



REDESIGN OF A PEDIATRIC STANDING FRAME

Guide : Prof. P. Kumaresan

Irshath Ahamed K

Introduction

- What, Who and why ?
- Cerebral palsy and its types

Standing frames and its types

Existing Products (Abroad and India)

Initial Concepts, Ideations and Approach

Discussions with Doctors and Guide

Finalized Design and Details

Iterations

Overview

A standing frame is an assistive technology that can be used by a person who relies on a wheelchair for mobility.

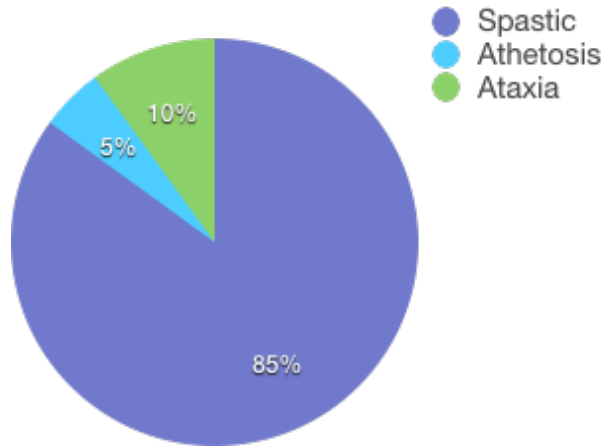
What is a stander/standing frame ?

Patients with spina bifida, spinal cord injury, traumatic brain injury, **cerebral palsy**, muscular dystrophy, multiple sclerosis, stroke, Rett syndrome, and post-polio syndrome.

Who uses a stander ?

- Means 'brain *paralysis*'. It is a *disability* that affects movement and body position.
- The earlier we start giving therapies, the more improvement can be made.

Understanding cerebral palsy



Monoplegia



Hemiplegia



Diplegia



Quadriplegia



Understanding different types of CP

Supine



Prone



Upright



Understanding different types of stander

Existing products



- Exoskeletons
- Physiotherapy + standers
 - Sit to stand feature
 - Transformable cushions
 - Electrical adjustments
- Battery powered mobility
- Hydraulic postural changes
 - Medical grade materials
- Supports Multiple postures



- Minimal usage of materials
- Non electrical, Non hydraulic, No Automations
 - Single posture
 - Same size
 - Non Adjustable
- No foot, knee braces
 - Non cushion
- Easy manufacturing
- Less moving parts



- Heavy Plywood
- No cushions
- Sharp Corners
- No headrest
- Huge activity tray
- Heavy activity tray
- No/bad Foot, knee braces
- Occupies large space
- Supports only single posture
- Needs three people to operate

Indian Approach

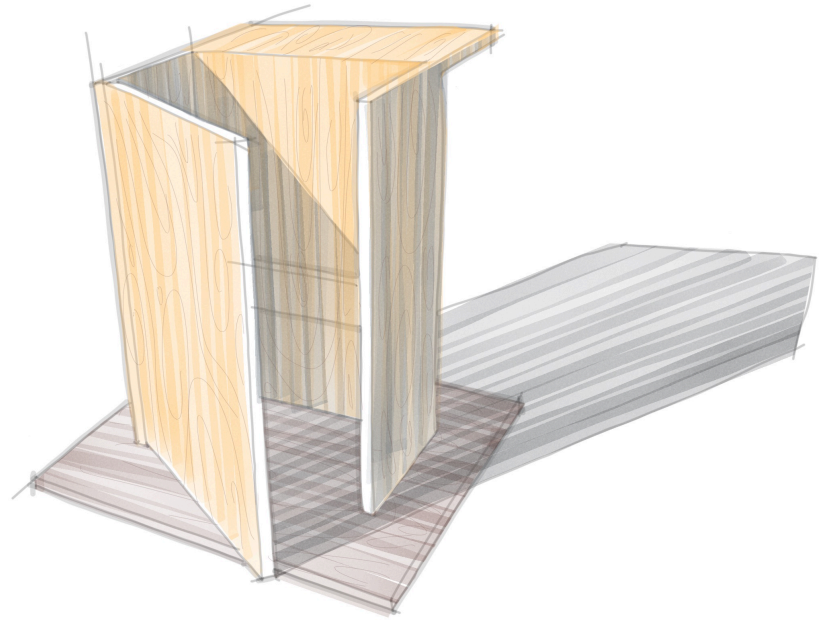
Is to design a standing frame for children, that is inexpensive and has all the basic features and could be used by all the children of age 16 - 24 months old with cerebral palsy .



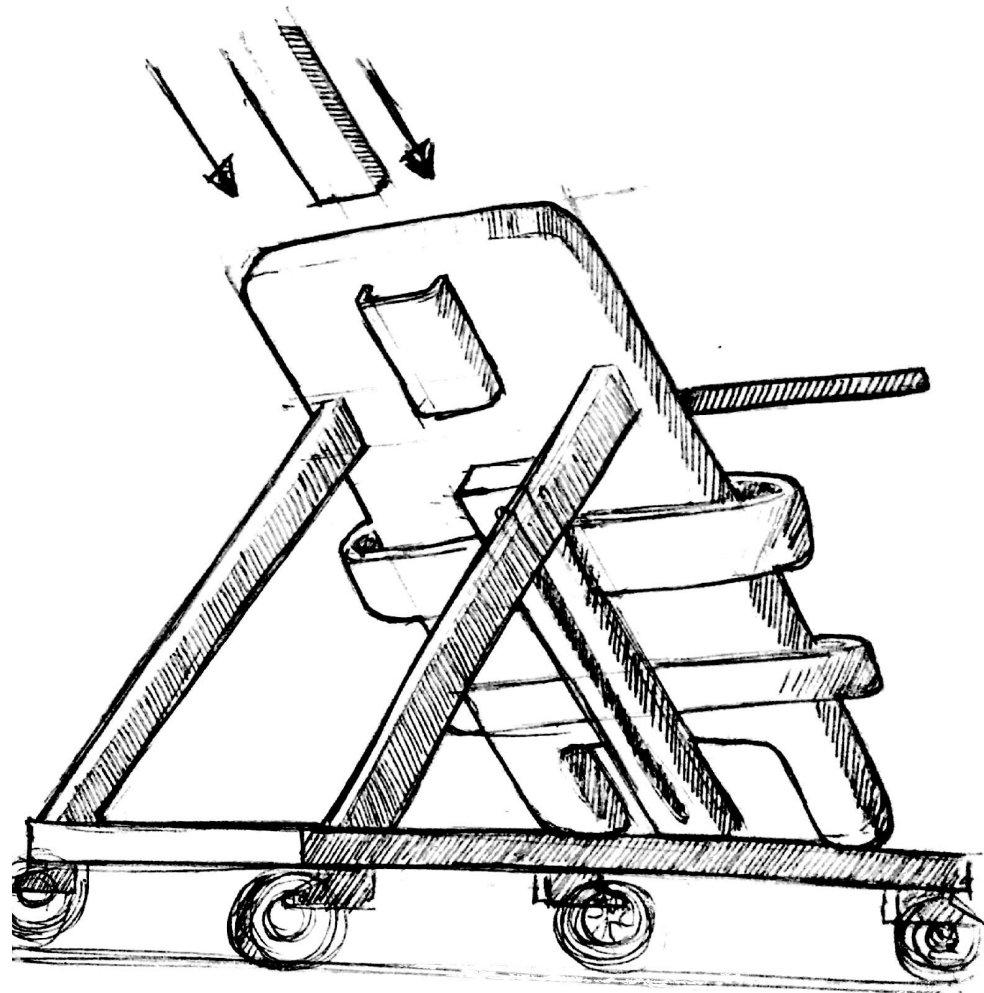
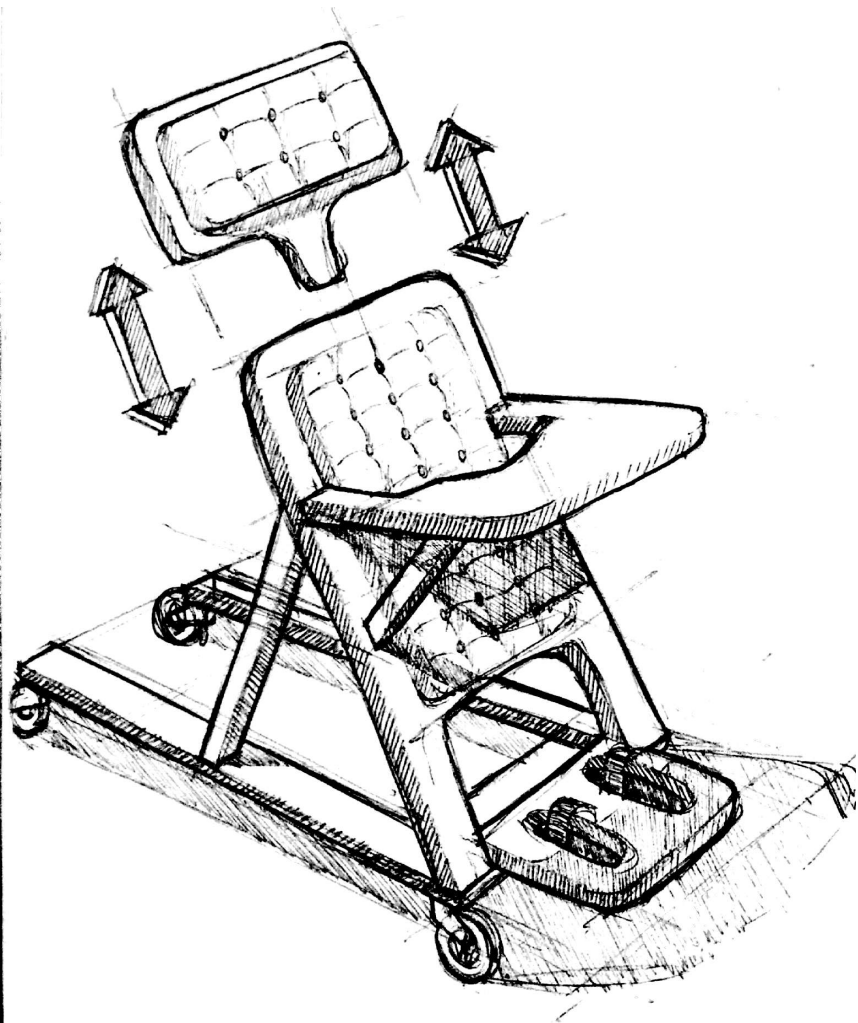
Discussions with Doctors, Professors and Physiotherapists

