MOTION U

PEDIATRIC APPROACHES WITH MOTION COMPOSITES HELIO KIDS AND APEX

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FACULTY DISCLOSURE

CHRISTIE HAMSTRA, PT, DPT, ATP

- Physical Therapist 20+ years
  - Acute Rehab, Long Term Care, School-based, Outpatient Pediatric Seating Clinic
- Two years as ATP for independent dealer in Michigan
- Invited guest lecturer: Oakland University and Andrews University
- Currently Clinical Education Specialist, Motion Composites
- Based in Dearborn Heights, Michigan
- c.hamstra@motioncomposites.com

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GREETINGS FROM MOTION COMPOSITES

INDUSTRY AWARDS

MOTION COMPOSITES

MISION & VISION STATEMENTS

"LEAD THE EVOLUTION OF MOBILITY
FOR BETTER LIVING"

"BECOME EVERYONE'S FAVORITE MOBILITY
COMPANY BY OFFERING INNOVATIVE PRODUCTS
AND THE MOST RESPONSIVE SERVICE"

MOTION COMPOSITES

CORE VALUES

KEY CONCEPTS FOR PEDIATRICS

- Proper fit
- Growth
- Weight of wheelchair/ratio to weight of child

"Selecting a chair that can grow with a child instead of expecting the child to grow into the chair"

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PROPER FIT

- Seat width
- Seat depth
- Footrest length

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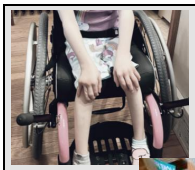
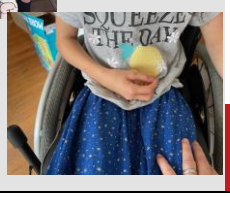
GROWTH

- "the need to 'grow' children's wheelchairs makes it difficult to get them as light as adult wheelchairs."
- "generic children's chairs are prescribed with more attention paid to what is easiest for the family rather than what may be best for the child. The relative weight of a child's wheelchair appears considerably greater than one for a young adult." Sawatzky et al 2006





WIDTH GROWTH

- 2020
  - 12-inch-wide wheelchair
  - 8-inch hip width measurement
- 2023
  - 12-inch-wide wheelchair
  - 9.5-inch hip width measurement
- Still with room to "width grow" into the wheelchair
- What about propulsion efficiency?

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WEIGHT OF THE WHEELCHAIR

- Studies show often with pediatrics more careis given to seating and positioning, and what is easiest for caregivers than on independent mobility
- The less the load (including wheelchair, user and accessories) the less rolling resistance (Ott et al 2020)

RESNA

RESNA Position on the Application of Ultralight Manual Wheelchairs

Rehabilitation Engineering & Assistive Technology Society of North America

1560 Wilson Blvd, Suite 850
Arlington, VA 22209
Phone: 703-524-6686
Fax: 703-524-6630

Wheelchair Weight to Bodyweight Ratio	Adults	Children
	.21	.44

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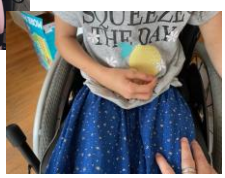
HOW MUCH WEIGHT????

	Wheelchair Weight	Child Weight	Percentage of Body Weight
2020	31.78	32 lbs.	99%
2023	31.78	38 lbs.	83.6%



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INAPPROPRIATE WHEELCHAIR SETUP

- "Inappropriate wheelchair set up or a poorly maintained chair will likely result in not only mental anguish … but also physiological strain associated with increased energy costs, resulting in relative inactivity." Sawatzky et al 2006

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NOT JUST LITTLE ADULTS

- However, many of the basic guidelines for adults and ultralightweight wheelchairs are recommended for pediatrics
- Like adults, pediatric population requires individualized configuration
- Proper COG
  - As far forward as possible without compromising the stability of the user

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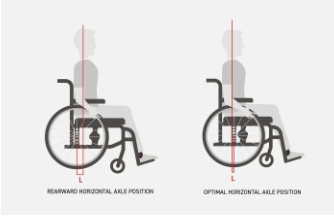
HORIZONTAL AXLE POSITION

- Move the rear axle as far forwardas possible without compromising stability of the user
  - At or in front of the shoulder
  - Consider use of anti-tips
  - Train clients in wheelies & fall recovery
- Axle position is USER Specific



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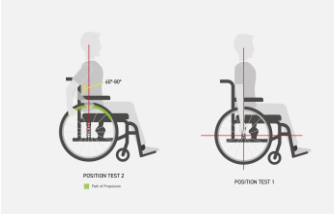
VERTICAL AXLE POSITION

