PRESSURE MANAGEMENT IN SITTING: CLINICAL EXPERIENCE AND THE LITERATURE
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Pressure ulcers are a serious cause of disability \(^1\) often resulting in longer hospital stays, as well as increased morbidity and mortality \(^4,6\). It is estimated that 1 in 4 people in the Canadian healthcare system have a pressure ulcer \(^2\). Pressure ulcers are a costly health issue both fiscally and personally. A pressure ulcer effects a person’s day to day living through imposed activity limitations, discomfort, pain, alterations to personal care routines and feeling as though life has been put on hold \(^4,6\). Changes to the Registered Nursing Association of Ontario best practice guidelines suggest that a person with a pressure ulcer can sit in their wheelchair as long as the pressure is managed \(^7\). This change in practice heightens the role therapists have in managing sitting pressure as much of management occurs through equipment use and strategies to facilitate effective day to day functioning/interacting with that equipment.

**Background for pressure management**
Pressure over the bony prominences of the buttock is one of the most prevalent causes of pressure ulcers for people who require a wheelchair for their mobility \(^3,4\). The impact of pressure varies based on the amount of pressure applied over the sitting area (magnitude) and the length of time the pressure (duration) is applied \(^19\). It is suggested that low magnitude over a long duration is just as detrimental as high magnitude over a short duration \(^19\). Evaluating the influence of both magnitude and duration of pressure on each sitting surface is critical for both prevention and treatment of pressure ulcers. An understanding of the different stages of pressure ulcer development is also important in meeting pressure management needs of the client for several reasons: 1) client education especially with regard to early identification of stage 1 and 2 ulcers to prevent progression to stage 3 or 4; 2) to make appropriate referrals to other health care professionals; 3) assess areas of risk and identify potential causes and; 4) determine appropriate assistive technology and/or strategies to address pressure issues. The ability of a person’s tissue at the sitting surface to tolerate pressure (both magnitude and duration) plays an important role in the development of pressure ulcers. Tissue tolerance varies across people due to many factors such as: the condition of the skin (skin elasticity, muscle atrophy, vascular change, etc.), age, hydration, metabolism, mobility, and sitting posture. While there are many of these factors that wheelchair and seating cannot address there are a few important ones that can be addressed, more specifically sitting posture, microclimate, and mobility with considerations for other factors such as condition of the skin, sensation changes and age.

**Postural Considerations**
In sitting, the pelvis bears most of the body weight, therefore how the pelvis is supported on the sitting surface will influence pressure at the bony prominences of the pelvis. The magnitude of pressure is influenced by the amount of contact between the sitting surface and the pelvis and thighs; the larger the area of contact the greater the area for pressure distribution. The symmetry of pressure distribution also influences pressure magnitude. An asymmetrical sitting posture will result in uneven weight distribution increasing pressure in the area of greater load. Uneven weight distribution occurring at the sitting surface and pelvis interface is influenced by the position of the body, whether from musculoskeletal changes influencing posture or, from postures assumed during daily life activities. The issues of contact area for distribution of pressure as well as positioning for even weight distribution across the sitting surface are addressed through the equipment choices and set-up including the cushion, back support, trunk laterals and wheelchair frame.

**Influence of movement on pressure**
How the client moves both to and from a surface and while on the surface is important to consider. Friction and shear can come into play during propulsion especially over rough or uneven surfaces.
Tam et al. (2003) found that during manual propulsion peak pressures occurred anterior to the ischial tuberosities. This finding may provide some insight into the potential causes of pressure when looking at the ulcer location during the full assessment. Transfers are an important part of the puzzle as bumps, scrapes, dragging and sliding that can occur during transfers have implications for pressure ulcer risk due to friction, shear and deep tissue injury. The impact of fatigue, tone, balance/stability, safety, and consistency of the transfer over the course of the day will influence risk.

Pelvic movement on the sitting surface over time is also a significant contributor to friction/shear injury whether from sliding forward or from pelvic drift. The techniques used in the transfer and in positioning/repositioning as well as the equipment used may contribute to risk of pressure ulcer development. Friction from the transfer board or the sling being inserted, pinch points during the transfer or scrape or scratch points from surfaces such as care giver’s rings are all examples of potential contributing factors to pressure ulcer risk. Intervention needs to address the risk factors of friction and shear in addition to pressure. Alternate techniques or equipment need to be considered such as changing the transfer style or using a low friction surface to reduce potential for friction injury.