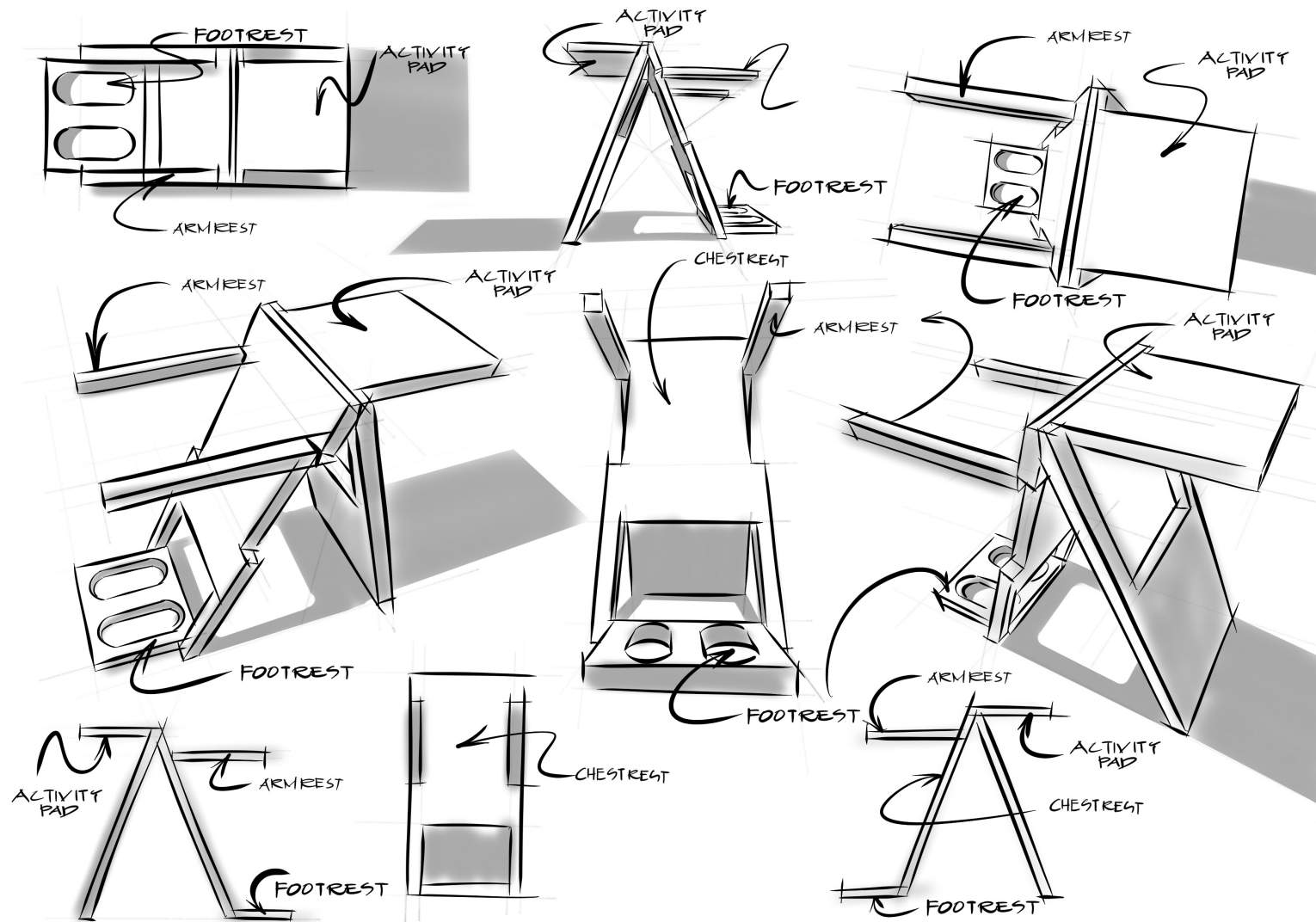
Doctors	Physiotherapists	Professors	Hospitals, Colleges and Educational Institutes
Dr.Gagan Preeg	Dr.Sudha - IIT - Bombay	Prof.P.Kumaresan	Mahathma Gandhi hospital and research Institute - Pondicherry
Dr.Pandiyar	Dr.Snehal Deshpande - Hiranandani	Prof. GG ray	Christian Medical College - Vellore
Dr.Renuka Devi	Dr.Kalashree - Hiranandani	Dr.Suresh - CMC Dr.Mohandas Gurup - Anna Dr.Sundaraganesh - Raja Muthaiya med. College Dr.Ramesh Kumar - JIPMER Dr.Priya Jose - PIMS	Stanley Medical College - Chennai
Dr.Natarajan	Dr.Lakshmi Praba - KEM		Government Hospital - Cuddalore
Dr.Prateesh - Mahatma	Dr.Archana - KEM		Annamalai University - Chidambaram
Dr.Natesan - Mahatma	Dr.Iyer - KEM		Raja Muthaiya Medical College - Chidambaram
Dr.Nallam	Dr.Sheela - Indra Gandhi		Indra Gandhi Hospital - Pondicherry
Dr.Younis	Dr.Anitha - AIIPMR		JIPMER-Pondicherry
	Dr.Smitha - AIIPMR		PIMS - Pondicherry
	Dr.Sini - IIT - Bombay		KEM - Mumbai
Dr. Ainapure - IIT Bombay			All India Institute of PMR - Mumbai
Dr.Chandrasekar			
Dr.Baskaran			
Dr.Bhuvanesh			
Dr.Prabakaran			
Dr.Vignesh Hari			
Dr.Lemiya			
Dr.Poorvi			

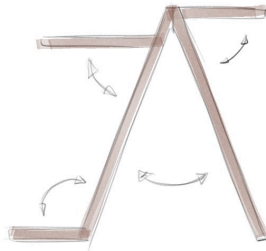
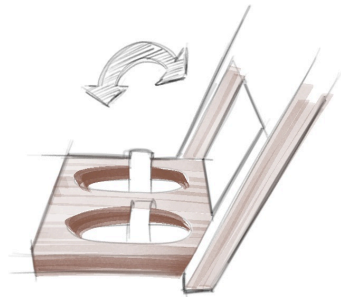
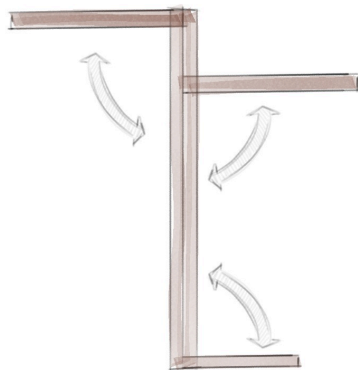
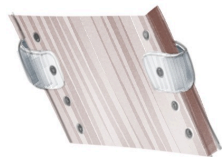
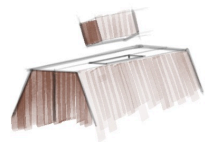
- Appropriate age for stander usage is at the beginning of 16 -18 months.
- Just standing is not much of an use
- Should be inexpensive
- Modular design for specific use
- Adjustable design for different sized children
- Adjustable angle
- Portable/Easy storage
- Children friendly design
- Try to incorporate more than one posture
- Weight of the stander should be appropriate if it's a mobile stander



Initial Ideations







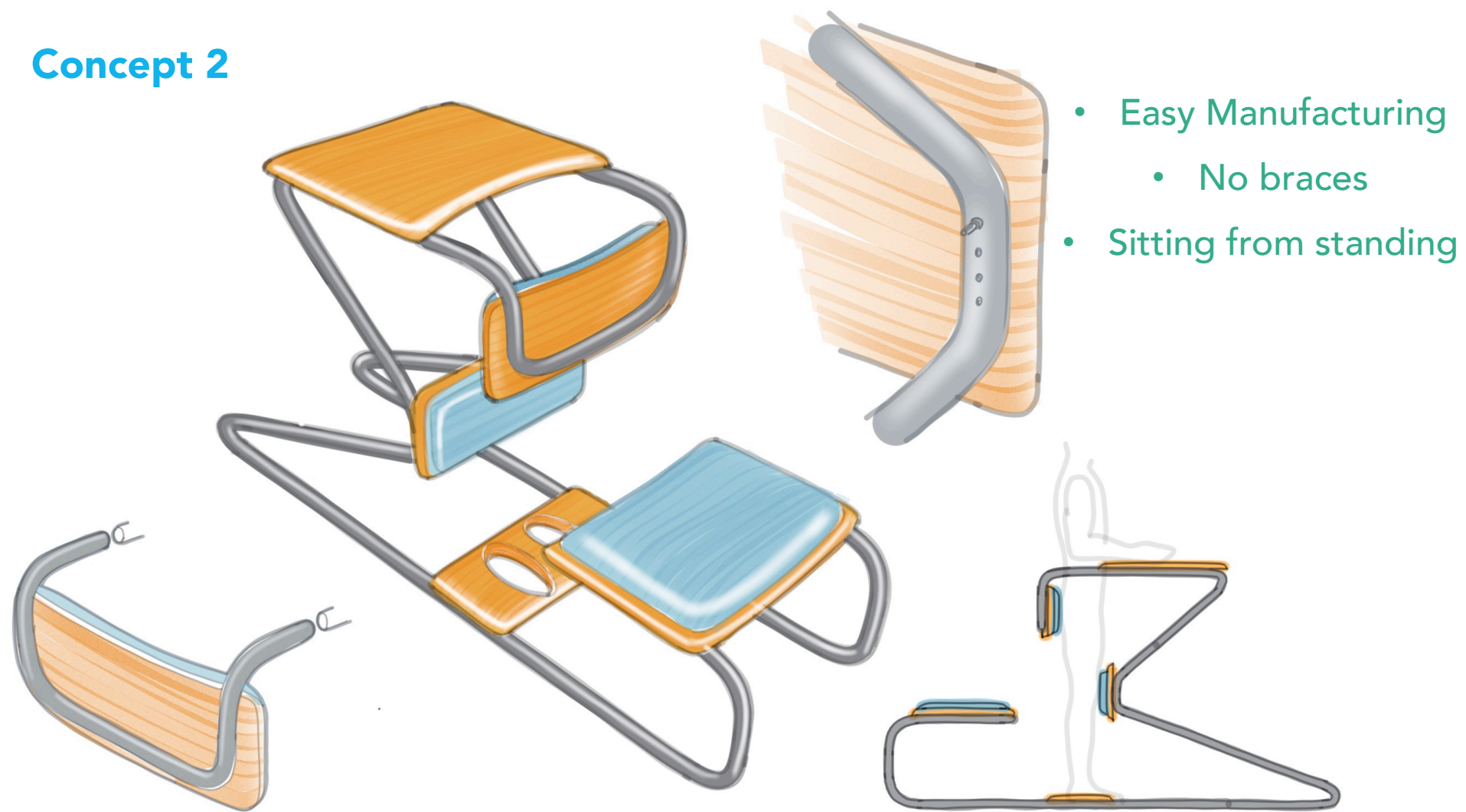


- Combinations of multiple standing positions
 - Easy storage
 - Easy assembly
- Targeted for Supine, Prone and Upright standers
 - Adjustable angles
 - Easy modifications