- Angle between the arm and forearm between 100-120 degrees (60-80 degrees of elbow flexion) with hand on top of push-rim
- Middle finger touches the center of the axle with arms hanging
- Can be difficult to optimize with some clients
- Look for:
  - Limited shoulder elevation
  - Reduced extension
  - Decreased external rotation



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BEST PRACTICE

LOOK AT EACH COMPONENT

- Frame style
  - Folding vs Rigid
- Material
  - Aluminum vs. Carbon Fiber
- Seating
  - Solid or upholstery backrest
  - Cushion selection
- Component selection
  - Wheels, tires, casters, footplates, push handles, etc

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FOLDING VS. RIGID MECHANICS

FOLDING FRAME	RIGID FRAME
Folds with traditional cross brace for transport	Backrest folds, wheels removed for transport
Swing away front with flip up footplates	Fixed front frame
Generally heavier frame	Generally lighter and more compact frame
More movement in frame	Less movement in frame

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FOLDING VS. RIGID CLINICAL ADVANTAGES

FOLDING FRAME	RIGID FRAME
Folds = Convenient	Lighter for transport
Few STD adjustments	More adjustability built in
More easily recycled between clients (ITC)	More customizable: dial in for best fit and performance
What people picture when they hear "wheelchair"	Lighter and easier to propel

MATERIAL CONSIDERATIONS

WHAT SHOULD WE BE CONCERNED WITH?

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FATIGUE

Fatigue is the progressive, localized, and permanent structural damage that occurs when a material is subjected to cyclic or fluctuating strains at nominal stresses that have maximum values less than (often much less than) the static yield strength of the material

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DAMPING

- Refers to the materials ability to decrease the amount of vibration transmitted to the user; it is a property of the metal and the structure itself.
  - Has high clinical implications
  - Spasticity, pain, fatigue
- A 2021 Systematic Review of the literature found "...vibration induced by MWC propulsion could be affected by many parameters relative to the MWC system (e.g., MWC design, material, suspensions, and cushion)..."
  - All play a role
  - Must fit individual client
  - Not well documented how vibration affects children, but seems as if it is harmful for adults, the cumulative effects in children could be harmful as well

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MOST COMMON MATERIALS

- Steel
  - Low carbon steel
  - Stainless steel
  - Chrome-Molly
- Aluminum Alloy
- Titanium
- Carbon

Material	Strength to Weight Ratio[1] kN-M/Kg
Al 6061 T6	115
Al 7075	204
Stainless Steel	63.1
Chrome Molly	71-85
Titanium Alloy	260
Carbon Fiber	2457

1. "ASM Material Data Sheet". asm.matweb.com.

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LIFETIME WARRANTY ON CARBON FRAME

- You can measurea manufacturer's confidence in its products bythe length of its warranty
- Motion Composites built its reputation on the unique attributes of carbon fiber in the wheelchair industry. Now we guarantee it
- Applies to manufacturing defects of the carbon fiber frame and cross brace.

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SEATING AND POSITIONING

MORE THAN JUST A CUSHION

- Kids are unique as they are constantly growing
- Ensuring proper support as they grow
- Look at cushions and backrests with critical eye
  - How much does it weigh
  - What support does it offer (contouringetc.)
  - Hardware and adjustability

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COMPONENT SELECTION

EVERY PART ADDS UP: TOP TOBOTTOM

- Wheels
- Tires
- Casters
- Handrims
- Adjustments on frame
  - (Depending on wheelchair model selected, can add additional weight with adjustability)

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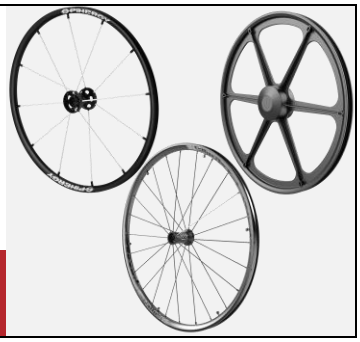
REAR WHEEL SELECTION

- Weight Matters!
- SIZE matters
  - Smaller child needs smaller rear wheel, 22 maybe even 20-inch rear wheel for proper propulsion
- Stiffness = increased lateral stability, more efficiency
  - Look at wheel movement duringturns
- Maintenance realities
  - Spoke wheels require little to no maintenance
  - Mag wheels warp over timeand are heavier



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REAR TIRE SELECTION

- The evidence is clear: air filled tires are more efficient
  - At 50% of recommended inflation, an air-filled tire rolls with less resistance than a solid tire. (Sawartky et al.)
- The maintenancereality
  - Tires should be checked weekly
  - Inflation needed 1-2x per month
  - New tire technology is puncture resistant
- Educate your client/caregiver
  - Give them responsibility and choice

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REAR TIRE SELECTION

"Wheelchair weight plays a major role in wheeling efficiency...the simple act of maintaining proper tire pressure decreases physical strain in children by 15% and may result in more active, energetic children, who can independently wheel their chair."

