Standing vs. Sitting on Bambach Saddle Seat

Grandjean (1973) describes sitting as a 'natural human posture' because sitting relieves the person of the need to maintain an upright posture and reduces the static muscular workload required to maintain the joints of the foot, knee, hip and spine and so reduces energy consumption. Seating also helps the person to be more stable and might help when performing tasks that require fine or precise upper limb movements, and it produces a better posture for foot control operations. This may be the reason for the major change in dental working posture from standing to sitting. However, sitting in a slumped posture may contribute to the development of musculoskeletal disorders e.g. Low Back Pain.

Although there are many physiological advantages in sitting, mobility might be severely restricted. Prolonged sitting might lead to complications, for example Grandjean (1973) stated that a sitting posture causes abdominal muscles to slacken and slump the spine, in addition to impairing the function of some internal organs. Pottier et al (1969) have demonstrated that prolonged sitting (> 60 minutes) produced swelling in the lower legs of all sitters, which is caused by increased hydrostatic pressure in the veins and by compression of thighs resulting in an obstruction of venous return.

Corlett and Eklund (1984) identified that only intermittent muscle activity is required when standing to restore momentary displacements of posture. They identified that in normal standing the line of gravity (a vertical line through the body's centre of gravity) passes through the lumbar vertebrae, trunk and feet and no net torque exists, hence only minimal activity of the postural muscles are needed to hold the trunk erect. They have observed this phenomenon by using force platform measurements and correlated the results with the electromyography (EMG) activity of the muscles observed. They found reduced muscular activity in the trunk during standing. This may be because of the lumbar lordosis in standing, which brings the lumbar vertebrae together, and the centre of gravity of the trunk, arms and head is in line. This position can be achieved when using a Bambach Saddle Seat.

Sitting disrupts this arrangement of vertebrae; sitting with a 90° angle between the trunk and the thighs causes the pelvis to rotate backwards, which reduces the lumbar lordosis (posterior pelvic tilt) (Grandjean, 1973). Any deviation in this line of gravity results in torque production and muscle contraction may create additional compression on vertebrae. If the line shifts anteriorly the lumbar paravertebral muscles contract to maintain the erect posture. This increases the tension in the muscles and ligaments in the lumbar region to compensate for the movement of centre of gravity towards the anterior of the body, which, in turn, increases the load placed on the spine and intervertebral discs. This is generally observed in slumped sitting posture when using a conventional seat. Prolonged use (>6 months) of slumped posture increases the activity of the postural muscles in the back (Longissimus Thoracic and Multifidus Lumborum) which may lead to back pain (Gandavadi, 2008). Increased activity of the postural muscles in the back was also observed after using Bambach Saddle Seat for 3 months; however long term use (>6months) of Bambach Saddle Seat significantly decreases the activity of postural muscles in the back (Gandavadi, 2008).

In a seated posture an anterior tilt of pelvis will change the inclination of the first sacral segment. This will result in increased lumbar lordosis and increase the shearing forces acting on the lumbar vertebrae and also increase the likelihood of anterior displacement of the fifth lumbar vertebrae on the first sacral segment. Lumbar lordosis also increases the compression forces on the posterior structures, which could damage the spinous process, zygapophyseal joints and posterior ligament. In order to avoid this, the abdominal muscles will contract to exert an upward pull on the pelvis, which posteriorly tilts the pelvis, but this can create a compressive force on the structures of the lumbar region. The annulus fibrosus, joint capsules, and orientation of the facets also will provide stability.

However it is important to maintain some lumbar lordosis and a neutral hip position (45 degrees of flexion) when seated; this achieves a balance between the abdominal and back muscles, recruiting them to maintain core stability. O'Sullivan et al (2006) indicated that different upright sitting postures resulted in altered trunk muscle activation with lumbar lordosis (upright thoracic sitting) involved less co-activation of local muscles with greater co-activation of core muscles which highlights the importance of postural training and maintaining a healthy working posture. O'Sullivan et al (2002) also compared the trunk muscle activity in different standing and sitting postures in pain-free population. They found that the lumbo-pelvic stabilising musculature is active in maintaining optimally aligned, erect postures and these muscles are less active during the adoption of passive postures. Hence it is important that an optimally aligned posture is achieved and maintained in order to recruit the correct muscles to maintain core stability. This can be easily achieved by adjusting the height and seat tilt when using the Bambach Saddle Seat. Previous research has also indicated that long-term use of Bambach Saddle Seat can decrease the postural muscle activity (Gandavadi, 2008).

In a posterior tilted seated posture the inclination of the first sacral segment moves to neutral or towards kyphosis. This will result in a flattening of the lumbar lordosis and may lead to kyphosis (slumping of the spine). Lumbar kyphosis also increases the compression forces on the anterior structures, which increases the intradiscal pressure (Nachemson, 1966) and may affect the nutrition of the discs. The body weight is supported by the passive structures, the ligaments and posterior joint capsules, since the line of gravity is posterior to the ischial tuberosities. This is generally observed in slumped sitting posture when using a conventional seat.

In the seated posture, the spine, pelvis, the legs and feet mainly support the body. The orientations of the lumbar and sacral vertebrae are very important since, it is these vertebrae and their respective discs and muscles that will take most of the spinal load in sitting. When standing, the spine is in its natural curved position, which enables the body's centre of gravity to pass through the trunk and feet, so requiring only minimal muscular activity to maintain the posture. This can be achieved when using the Bambach Saddle Seat.

A chair design should aim at reducing the spinal load and should be concerned in the angle of seat inclination, since this may influence the amount of pelvic tilt. Since the spine naturally rests in its normal 'S' shape, it is important to maintain this position in sitting as it reduces the pressure on the intervertebral discs and static loads on the spinal extensors. This can be attained when using the Bambach Saddle Seat as it can effectively simulate standing. Studies on intervertebral disc pressures when adopting various seat angles and posture have suggested that intradiscal pressure is gradually lowered to around 100 to 120 kg when the seat angle is increased to above 110° to 120° (Oborne, 1987) When the seat angle is increased the pelvis moves into anterior tilted position and the intradiscal pressure is lowered, as this position is comparable to standing. This can be attained when using the Bambach Saddle Seat. The Bambach Saddle Seat is designed to maintain the pelvis in an anterior tilted position in order to achieve a slight lumbar lordosis (Gale et al, 1989) and the angle of hips and knees can be adjusted so that the spinal posture simulates standing, thereby contributing to a healthy spinal posture.

Our body is designed to be dynamic and any prolonged static activity is not good for our body and in the long term can cause musculoskeletal problems. There is no right working posture and it cannot be assumed that standing working posture is good, as working on a static standing posture may also lead to musculoskeletal problems. Also for some professions working in a standing posture is not an option. It is important to achieve an optimal working posture; this should be accompanied with regular rest breaks and chair-side exercises which helps in restoring blood supply to the postural

muscles. Optimal posture can be achieved when using a Bambach Saddle Seat; this depends on properly adjusting the seat height and tilt to suit the person using.

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