Concept 1

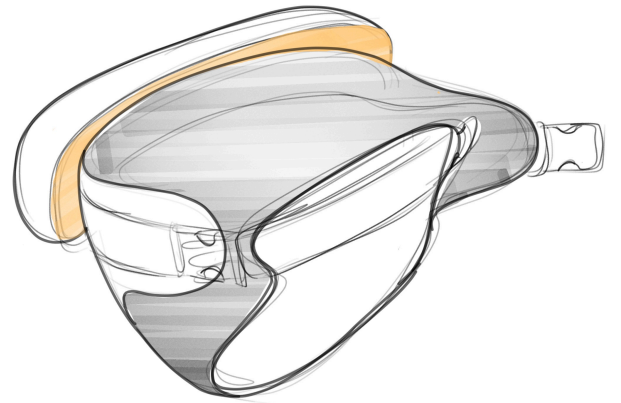
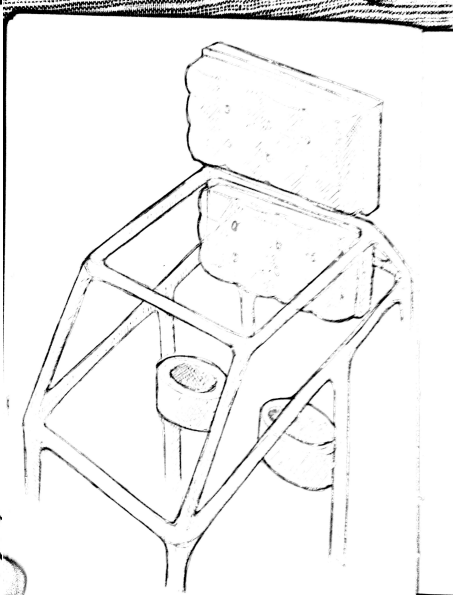
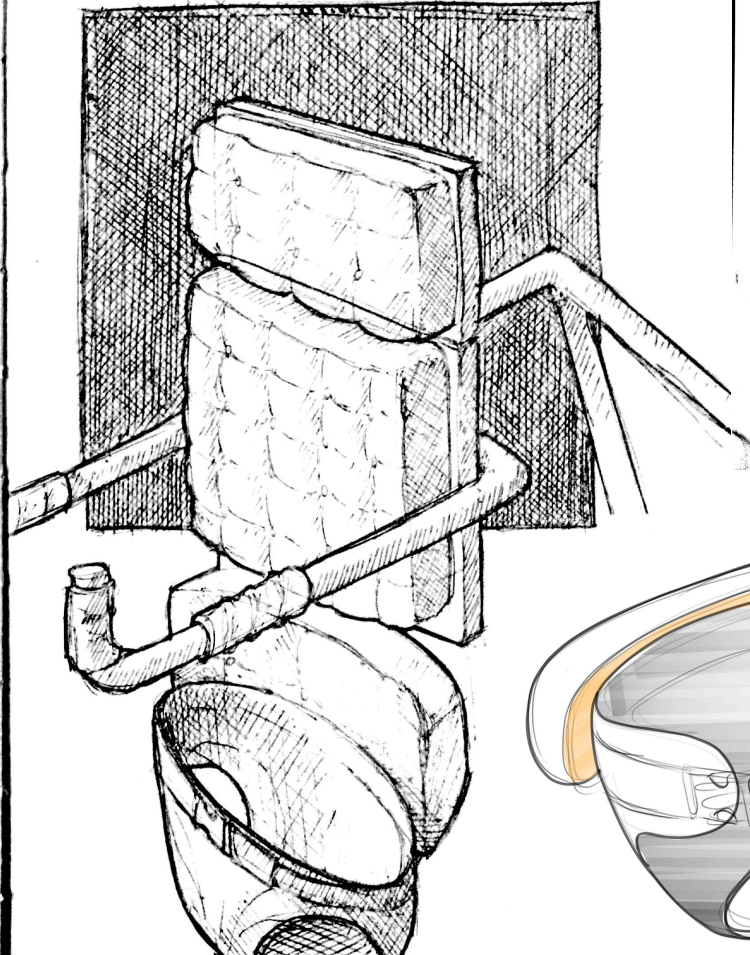
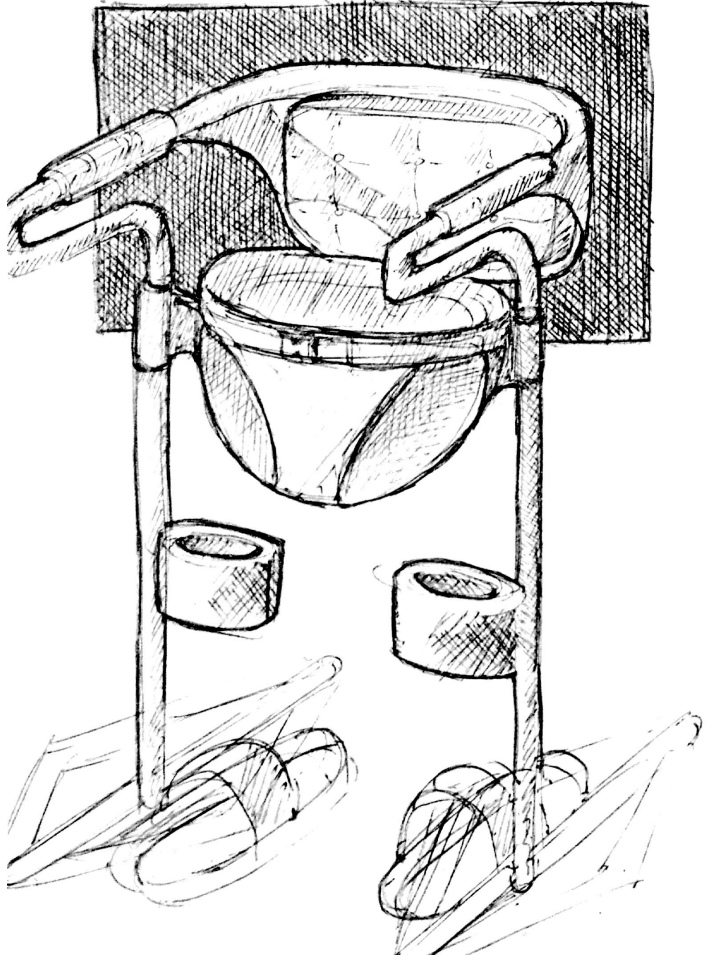


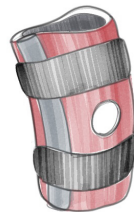
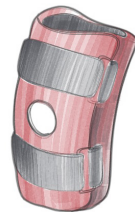
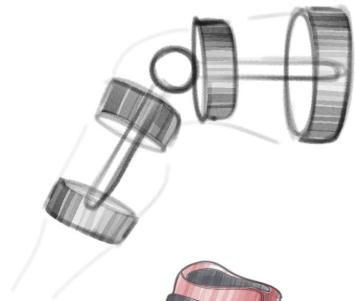
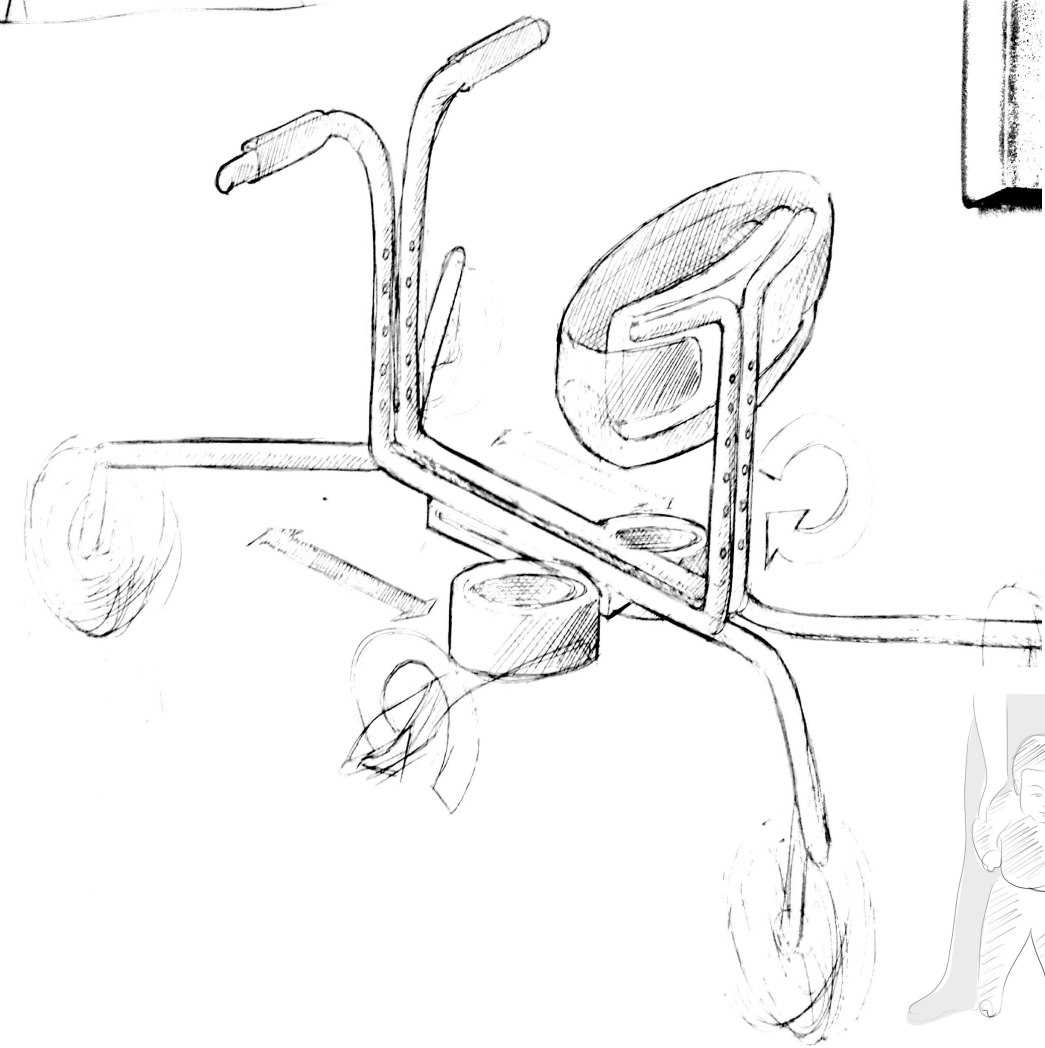
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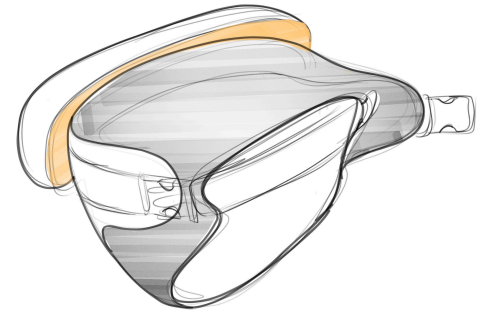
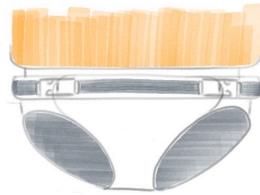
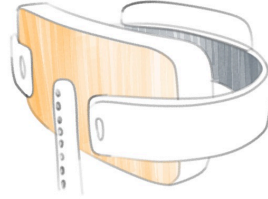
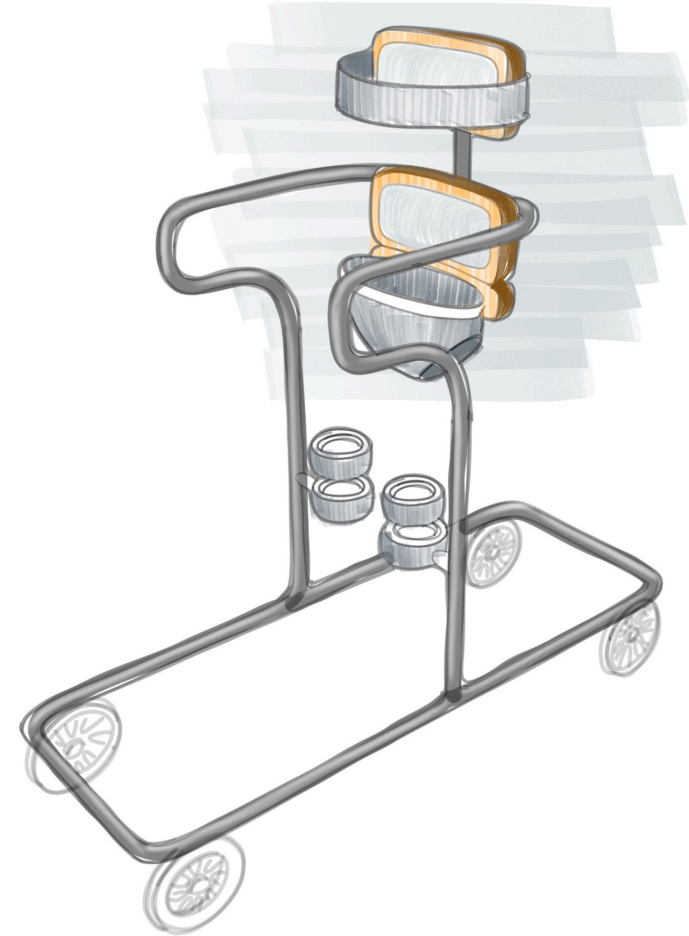