Sawatzky et al 2006

PNEUMATIC WITH AIRLESS INSERTS

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CASTER SELECTION

- 3–8-inch casters available
- (Please don't ever do 8 inch on a Helio Kids)
- Ultra casters are available!!! 4-6 inch
- The larger diameter of the caster, the more it will interfere with front riggings.
- Smaller diameter caster 4-5 is prob recommended if the child is propelling themselves.

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HANDRIM

- Not many clinicians think about handrims for kids
- Kids = small hands
- Newton Airgrip is a good option as it is grippy

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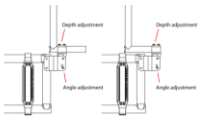
DEPTH ADJUSTABLE BACK*

- 3" of adjustability
  - *not available with WC-19
  - Can get unoccupied transit
- Angle adjustability
  - 90°-105°



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DEPTH ADJUSTABALE BACK APEX

- Extension of the seat rail
- Can have depth adjustable backrest with WC-19

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HELIO KIDS

- Modeled after the Helio C2
- Full carbon fiber frame
- Standard with depth adjustable back
- Transport weight of 12 lbs. (without front riggings)
- 175 lb. weight capacity
- Free growth kit
- Full lifetime warranty on frame

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DIMENSIONS

- Width 12-16
- Depth 12-16: without depth adjustable back
- Depth 12-17: with depth adjustable back
- 175 lb. weight capacity
- Free Growth Kit within first 5 years
  - Includes carbon crossbrace, crossbrace links, seat sling, back upholstery, front riggings and footplates

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Section 2b – Manual Wheelchairs

Base Device (check one)

☐ Adult Standard Manual Wheelchair	☐ Paediatric Lightweight Standard Manual Wheelchair	☐ None
☐ Adult Lightweight Standard Manual Wheelchair	☑ Paediatric Lightweight Performance Manual Wheelchair	
☐ Adult Lightweight Performance Manual Wheelchair	☐ Paediatric High Performance Rigid Manual Wheelchair	
☐ Adult High Performance Rigid Manual Wheelchair	☐ Paediatric Manual Dynamic Tilt Wheelchair	
☐ Adult Manual Dynamic Tilt Wheelchair	☐ Paediatric Specific Specialty Stroller	

Confirmation of Applicant's Eligibility for A Manual Wheelchair: (answer required for each statement)

1. Applicant requires the use of a manual wheelchair to move throughout his/her place of residence and can move independently throughout his/her place of residence with the prescribed device.	☑ Yes	☐ No	☐ N/A
2. Applicant requires the use of a manual wheelchair to move beyond his/her place of residence and can move independently beyond his/her place of residence with the prescribed device.	☑ Yes	☐ No	☐ N/A
3. Applicant requires the use of a manual wheelchair to move throughout his/her place of residence and is dependent on attendant for propulsion.	☐ Yes	☑ No	☐ N/A
4. Applicant requires the use of a manual wheelchair to move beyond his/her place of residence and is dependent on attendant for propulsion.	☐ Yes	☑ No	☐ N/A
5. Applicant requires the use of a titanium frame wheelchair to move independently throughout his/her place of residence.	☑ Yes	☐ No	☐ N/A
6. Applicant requires the use of a titanium frame wheelchair to move independently beyond his/her place of residence.	☑ Yes	☐ No	☐ N/A

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Additional ADP Funded Options Required for Prescribed Manual Wheelchair: (check one or more)

☐ Adjustable Tension Back Upholstery	☐ Spoke Protectors (pair)	☐ Stroller Handles/Paediatric
☐ Heavy Duty Cross Braces & Upholstery	☐ Projected Handrims (pair)	☐ Oxygen Tank Holder
☐ Recliner Option	☐ Standard Manual Wheelchair Frame with Manual Dynamic Tilt *	☐ Ventilator Tray
☐ Angle Adjustable Footplates (pair)	☐ Grade Aids (pair)	☐ Titanium Frame *
☐ Elevating Legrests (pair)	☐ Caster Pin Locks (pair)	☐ Clothing Guards (pair)
	☐ Amputee Axle Plates (pair)	☐ One Arm/Lever Drive
	☐ Quick Release Axles (pair)	☐ Uni-Lateral Wheel Lock
		☐ Plastic Coated Handrims

*** Provide Clinical Rationale**

Evidence recommends a w/c be properly configured/sized and be as lightweight as possible. A w/c of of carbon fiber is the lightest and most durable material available for a wheelchair as based in evidence of materials. And a Motion Composites carbon fiber w/c has a lifetime guarantee, and a growth program, making it very cost effective for ADP

