

## Flexx Clinical Justification

### Progressive Health Condition

The progressive changes in health status affects sitting stability, propulsion efficiency, and transfer safety during the transition from "weak to strong" (recovery period) and "strong to weak" (degeneration period) states. Seat tilt adjustment, rear axle position adjustment, and the use of adjustable component are implemented to accommodate different levels of physical independence.

**Weak → Strong, Dependent → Partially Independent → Independent (SCI / CVA / Amputation / CP).**

**Changes in sitting stability requirements — Seat Dump:** In the early post-injury phase, the user's core muscle strength is poor, resulting in poor sitting stability. Increasing the **seat dump angle** (rear seat height – front seat height), combined with increasing the **backrest angle** posteriorly, utilizes gravity to enhance body stability and maintain sitting posture with less effort. As the user recovers or trains to improve their health condition, the seat dump angle should be reduced to increase limb agility and wheelchair propulsion efficiency, enabling independent performance of daily living activities.

**Propulsion efficiency and trunk stability:** In the early post-injury phase, wheelchair propulsion skills are poor; the **rear wheel axle** must be moved posteriorly to prevent backward tipping. As operational skills and trunk stability improves, with longer required propulsion distances, the rear axle can be moved forward, or even converted to pneumatic tires to increase propulsion efficiency and enable wheelie techniques climbing curbs and obstacles.

**Transfer convenience and safety:** Selecting a wheelchair with **flip-back armrests** and **swing-away legrests** allows caregivers to assist with transfers more easily and safely during the early injury phase. As abilities improve, users can also transfer independently more easily and safely. **Seat height adjustment** matches daily transfer heights.

**Positioning should be adjusted according to condition:** **Armrest height adjustable**, **backrest angle adjustable**, tension adjustable backrest conforms to body shape, high compatibility with third-party positioning products.

**Training requirements:** For efficient propulsion and wheelie training, the **rear wheel axle** is moved forward, but this setting makes the wheelchair prone to backward tipping, so **anti-tipper** must be added to reduce riding risk.

**Environmental requirements:** **Large front casters** for negotiating curbs and thresholds, **small front casters** for agility, **large rear wheels** for energy-efficient self-propulsion.

**Strong → Weak, Independent → Partially Independent → Dependent (ALS / MD / SMA / DMD / Age-Related Decline).**

**Changes in seated stability requirements — Seat Dump:** When muscle strength is initially good, the **seat dump angle** should be set low to maximize limb agility, facilitating independent daily living. As the condition deteriorates, increasing the **seat tilt angle** combined with increasing the backrest angle posteriorly utilizes gravity to enhance proximal body stability and maintain seating posture with less effort.

**Propulsion efficiency and prevention of body deformity or secondary injury:** When the body condition is initially good and limb stability is strong, , the **rear axle** can be moved forward, or even converted to pneumatic tires to increase propulsion efficiency and prevent excessive energy expenditure that could cause muscle degeneration or compensatory movements leading to shoulder injury or scoliosis.

When deterioration becomes more severe and wheelchair propulsion risk increases, the rear wheel axle should be moved posteriorly, or **anti-tippers** added to prevent backward tipping.

**Transfer convenience and safety:** Selecting a wheelchair with **flip-back armrests** and **swing-away legrests** allows caregivers to assist with transfers more easily and safely during the early injury phase. When deterioration becomes severe and the user is dependent on caregivers, **the rear wheels can be converted to attendant wheels**, providing more lateral transfer space (vs. self-propulsion wheels).

**Positioning should be adjusted according to condition:** **Armrest height adjustable, backrest angle adjustable**, strap tension adjustable backrest conforms to body shape, high compatibility with third-party positioning products.

Accessory / Feature	Clinical Application for Amputation
<b>Adjustable Seat-to-Floor Height</b>	Optimizes transfer safety: Transfers from the wheelchair to the bed, toilet, or chair are among the most hazardous moments clinically. Excessive height discrepancy between the wheelchair seat and the target surface increases the risk of user falls or caregiver back injuries. Adjusting seat height to match the home environment (e.g., kitchen counter, desk) better accommodates daily functional needs. Resolves environmental accessibility issues (Wheelchair users frequently encounter the problem of being unable to fit under tables.)