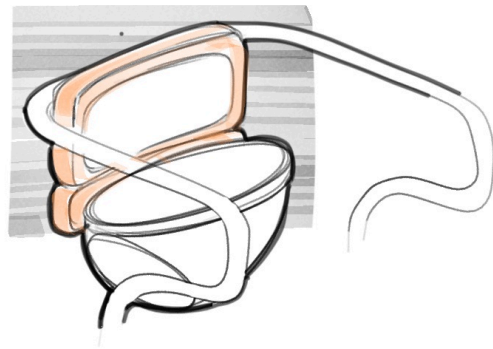
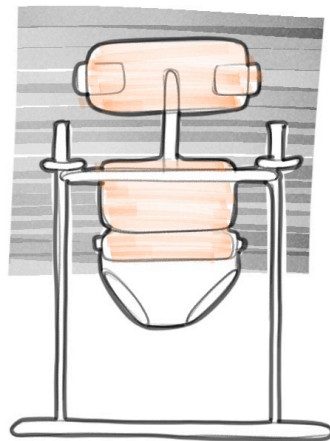
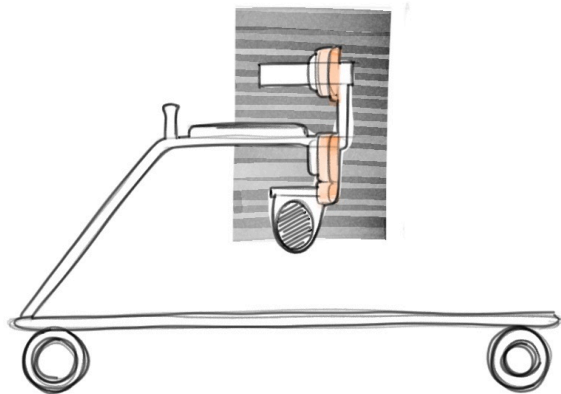
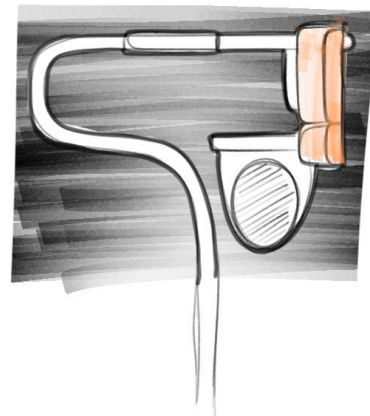
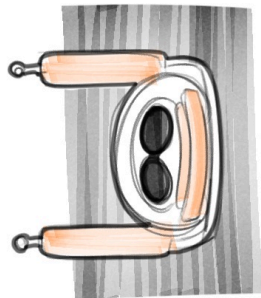
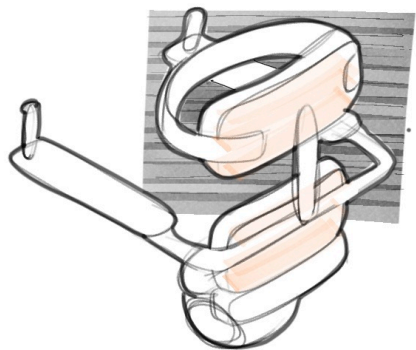
Concept 3