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WAMZ

- WHY is this material needed clinically?
  - Strength
  - Durable
  - Vibration damping
  - Ease of maneuverability
  - Extreme lightweight
  - Controlled propulsion

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Clinical Examples

- Limited strength/weakness of UEs or LEs if foot propelling
- Limitations in Range of Motion in UEs
- Spasticity/ high tone/fluctuations in tone
- Decreased endurance/fatigue
- High risk of UE overuse injury
- Pain/limited sitting tolerance when rolling over bumps, thresholds, and obstacles
- Requires wheelchair that is responsive and lightweight to reduce propulsion strokes, reducing risk of repetitive injury
- Durable wheelchair frame that is responsive for ease of propulsion but strong for active use

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OTHER CHAIRS IN SAME CATEGORY

Brand/ Model	Transport Weight
Motion Composites Helio Kids	10.6 lbs.
Ki Mobility Catalyst 5	12.8 lbs
Ki Mobility Spark	17.5 lbs.
Sunrise Zippie X Cape	19 lbs.
Sunrise Zippie 2	25 lbs.
Tilite Aero X	15.6 lbs. - 18 lbs.

- Clinical implications
  - Clinical practice guidelines recommend "as lightweight as possible"
  - Want to lower the chair to bodyweight ratio as much as possible
  - Start with a lower weight base, as all the components added on will add more weight
  - Justify it

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APEX

- Available in aluminum or carbon fiber
- Lightest fully adjustable rigid frame in aluminum and carbon fiber
- AAA program, allows for growth within first three years of purchase
  - Seat width, seat depth, frame length, frame angle

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DIMENSIONS

- Width 12-20
- Depth 12-20: with depth adjustable back
- 265 lb. weight capacity
- AAA program for growth

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Section 2b – Manual Wheelchairs

Base Device (check one)

☐ Adult Standard Manual Wheelchair	☐ Paediatric Lightweight Standard Manual Wheelchair	☐ None
☐ Adult Lightweight Standard Manual Wheelchair	☐ Paediatric Lightweight Performance Manual Wheelchair	
☐ Adult Lightweight Performance Manual Wheelchair	☐ Paediatric High Performance Rigid Manual Wheelchair	
☑ Adult High Performance Rigid Manual Wheelchair	☐ Paediatric Manual Dynamic Tilt Wheelchair	
☐ Adult Manual Dynamic Tilt Wheelchair	☐ Paediatric Specific Specialty Stroller	

☐ Power Add-On Device Requested (check in addition to base device if required)

Reason for Application (check one)

☐ First access for Mobility Devices

☐ Another type of device required in addition to Previously ADP Funded Device(s)

☐ Modifications to Non ADP Funded Device(s)

☑ Replacement of Previously ADP Funded Device(s) no longer in use

☐ Modifications/Adjustments/Additional Components to Previously ADP Funded Device(s) currently in use

Replacement Device(s) and/or Modifications Required Due To: (check as appropriate)

☐ Change in applicant's mobility status - previously ADP funded equipment no longer meeting basic mobility needs as defined by ADP for funding purposes

☐ Change in applicant's body size - previously ADP funded equipment is either too large or too small.

☐ Previously ADP funded equipment is worn out
- attach vendor quote and/or copies of repair bills for wheeled walkers and wheelchairs only.

☑ Special circumstances - none of the above - **attach letter of rationale.**

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Children most often use their wheelchair in short distance bursts. Literaturesupports that WC users more typically demonstrate mostly stop/starts/turns andshort distance bursts ofpropulsion vs. long pushing sessions. Stop/start requires greater force production and energy expenditurethan to maintain a chair motion once in motion. Therefore, as evidence suggests a child's wheelchair must be as light as possible. Rigid wheelchairs arelighter and therefore easier to propel. Rigid wheelchairs can be more dialedinto client specifics.

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OTHER CHAIRS IN PEDIATRIC RIGID CATEGORY

Brand/Model	Transport Weight
Motion Composites Apex C	9.7 lbs.
Motion Composites Apex A	10.6 lbs.
Ki Mobility Little Wave Clik	12.5 lbs.
Ki Mobility Rogue XP	11.6 lbs
Tilite Twist	12 lbs.

- Motion Composites chairs transportweight listed as 16x16
- Ki Mobility Little Wave Clik transport weightlisted as 12x12
- Ki Mobility Rogue XP transport weight listed as 14x14
- Tilite Twist transport weight listed as 12x12

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WRAP UP

- Proper fit
- Growth
- Weight of wheelchair/ratio to weight of child
- Select frame
  - Folding vs Rigid
- Evaluate Every Component


Thank You!
For more information contact:
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C.hamstra@motioncomposites.com