<p><b>Adjustable Seat Angle (Seat Dump)</b></p>	<p>Increasing the posterior seat tilt allows gravity to assist in sitting stability. This reduces the energy expenditure required for maintaining sitting balance, enabling users to conserve energy for propulsion or functional activities.</p> <p>Depending on the user's trunk control ability, reducing the between front and rear seat height improves transfer convenience and upper-limb wheelchair propulsion efficiency.</p>
<p><b>Adjustable Backrest Height</b></p>	<p>Lowering the backrest height provides adequate scapular clearance, enabling smoother wheelchair propulsion. Suitable for active users with strong independence in activities of daily living. Raising the backrest height increases the support of the back, reducing muscular fatigue.</p> <p>This is particularly important for early-stage rehabilitation patients or frail elderly users. The extensive 380–530 mm adjustment range allows a single wheelchair to accommodate various sizes of rigid backrests or headrest support brackets, extending the wheelchair's functional lifespan.</p>
<p><b>Adjustable Backrest Angle</b></p>	<p>Reclining the backrest compensates for cervical spine deformity through hip joint angle adjustment, helping the user restore a horizontal line of sight. For cases where trunk control ability changes with disease progression, the Flexx offers 4-degree increment adjustments, enabling therapists or caregivers to precisely identify the optimal balance between stability and mobility.</p> <p>This ensures adequate spinal support (stability) while preserving the range of motion needed for upper extremity wheelchair propulsion (mobility) - particularly critical for users who rely on their upper limbs for activities of daily living (ADLs).</p> <p>Slight recline utilizes gravity to rest the trunk against the backrest, reducing the force needed for trunk control, thereby reduce the risk of kyphosis and respiratory efficiency.</p> <p>Combined with seat angle adjustment, it effectively prevents anterior pelvic sliding.</p>

<p><b>Adjustable Rear Wheel Axle</b></p>	<p>Repositioning the rear wheel axle posteriorly increases the wheelchair’s base of support, significantly enhancing stability — critical for providing beginners with a sense of security. Moving the rear axle anteriorly positions the axle center closer to the user's center of gravity (approximately below the vertical line of the shoulder joint). This increases propulsion stroke length and reduces the frequency, achieving energy efficiency and improved endurance for long-distance travel. It also reduces moment of inertia, decreases energy expenditure, and increases maneuverability.</p>
<p><b>Adjustable Armrest Height</b></p>	<p>200-280 mm adjustable range ensures the elbows are comfortably supported at 90 degrees of flexion. This not only stabilizes the trunk but also provides a stable platform for users to perform pressure relief through push-ups</p>
<p><b>Flip-Back Armrest</b></p>	<p>Ideal for lateral transfers when the lower extremities are non-weight-bearing or when caregiver assistance is required. With the armrests flipped back, the wheelchair seat surface aligns seamlessly with the bed surface or transfer board. This eliminates barriers to lateral transfer, significantly reducing energy expenditure and fall risk during transfers.</p>
<p><b>Quick-Release Swing In/Out Legrest</b></p>	<p>The entire support structure can be swung outward and detached. Swinging the legrests away allows the wheelchair to be positioned closer to the target surface (e.g., toilet or hospital bed), shortening the physical transfer distance and reducing risk for both the caregiver and the user.</p>
<p><b>Multiple Front Caster Sizes</b></p>	<p>Balance between terrain and agility: Front caster size and ground contact area produce different characteristics. Small front casters (5–6 inches): Small turning radius, low resistance, extremely responsive steering — ideal for indoor activities, smooth surfaces (e.g., hospitals, shopping malls), and users pursuing high mobility in manual propulsion. Large front casters (7–8 inches): Superior obstacle-clearing capability — suitable for outdoor activities and environments with poor road conditions around the home (e.g., brick paths, asphalt roads).</p>

<p><b>Multiple Rear Wheel Sizes</b></p>	<p>Balancing self-propulsion and transfers: 14-inch small wheels are designed for users who are caregiver-dependent, have upper-limb weakness, or have cognitive impairment preventing independent operation. Addresses space and weight concerns — without hand rims, the overall wheelchair width is significantly reduced, allowing passage through extremely narrow doorways; additionally, smaller wheels reduce the total wheelchair weight, substantially decreasing lumbar strain for caregivers who frequently need to load the wheelchair into vehicles. 20/22/24-inch large wheels are suitable for users with upper extremity self-propel capability. Larger wheel diameter provides a longer lever at the handrim contact point, reducing propulsion effort and increasing propulsion efficiency. 24 inches is the standard adult size; 20–22 inches are suitable for shorter users or those requiring lower seat height (e.g., hemiplegic foot propulsion).</p>
<p><b>Compatible with Third-Party Cushions</b></p>	<p>Seat height, armrest height, and backrest height adjustability allow Flexx to fully accommodate cushions of varying thicknesses.</p>
<p><b>Compatible with Third-Party Backrests</b></p>	<p>Installing third-party rigid backrests and lateral supports provides three-point force to stabilize spinal alignment, reducing deformity risk and improving seated posture stability.</p>
<p><b>Anti-Tipper</b></p>	<p>Anti-tipper provide the protection during sudden center-of-gravity shifts, preventing the wheelchair from tipping over.</p>



*The clinical recommendations provided in this document are for professional therapists' reference only and should not replace individualized clinical assessment. The actual prescription should be determined by healthcare professionals based on the user's physical functions, home environment, and individual needs. Karma Medical reserves the right to change product specifications.*

