



Occupational Therapy Services
for Independent Living



Promoting healthy posture for wheelchair users through appropriate lumbar support:

An outline article by Ailsa Reston,
Occupational Therapist, that highlights the
issues and appropriate solutions through
effective ergonomic design

RKS Occupational Therapy Services

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Ailsa Reston qualified as an OT in 1986 from St. Andrews School of Occupational Therapy. She initially worked in the NHS in the field of adult physical medicine and then specialised in the field of neurology and the treatment of Stroke. In 1999, alongside fellow OT and COTSSIP member Bev Kelly, she set up the independent OT Practice, RKS Occupational Therapist Services based in Cheshire.

RKS provides assessments and reports for various organisations and individuals including the NHS, Social Services, case managers, housing associations and charities. It has specialist knowledge regarding wheelchair and seating provision – both of which the NHS and Social Services depend upon. In addition to these frontline activities, the Practice provides an independent living showroom where end users can discuss individual mobility needs and trial products before purchase.

1. Introduction

The provision of an appropriate and supportive wheelchair will enable good posture with head, spinal and trunk support and pelvic alignment. This is essential for regular or permanent wheelchair users to facilitate better occupation and well-being through reduced discomfort, back pain or fatigue. However many traditional wheelchairs do not promote good posture and lack appropriate lumbar support which can lead to chronic pain or long term health problems. This article discusses the importance of good posture, appropriate lumbar support and how an example wheelchair design, the TGA Strongback, may provide occupant benefits through a considered ergonomic backrest.

2. The definition of Posture

Posture is a term that indicates the relative position of the body segments during rest or activity' Twomey and Taylor 1987⁽¹⁾. 'Sitting' is a posture where weight is transferred to the seat of a chair or wheelchair through the Ischial Tuberosities and surroundings soft tissue of the buttocks and thighs. Depending on the wheelchair design, weight is also transferred through the backrest and armrests.

In the context of this article seated posture is as stated in Seeking the optimal posture of the seated lumbar spine Jenny Pynt et al. 2001⁽²⁾: 'Seated posture is defined according to the effect of sitting on the lumbar spine curvature. A flex seated posture is one that reverses the individual's standing (normally lordotic) lumbar curve into a Kyphotic position (forward slouching / backwards slumping). A lordotic or extended seated posture is one that maintains the lumbar curve close to that of an individual's lordotic standing position (upright/slight rear recline).'

Hence good postural health and reduced discomfort arises from maintenance of lordosis, interspersed with movement – achievable with a wheelchair that incorporates an ergonomically curved backrest and frame as opposed to a traditional upright backrest.

3. Many traditional wheelchairs promote poor posture

Frequent wheelchair users can experience multiple problems associated with poor posture. Without appropriate lateral and backrest support, an occupant's spine may not achieve a natural position resulting in several issues associated with:

- Reduced Occupational Performance
- Back pain and increased fatigue
- Detrimental affects on internal organ function
- Decreased communication
- Difficulties with breathing, eating and drinking
- Increased risk of spasm
- Musculoskeletal deformities such as Kyphosis and Scoliosis

Spinal Cord Injury Peer Support Group, Apparelyzed, provides a useful summary explaining why poor posture is common with users of badly designed wheelchairs and illustrates the resultant problems. "To feel more comfortable or stable, many wheelchair users slump back and slide the buttocks forward in the seat. This type of posture results in a very stable sitting position, but increases the risk of developing posture related health problems. Bad posture can result in reduced lung capacity, back and neck pain, and pressure ulcers. These are some of the most common postural related complaints amongst wheelchair users."⁽³⁾

"Bad posture and seating of an individual in a wheelchair often leads to musculoskeletal changes over time. If the wheelchair user

is not sitting in a correct position, changes to the skeletal system can take place over a number of years, putting additional strain on the spinal column and limbs. These changes alter the efficiency of muscle groups increasing the stress on them resulting in joint and muscle pain.”⁽³⁾

4. Preventing back pain through the lordosed sitting posture

There is a variety of evidence to suggest that sitting in a lordotic posture reduces the possibility of many health issues and back pain. It is important to note that pain arising from poor seated posture is insidious and that a wheelchair user’s healthy back, may not register pain until irreversible problems such as Intervertebral Disc Degeneration (IVD) has occurred. Therefore it is essential that a well-designed wheelchair is provided in the early stages of a user’s requirement and that teaching of healthy seated posture is both preventive and therapeutic.

Hedman and Fernie, 1997⁽⁴⁾ also reported benefits of sitting in a sustained lordosis lumbar position compared with cyphered postures. They discovered that:

- the compressive forces in discs were reduced
- disc shear force was decreased by 75%
- a balancing of forces in Zygapophysial joints



Effective lumbar support assists with a comfortable, healthy posture



Poor seated posture causes discomfort and pain

As a definition, Zygapophysial joints (also known as facet joints or z-joints) are located on the posterior of the spine on each side where two adjacent vertebrae meet. The facet joints provide stability and permit the spine to bend and twist. The joint contains cartilage between bones and is surrounded by a sac-like capsule that is filled with synovial fluid.⁽⁵⁾

If a regular or sustained kyphotic sitting position occurred, there was a:

- 9% increase in disc shear force
- large increases in the tensile forces around the posterior annulus
- greater, unbalanced anterior forces in the Zygapophysial joints
- three times the level of force in the posterior ligament on the flexed position than occurred in the anterior ligament in the extended position

Hedman and Fernie⁽⁴⁾ referred to the results of the aggregate posterior ligament and force exaction that occur from loading in the flexed posture as ‘alarming’ in terms of potential damage to the posterior ligament and disc. Therefore it can be concluded that the potential for IVD and lower back pain is increased when a cyphered (bending forward) sitting position is achieved.