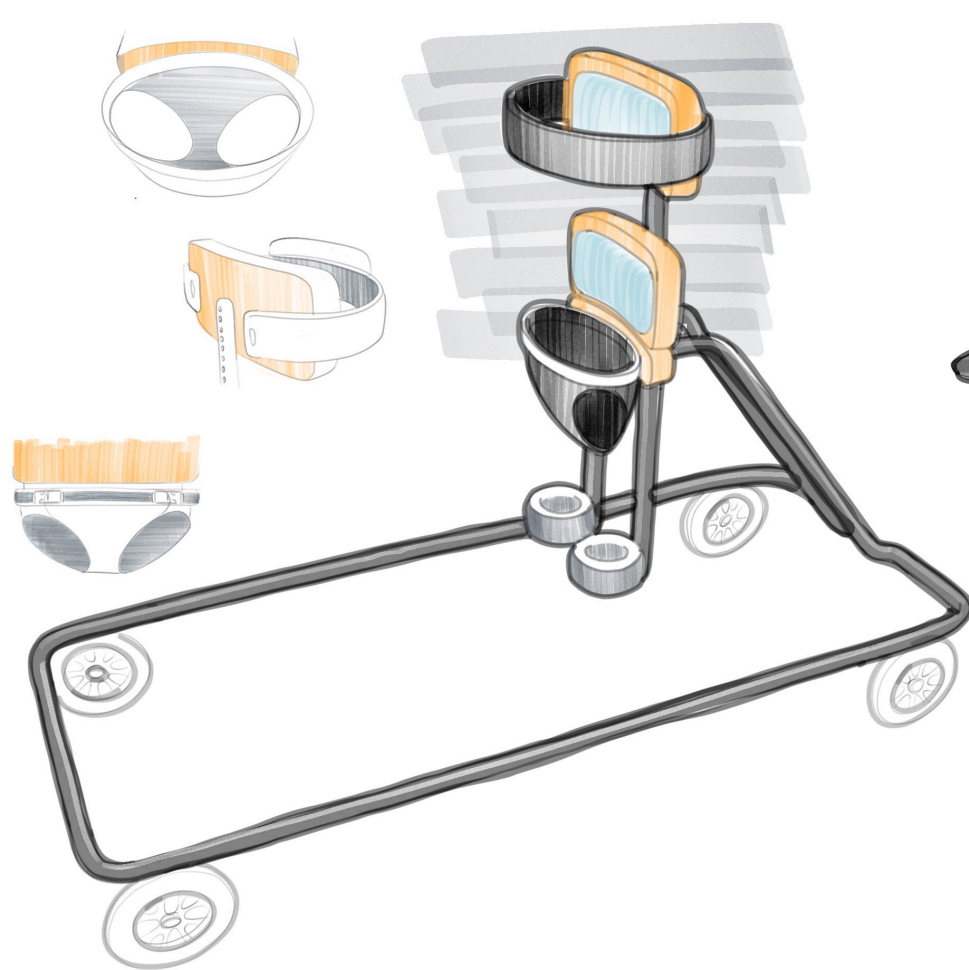




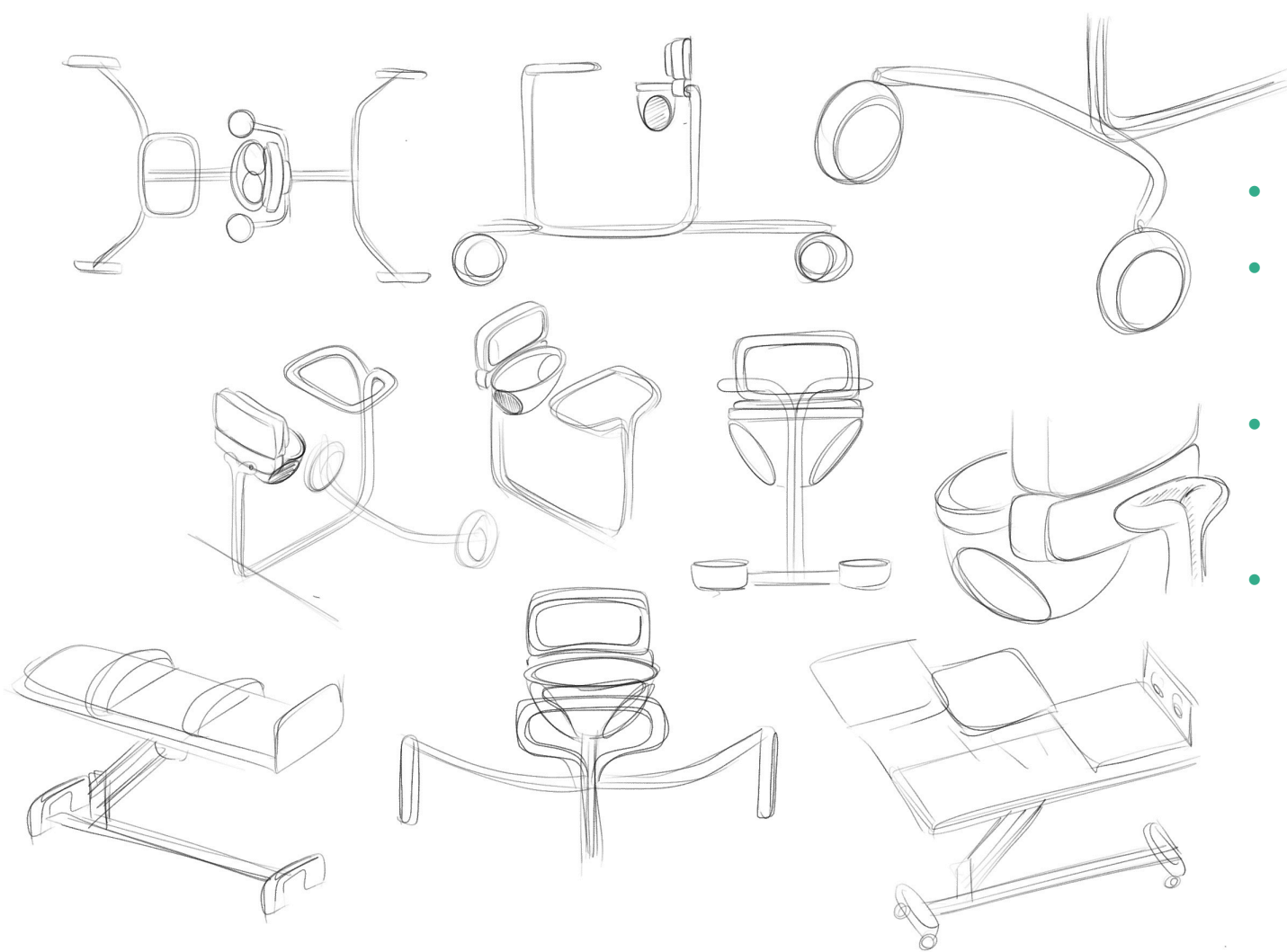


- Combination of upright stander and walker
- Modular back rest
- Attached harnessing for knees and waist
- Adjustable sizes for different children

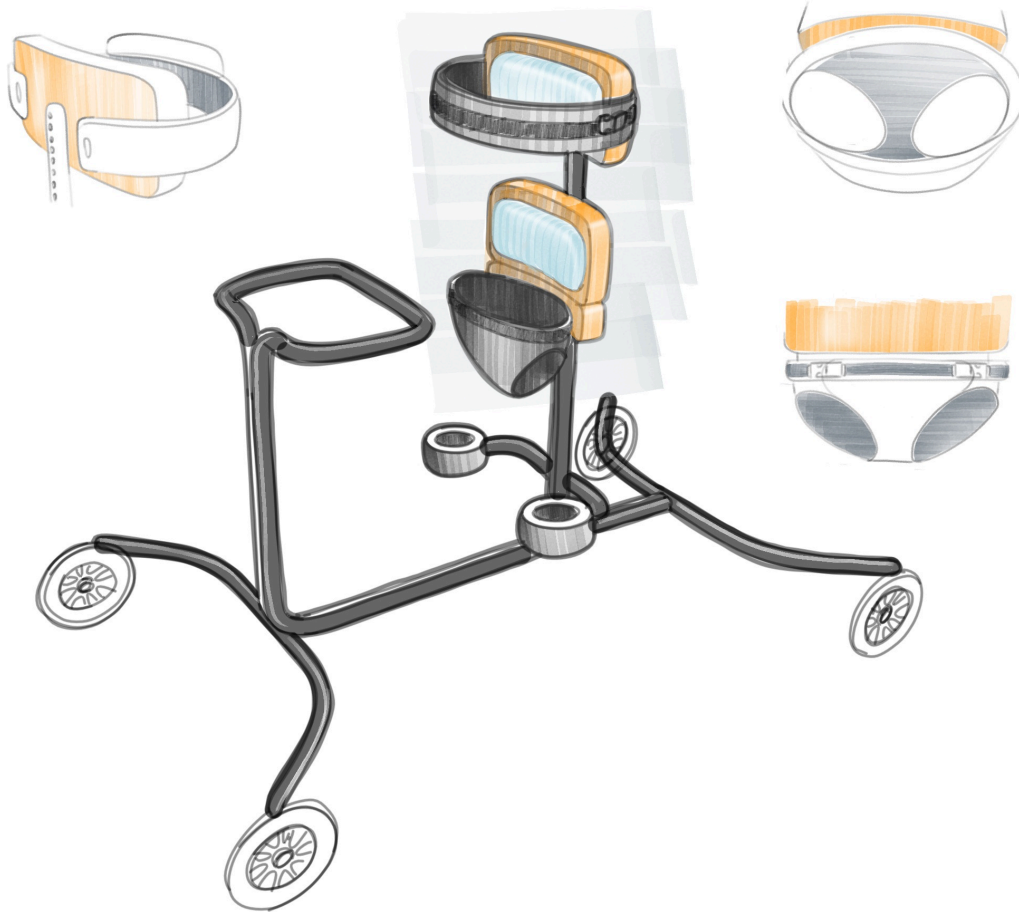




- Combination of upright stander and walker
- Modular parts.
- Detachable orthosis
- Adjustable sizes for different children

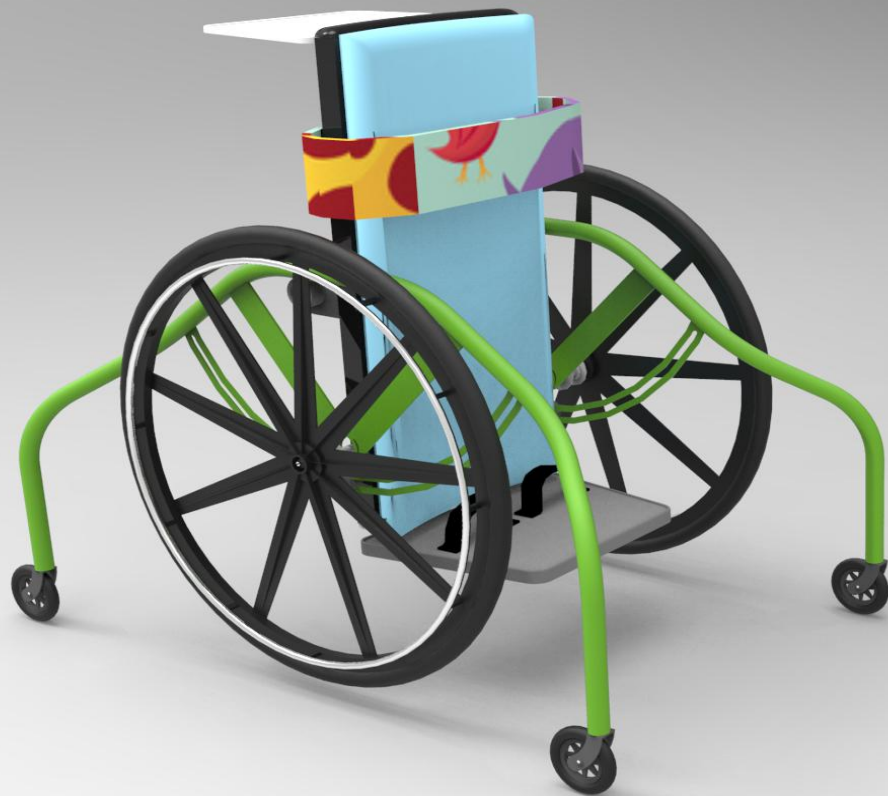


- Bicycle form
- Children friendly aesthetics
- Complete Modular design
- Detachable seating



- Modular parts.
- Detachable orthosis
- Adjustable sizes for different children
- Modular and adjustable back rest
- Adjustable handle bar
- Adjustable length and height





Concept 4

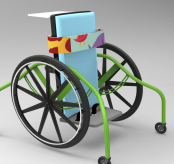
Initial Concept Validation

Dr.Smita

Dr.Anita

Dr.Sini

Professor GG Ray

Design	Concept	Easy Storage	Easy Assembly	Multiple Postures	Adjustable for different kids	Adjustable Angles	Modular	Children friendly	Manufacturing Processes involved	Manufacturing cost estimation	Materials
	Concept 1	Yes, Can be folded and easily stored	Yes	Yes	Yes	Yes	Yes	No	1 - Wood Working	10,000 - 12,000 INR	Mostly Wood
	Concept 2	No, Cannot be modified once manufactured	Yes	No	No	No	No	No	2 - Wood Working and Tube bending	3000 - 4000 INR	Wood and Steel
	Concept 3	No, Has to be Dismantled before stored	Yes	No	Yes	No	No	Yes	2 - Wood Working and Tube bending	8000 - 10,000 INR	Wood and Steel
	Concept 4	No, Cannot be stored unless dismantled	No	Yes	Yes	Yes	No	No	More than 3 - Tube bending, Injection moulding, Leather and Metal work	More than 25,000 INR	Wood, Leather, Plastic and Steel

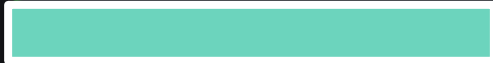


Discussions with the guide and classmates

Prof. P. Kumaresan



what is the purpose of this stander? Despite of being a torture machine for naughty children?



