Understanding basic principles of seating

A wheelchair is a “body orthosis on wheels”.
Bengt Engström

Orthosis = splint

FUNCTIONS OF AN ORTHOSIS
- Maintaining alignment
- Protecting weak muscles
- Protecting joints
- ↓ Abnormal reflex mechanism
- Provide postural support
- Allow improved movement
- Allow improved function as result
- Prevent pressure sores and other secondary complications

Seating
- Seating is individualised
- Bio-psycho-social needs
  - Environment
  - Postural support factors
  - Activity level
  - Cost
  - Personal preference
- Problems solving approach
- Preventative and promotive aspects
- 24-hour approach

REQUIREMENTS OF SEATING
- Provide postural support
- Provide stability
- Prevent secondary complications
- Should be revised regularly
- Corrective seating to be combined with treatment and closely monitored
BIOMECHANICS OF SEATING

Mechanism of spinal deformity development (1)

- Normal spine
- S-curved spine
- Small joints in full contact with each other
- Spine stable
- No stretch on ligaments and muscles
Mechanism of spinal deformity development (2)

- Slumped posture
- Spine bent, twisted and/or rotated
- Small spinal joints open up
- Stretch on any muscle, ligaments, and joint structures
- Spine unstable
- Gravity “sucks”

THE REQUIRED SEATING POSTURE

PRINCIPLES OF SEATING

- Stabilise the pelvis
- Stabilise the spine
- Tilt in space (if required)

STABILISE THE PELVIS

- Stop sideways movement
  - Correct chair width
- Stop sliding
  - Correct seat length
  - Correct footplate height
  - Correct cushion
  - Angled seat
  - Lap strap
STABILISE THE PELVIS

- Stop sliding
  - Correct cushion

- Stop sliding
  - Angled seat

STABILISE THE PELVIS

- Stop sliding
  - Lap strap
  - At angle of 45 degrees over hips

STABILISE THE SPINE

- Stop slumping
  - Correct back height
  - Back support adjusted to maintain S-curve of spine

- Stop sideways movement
  - Correct chair width
  - Postural support system (special back)

STABILISE THE SPINE

- Stop slumping
  - Correct back height

- Stop slumping
  - Back support adjusted to maintain S-curve of spine
BACK SUPPORT SYSTEMS:
Tension adjustable back

STABILISE THE SPINE

- Stop sideways movement
  - Correct chair width
  - Postural support system (special back)

BACK SUPPORT SYSTEMS:
Adjustable rigid back: Jay series

ADJUSTABLE RIGID BACK

ADJUSTABLE MODULAR BACK

BACK SUPPORT SYSTEMS:
Adjustable modular back
Shonaquip Monty back
ADDING TILT IN SPACE

- After seating, adding tilt to the whole seating unit to:
  - Improve stability
  - Counteract gravity
  - Align head in space
  - Pressure relief

THE REQUIRED SEATING POSTURE

Achieved by anatomical and biomechanical analysis and principles
- Require specialised training

THE REQUIRED SEATING POSTURE

Can it be achieved by:
- Box seats
- Body braces
- Workshop inserts
Results of inappropriate seating

“It is a medical responsibility to make wheelchairs function to prevent long-term injuries.”

Bengt Engström
SEVERE LESION

THORACIC KYPHOSIS

REQUIREMENTS FOR CUSHIONS
- No chair prescribed without a cushion
- No cushion any good without adequate back support
- Contoured with pre-ischial bar
- Firm contoured or flat solid base
- Purpose of cushion
- Velcro for stability
- Review regularly
- Check for bottoming-out

SKIN BREAKDOWN PRESSURES
- Femur: 80mmHg
- Trochanter: 75mmHg
- Ischial tuberosities: 40-45mmHg
- Coccyx: 18mmHg

DECUBITUS: CAUSES

<table>
<thead>
<tr>
<th>EXTERNAL</th>
<th>INTERNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>Blood perfusion</td>
</tr>
<tr>
<td>Shear forces</td>
<td>Sensation</td>
</tr>
<tr>
<td>Friction</td>
<td>Mobility</td>
</tr>
<tr>
<td>Moisture</td>
<td>Nutrition</td>
</tr>
</tbody>
</table>
### DECUBITUS: STAGES AND MANAGEMENT

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local redness</td>
<td>Find and remove cause, rest, ice, Prep</td>
</tr>
<tr>
<td>Blister</td>
<td>As above Do not sit until healed</td>
</tr>
<tr>
<td>Wound, with / without necrosis</td>
<td>No sitting Medical care and management</td>
</tr>
<tr>
<td>Deep wound, with / without necrosis</td>
<td>No sitting Surgical and medical care</td>
</tr>
</tbody>
</table>

### Basic foam cushion

**Top layer:**
- High density foam
- Hardness 18.5 – 20.5
- Density 30kg/m³

**Base layer:**
- High density compressed foam
- Hardness 39-42
- Density 80kg/m³

SABS 642 - 1976

### Selecting a cushion

- Purpose of the cushion
  - Positioning
  - Stability
  - Pressure relief
- Pressure relief substance: Air / gel / fluid / foam
  - Assess degrees of movement of pressure relief substance
  - Assess fill of pressure relief substance
  - Continue pressure relief strategies

- Size (width/depth) of the pre-ischeal shelf area
- Length
- Check for bottoming out

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