Jenny Pynt et al. 2001⁽²⁾ in summary suggests: ‘Sustained lorded sitting posture (healthy upright posture with natural spinal curvature) decreases disc pressure and thereby disc degeneration, exhibits less injurious levels of ligament tension and although it may increase Zygapophysial loading, this is not of itself considered hazardous to spinal health. A sustained cyphered sitting posture (bent, hunched over), on the other hand, increases Intradiscal pressure leading to increased cell synthesis and biomechanics of the disc, appearing to culminate ultimately in disc degeneration that is a cause of low back pain.



5. The importance of an ergonomic wheelchair backrest

A curved convex wheelchair backrest that has been carefully considered in terms of appropriate ergonomics will provide more effective lumbar support and encourage a lordotic or extended seated posture. However the angle and curvature of the backrest must be carefully considered to ensure Hyperlordosis does not occur. Andersson et al, 1975⁽⁶⁾ demonstrated that: “If the lumbar support is placed at the level of the sacrum it will have the effect of forcing the buttocks forward, creating lumbar Kyphosis.” Further, it was the opinion of Jenny Pynt et al. 2001⁽²⁾ that the apex of the lumbar support is placed so as to maintain the lordosis but not at end of range extension, and such a placement creates pain-free and relaxed position, this will be the optimal location for lumbar support of the seated individual.

Postural health and reduced pain is more achievable if the lumbar support is appropriate to the degree of individual lordosis. This avoids holding the lumbar spine in sustained hyperlordosis, which causes vertical compression of the Zygapophysial joints and may impinge on the lamina of the vertebra below (Bogduk and Twomey, 1987⁽⁷⁾, causing

pain. The depth of the lumbar support may therefore need to be adjustable to accommodate individual lordosis.

Sue Hall Head of Physiotherapy and Karen Marshall, Wheelchair and Seating Department Manager at The Royal Hospital for Neuro Disability also state that: "The surface on which the body is resting has an effect on comfort and position – if it is contoured to the shape of the body it will be more comfortable than a flat surface and will distribute the weight more evenly."⁽⁸⁾

6. Maintaining lordosis through exemplary wheelchair design

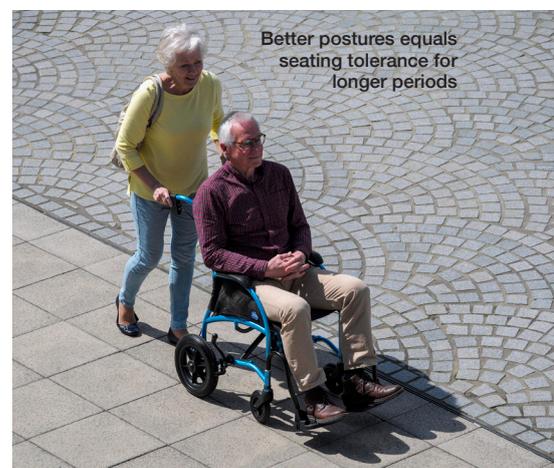
To eliminate the posterior rotation of the pelvis and concomitant flattening of the



An attendant-controlled wheelchair with a powerpack to assist carer propulsion

lumbar spine, the angle between the hip and the trunk needs to be increased (Keegan, 1953)⁽⁹⁾, thus a greater reduction in hip flexion may be achieved by assuming a semi-lying position. Jenny Pynt et al. 2001⁽²⁾ also reiterated the findings of Andersson et al. (1975)⁽⁶⁾ that for tasks not involving a forward posture, such as sitting in a wheelchair, it has been shown when a lumbar support of 4cm depth is used in conjunction with a reclined backrest of 130 degrees, lumbar lordosis is restored close to that of standing ie. intradiscal pressure is decreased approximately 6% compared with erect sitting without lumbar support. Therefore, a supported 'rear arched' spinal position approximately 10% less than full extension can assist with better postural health.

This concept should be taken into consideration when choosing the appropriate wheelchair and back. Incorporating a convex curved backrest to support natural lumbar lordosis should be considered. With traditional vertical backrests, users tend to slump in their wheelchair and adopt an unhealthy seated position. This is because the conventional wheelchair geometry makes effortless upright sitting impossible.



It is known that many people suffer from backache in their traditional wheelchair due to poor ergonomics. Providing a backrest that is geometrically more in-keeping with the natural curvature of the spine so extended periods of sitting will not result in chronic pain or other associated health and well-being problems. Added to this, firm yet appropriate lateral support will keep the pelvis mid-line so spinal curvature can be prevented in both planes. The importance of a well-fitting wheelchair is a vital consideration to maximize users Occupational Performance.

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