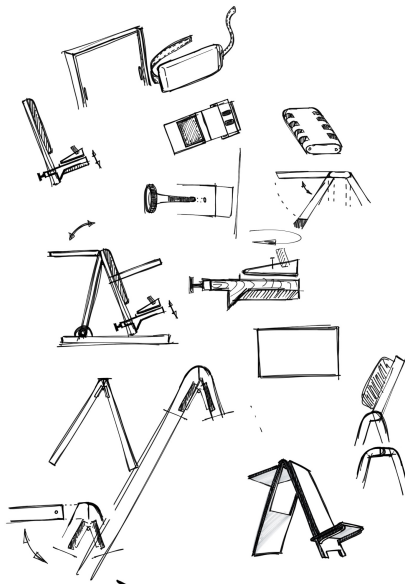
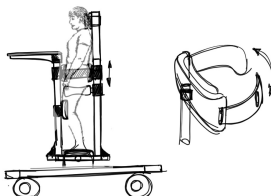
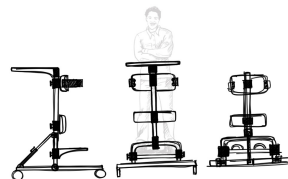
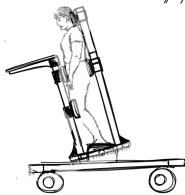
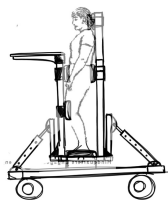
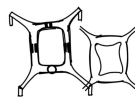
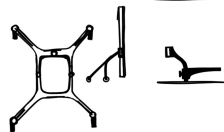
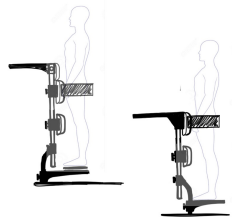
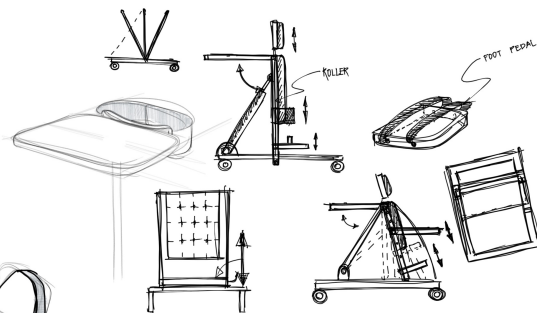
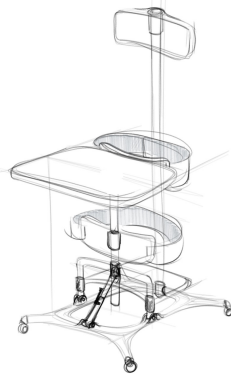
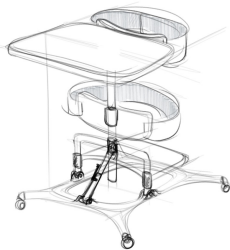
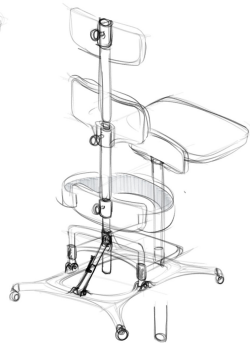
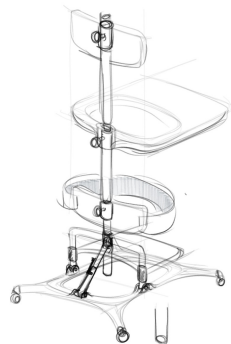
Is that a torture device ? XD

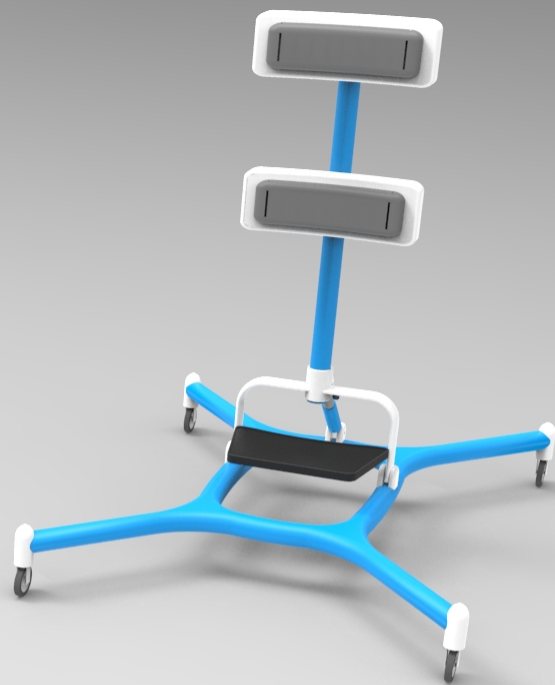
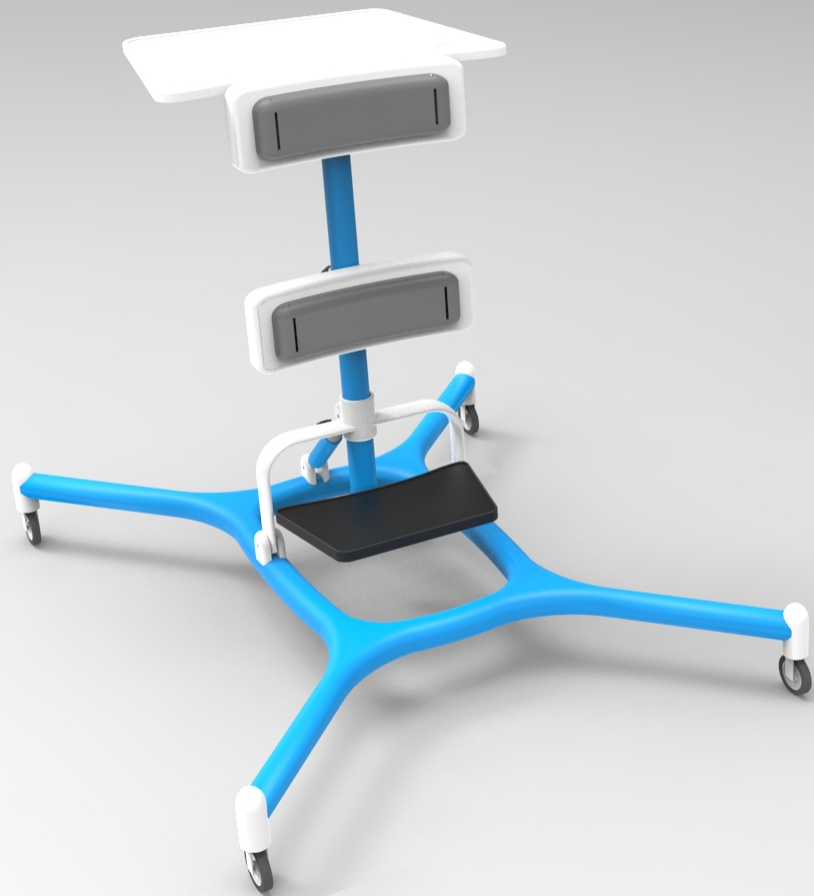
Influence from toy design

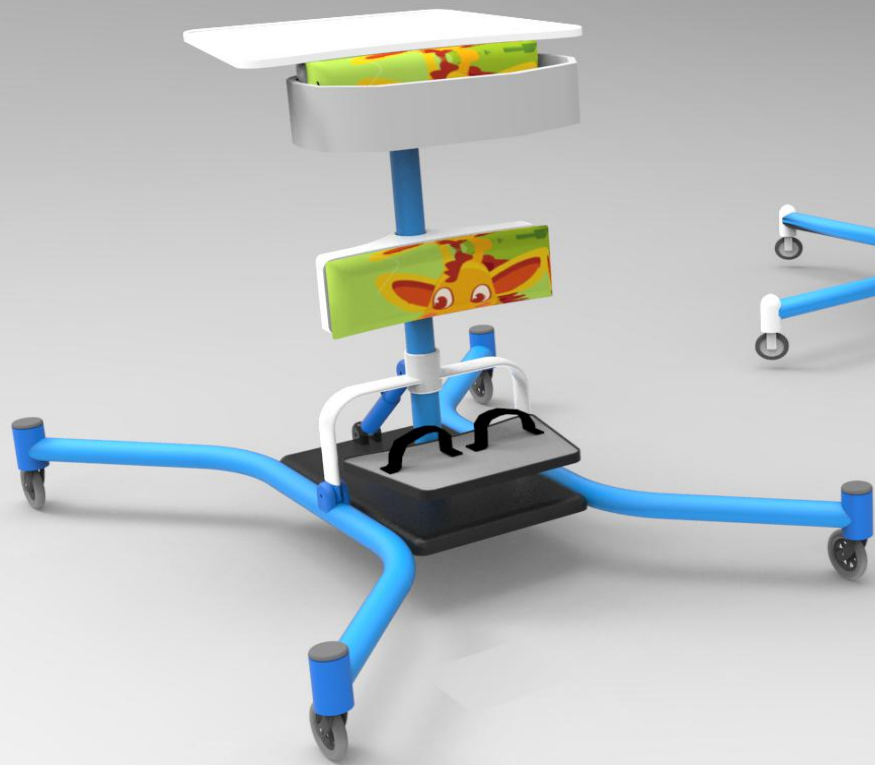


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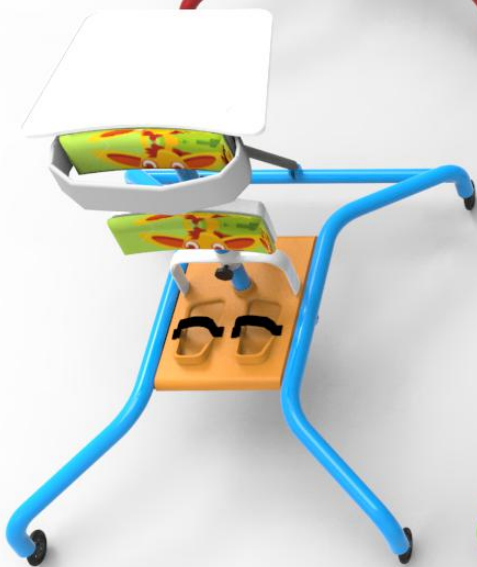




