one reported an increase). Furthermore, significant reductions in low back pain, outside of working hours were reported. A number of subjects stated that using the chair relieved lower back pain, others reported that it did not initiate lower back pain and a large proportion commented favourably on the upright sitting posture encouraged by the chair. Taken together, these results support the view that the prototype chair may have beneficial consequences for the incidence of low back pain in certain cases.

No clear pattern is discernible regarding the subjects' dislikes about the chair. perhaps unsurprisingly, a number of subjects reported discomfort in the knees. This discomfort was reported to be mild, only occurring towards the end of the working day or after sitting for long periods. Of the 5 subjects who complained of knee discomfort, 4 of them preferred the pelvic tilt chair to conventional chairs. It may well be that they were prepared to "trade-off" discomfort in the knees for increased comfort elsewhere. This may not be the case for users who do not suffer from low back pain.

The subjects, as a group, expressed a clear preference for the pelvic tilt chair. 90% of the subjects felt that the chair was comfortable and, unexpectedly, several subjects commented on the manoeuvrability and stability of the chair as an important positive feature. A particularly important result concerns the absence of a backrest. 5 subjects felt that back support was unnecessary while using the chair whereas two subjects disliked the absence of a backrest. Additionally, a number of subjects reported an increase in back pain when first using the chair. This diminished within the first two weeks of the trial period.

The purpose of this investigation was to document the utility of the prototype chair, as perceived by the users. Although the number of subjects participating was small, the results indicate that further attention should be paid to this seating concept.

Future Research Directions

1. Seat angle, pelvic tilt and truncal posture need to be investigated using dynamic methods of posture measurement.

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2. Clinical investigations are required to identify medical and occupational factors which either support or contra-indicate the use of this seating concept in the treatment and management of low back problems.
3. Long term investigations of back pain, comfort and acceptability are required.
4. The prototype chair needs to be evaluated in comparison with conventional, well designed workplaces in order to clarify the reasons underlying the results reported above.

CONCLUSIONS

Users' reactions to the prototype chair suggest that it is of value in reducing the incidence of sedentary low back pain and that it is perceived by many as an acceptable and appropriate item of office furniture.

This supports the view that further research and development is required in order to gain a fuller understanding of the effects of the chair on musculoskeletal and physiological strain and sitting posture.

The sitting concept described above merits the close attention of researchers and practitioners in the fields of back pain and furniture design.

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Suggestions for a Training Programme for Home-helpers for the Aged and Disabled

S. WERNER

INTRODUCTION

The general improvement in health status and the continuous increase in life expectancy have caused a considerable growth of the aged population. Health and welfare organisations throughout the world are faced with the imminent problem of providing adequate care for this large population at risk, for as people grow older they accumulate various losses in most

aspects of life, making them increasingly dependent on the support of family and society.¹

The current concept of care for the aged is to enable people to remain part of their family and community for as long as possible before being confined to insitutional care. This concept, combined with the ever increasing cost of hospital treatment, has given rise to the development of community health and welfare services. Nurses, social workers, physiotherapists and others were diverted from the hospitals to the community to provide the elderly population with expert care in the various professions. The common objective of the multi-disciplinary teams was to enable the elderly to retain or regain their functional effectiveness in everyday life.^{2,3}

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