**Pressure Redistribution Strategies**

The duration of sitting pressure can be managed by pressure re-distribution strategies using specific weight shifting techniques with or without dynamic positioning technology. The goal of weight-shifting is to redistribute pressure from high risk areas to more tolerant low risk areas or offload pressure from the high risk bony prominences of the pelvis. Weight shifting techniques include manual techniques of leaning forward, leaning to one side and lifting the buttocks entirely off the sitting surface often referred to as a push up. Dynamic positioning devices offer weight shifting through tilt, recline, or standing where manual weight shifting may not be effective or appropriate. Use of these techniques or equipment needs to occur in conjunction with appropriate sitting surfaces for pressure management. Implementing a weight-shifting technique alone will not manage sitting pressure if the equipment used does not adequately address pressure magnitude. Use of dynamic positioning devices also requires a full assessment to ensure the device will meet the person’s full needs and contraindications are not present.

Research has not linked weight-shifting strategies to pressure ulcer prevention therefore determining the effectiveness of these techniques is based on clinical experience, knowledge of contributing factors and observation of client’s use of the technique as well as of the sitting surfaces. Assessing effectiveness includes: determining adequacy of clearance at the bony prominence being addressed; the impact on posture during the shift including the ability to return to the original or optimal posture especially at the pelvis; the risk for friction and shear during the weight-shift; the length of time the weight-shift can be held to allow adequate blood flow and tissue reperfusion and; the ability to complete the technique with the recommended frequency. Pressure mapping may be used to assist in determining effectiveness of weight-shifting techniques.

Some research has used pressure mapping to determine that a minimum of 30 degrees of tilt is required to have a significant effect on redistributing pressure off of the buttocks. The greater amount of tilt used past 30 degrees, the greater the pressure redistribution off the buttocks onto the back. It is important to note that while the power positioning devices offer the ability to weight-shift for those people who are unable to effectively do so for themselves, offloading does not occur. At 55 degrees tilt a 46% reduction in seat pressure was found. In either full recline or in 75 degrees in standing a 61% reduction in seat pressure was found. It is important to note several other researchers have also studied the relationship between tilt and/or recline and pressure redistribution at the buttocks. In these studies the percentage of reduction varies at similar amounts of tilt and/or recline suggesting that there needs to be an individualized approach to determining the amount of tilt needed for load reduction at the buttocks.

Best practice guidelines recommend a frequency of weight-shifting every 15 minutes. Pressure management best practice guidelines vary in their recommendations for duration of weight-shifting from 30 to 60 seconds. Coggrave and Rose (2003) found that an average of almost 2 minutes is required for blood flow to return to an offloaded area with a range of 42 seconds to 3 minutes.
These variations again support an individualized approach to determining pressure management strategies.

The push-up or lift-off manual technique for weight shifting needs to be carefully assessed to determine effectiveness. Besides long term implications for shoulder joint integrity, the ability of the person to hold this position longer than 30 seconds must be considered. The other manual weight shift techniques of leaning to one side and leaning forward also provide an opportunity to redistribute pressure off of specific areas of the buttocks. Leaning forward has been found to reduce pressure at the ischial tuberosities by 78% \(^{20}\). This may be an easier and more acceptable position to assume on a regular basis. However, this technique does require trunk strength and stability to lean forward. Environmental supports such as a table or vanity may offer some support \(^{14}\). Leaning to one side can also redistribute pressure from one side of the buttock to the other but requires some trunk strength and stability. This technique has the potential to offload if the person is able to lift the opposite side buttock entirely off the sitting surface. The effectiveness of this technique needs to be assessed for both the weight shift but also the return to the original or optimal position. Leaning to the side has high potential to create pelvic asymmetry if the person cannot return to the optimal position \(^{14}\). The frequency with which the pressure redistribution strategy needs to be completed across the day needs careful consideration. The use of several techniques may be needed to make pressure redistribution effective for the person in his/her daily life.

**Conclusion**

Pressure management in sitting is complex. A comprehensive assessment of the interplay between sitting posture, sitting surface equipment and movement with consideration of the duration and magnitude of pressure is required to determine the pressure management plan. Pressure redistribution strategies to address pressure duration are part of a comprehensive pressure management plan but are dependent on appropriate postural support and equipment to manage the magnitude of pressure. Pressure management requires prioritization and compromise based on client needs and the needs for pressure management. An individual approach to assessment and intervention plans is essential to meet the pressure management needs of the person. An individualized approach is essential to meet not only the person’s pressure management needs but also to be able to integrate the strategies into daily life.

**References**


**Speaker Bio**

Laura Titus and Susan Moir are both occupational therapists with over 20 years experience in the area of wheelchairs and seating. For the past 12 years they have both worked at the adult wheelchair and seating program in London, ON at SJHC-Parkwood Hospital.