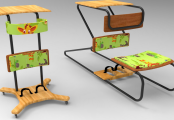


Finalized Design





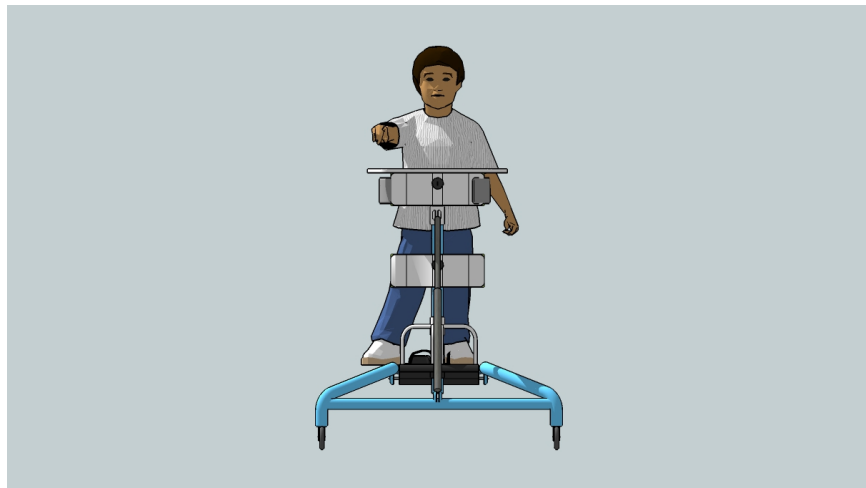
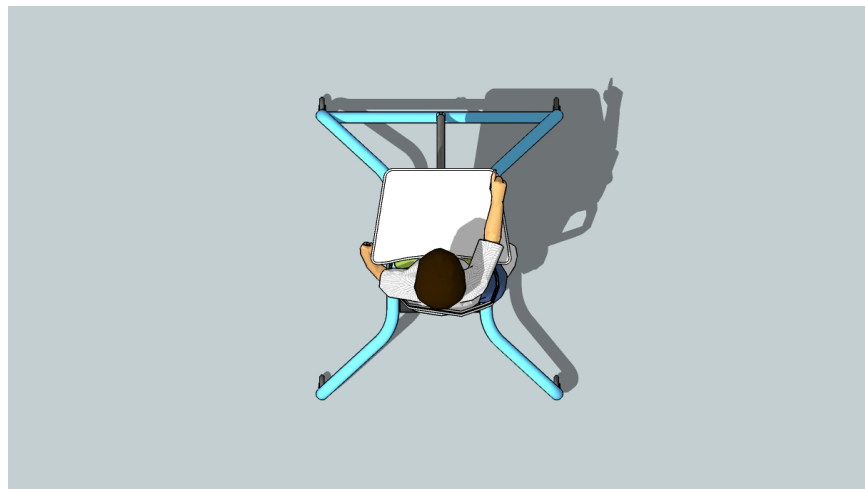


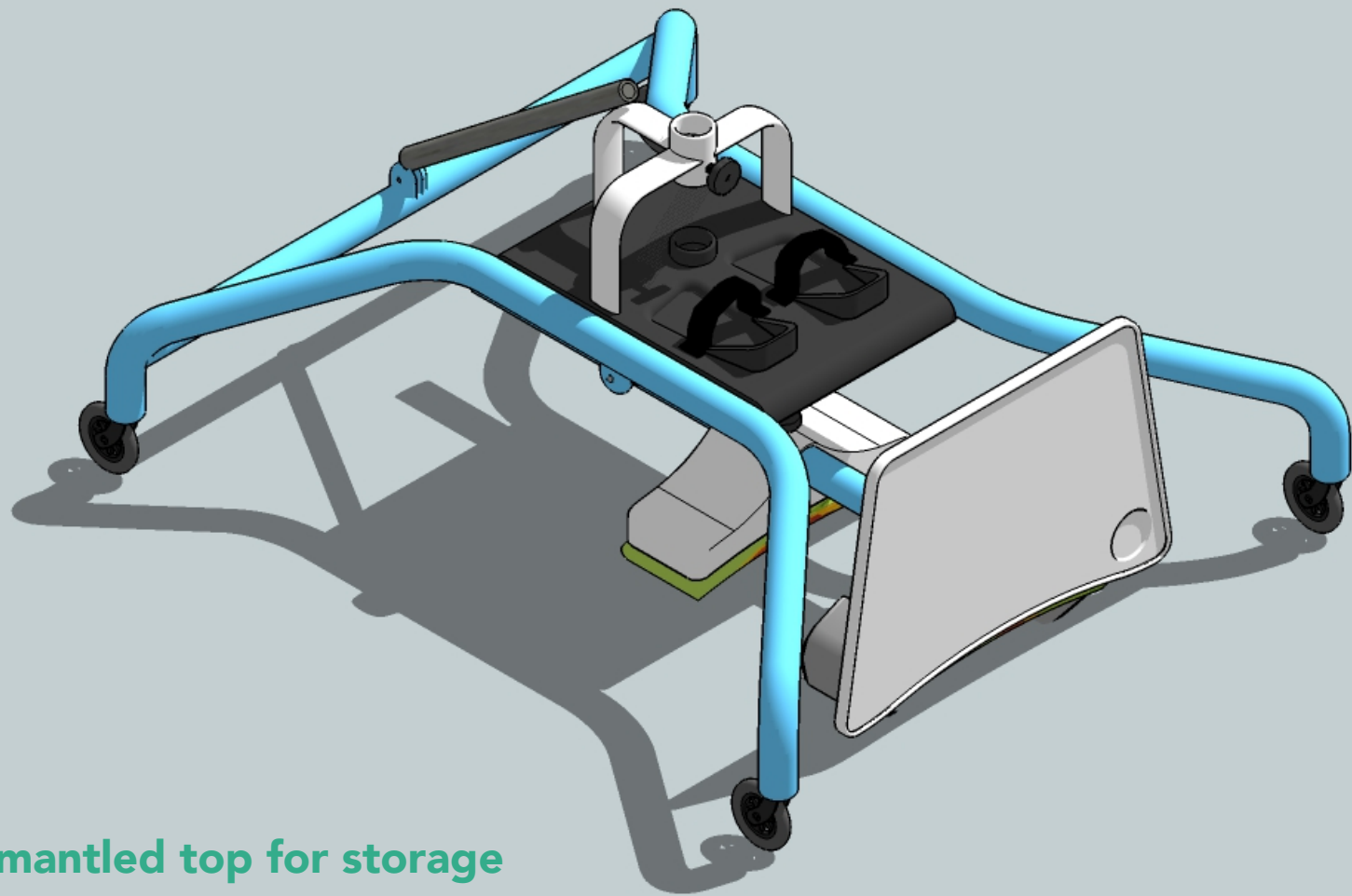
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	Concept 1	Yes, Can be folded and easily stored	Yes	Yes	Yes	Yes	Yes	No	1 - Wood Working	10,000 - 12,000 INR	Mostly Wood
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	Concept 5	Yes, Can be easily dismantled and stored	Yes	Yes	Yes	Yes	Yes	Yes	2 - Wood and Metal working	10,000 - 12,000 INR	Mostly Wood and Steel

Features

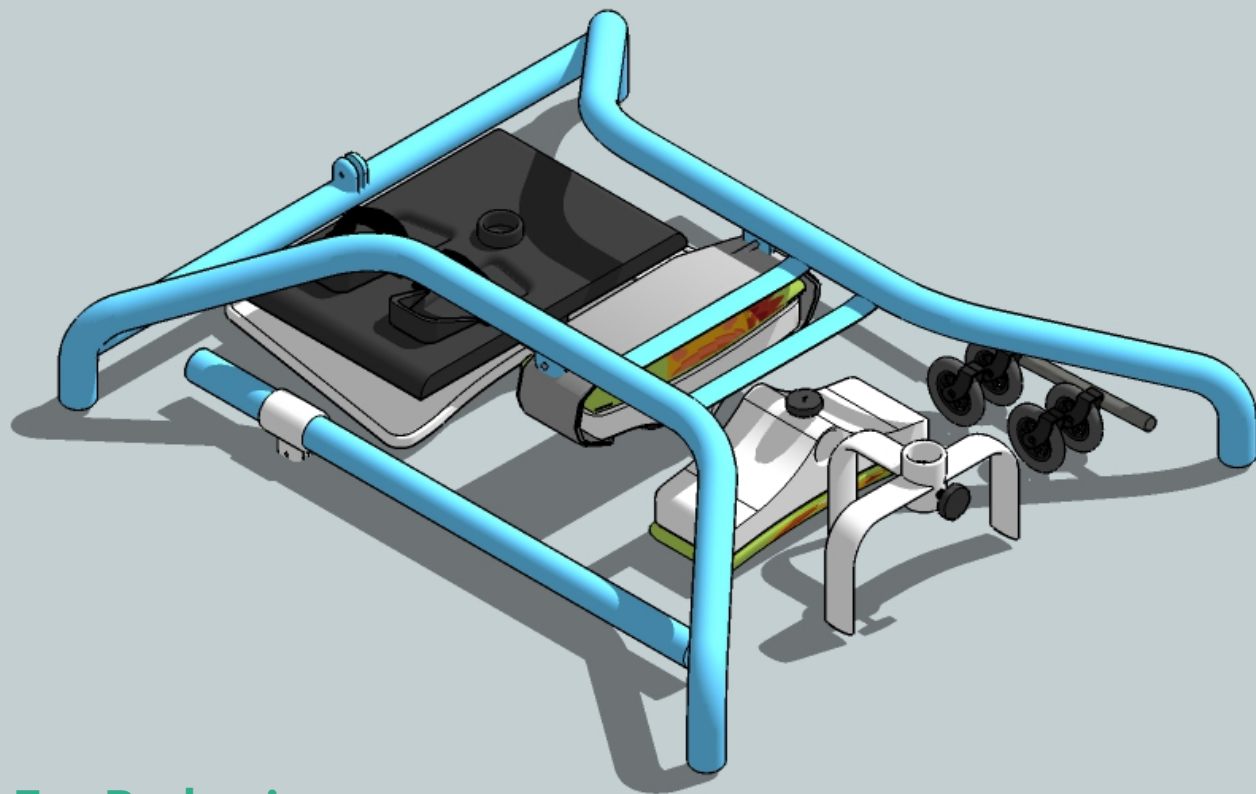
- Child friendly aesthetics
- Adjustable to suit children of all sizes
- Modular parts
- Supports different postures
- Supports different angles

Anthropometry					
Part	Age	Unit	Mean	Minimum	Maximum
Weight	18 months	kg	11.2	8.3	13.6
	24 months	kg	12.3	7.4	16.1
Height	18 months	cm	81.2	70.8	88.6
	24 months	cm	76.3	76.2	94.2
Shoulder - Elbow	18 months	cm	16	13.7	18.2
	24 months	cm	17.2	13.9	21
Elbow - hand	18 months	cm	21.3	18.5	24.6
	24 months	cm	22.8	19.3	26.1
Sole - Crotch	18 months	cm	0	0	0
	24 months	cm	34	29.2	37
Knee - Sole	18 months	cm	22.3	18.7	25.1
	24 months	cm	24.3	20.5	28.1





Dismantled top for storage



Dismantled For Packaging



Mock up



Mock up

Validation II

Prof. GG Ray
Prof. P. Kumaresan

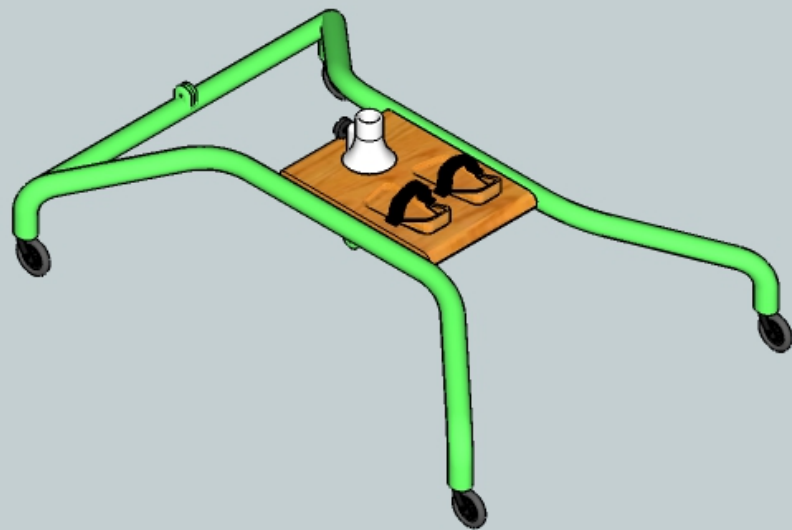
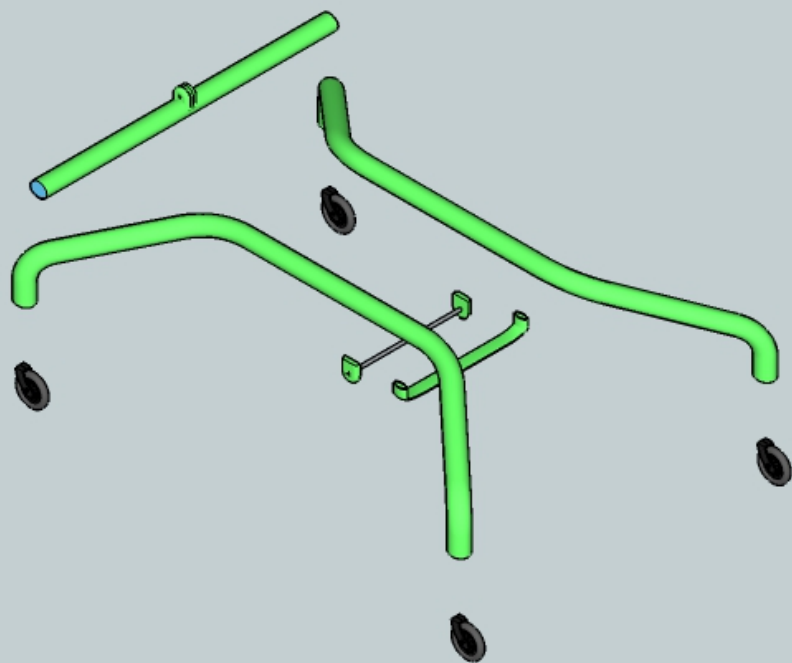
Dr.Sini
Dr.Ainapure

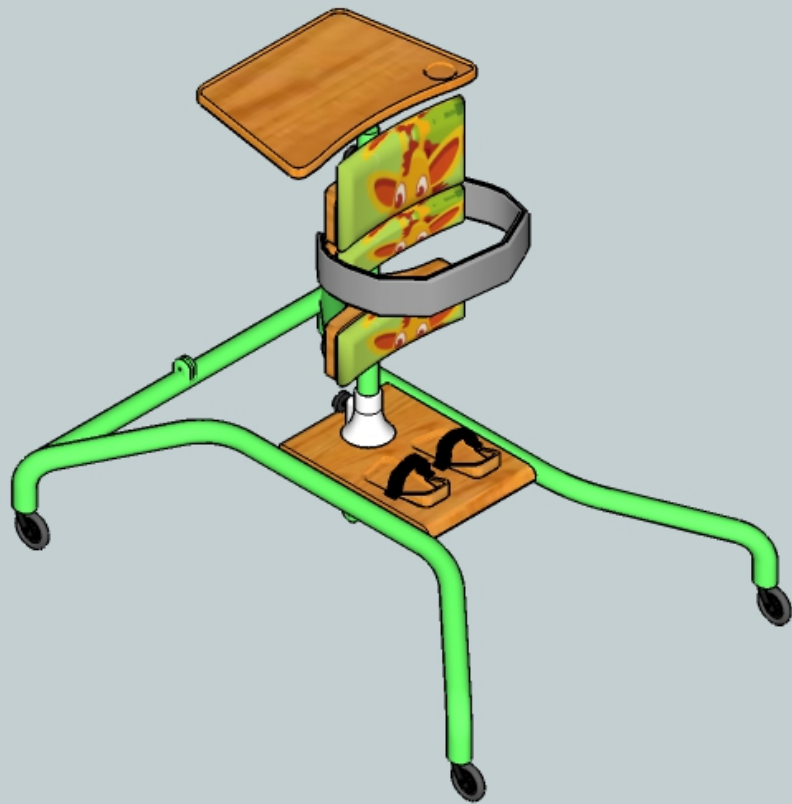
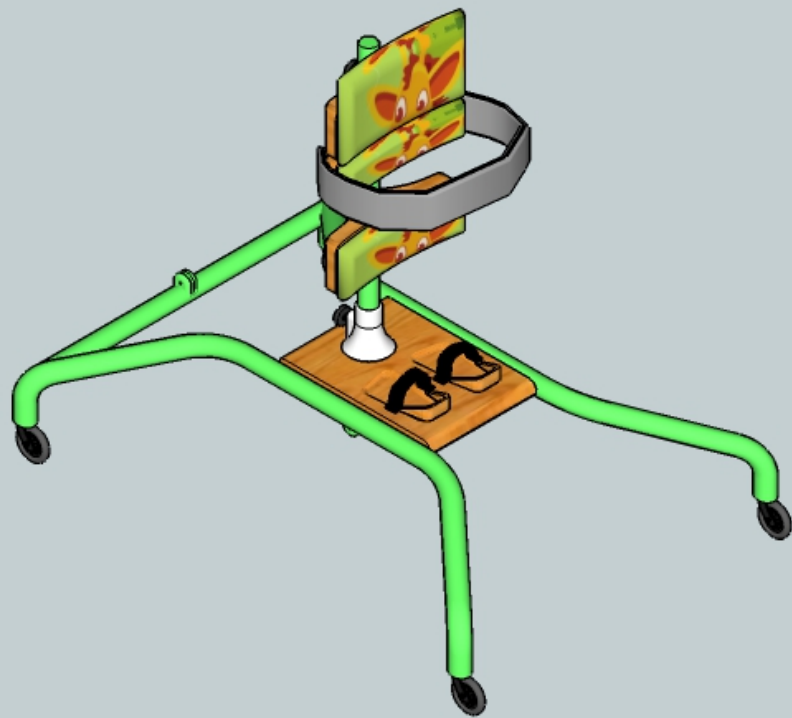


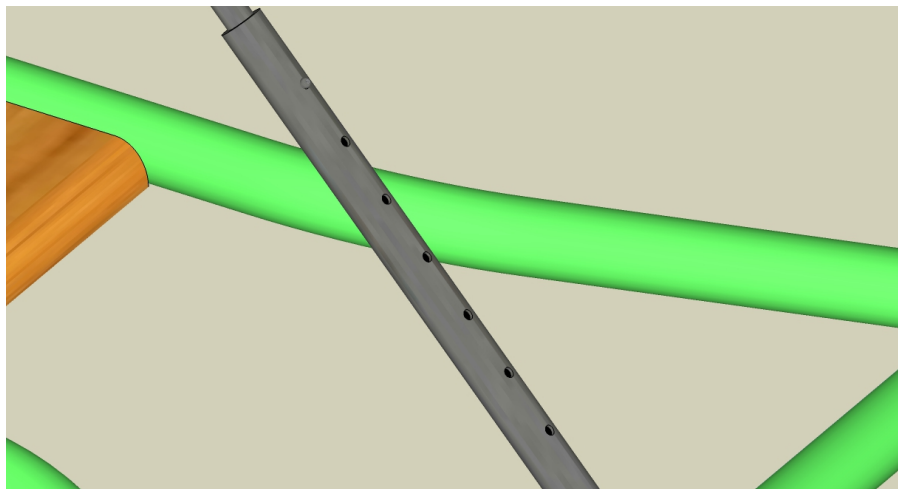
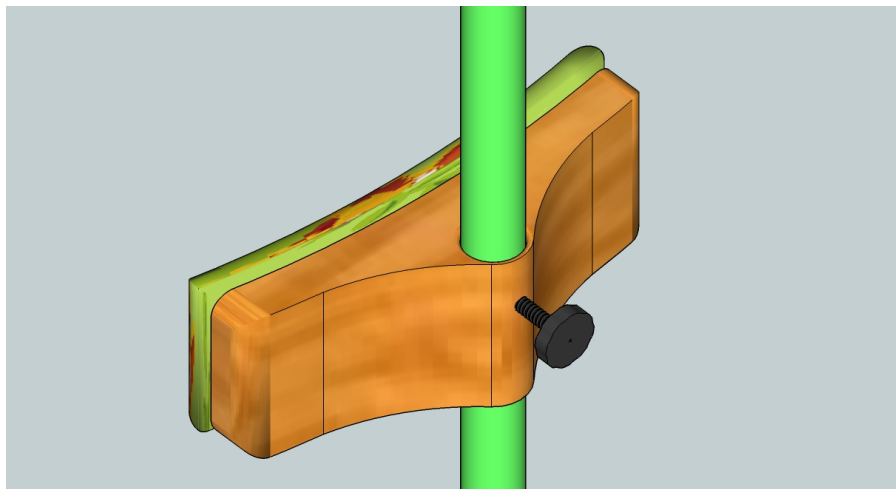
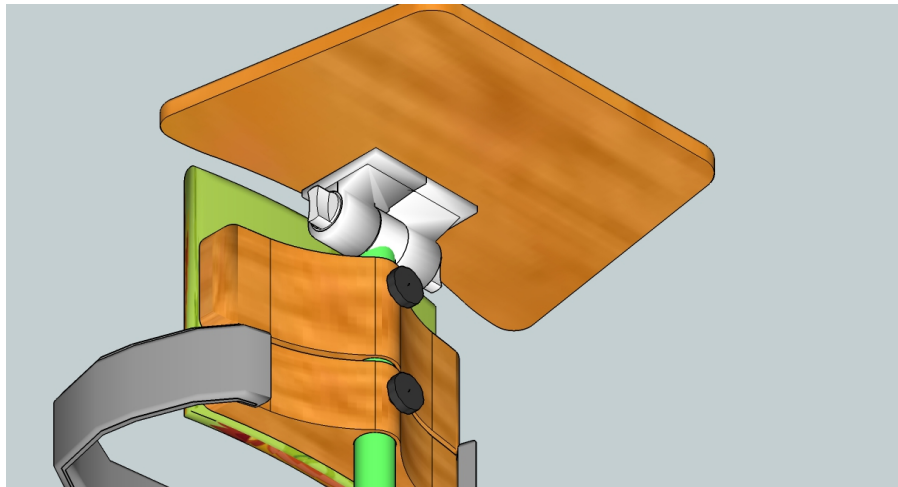
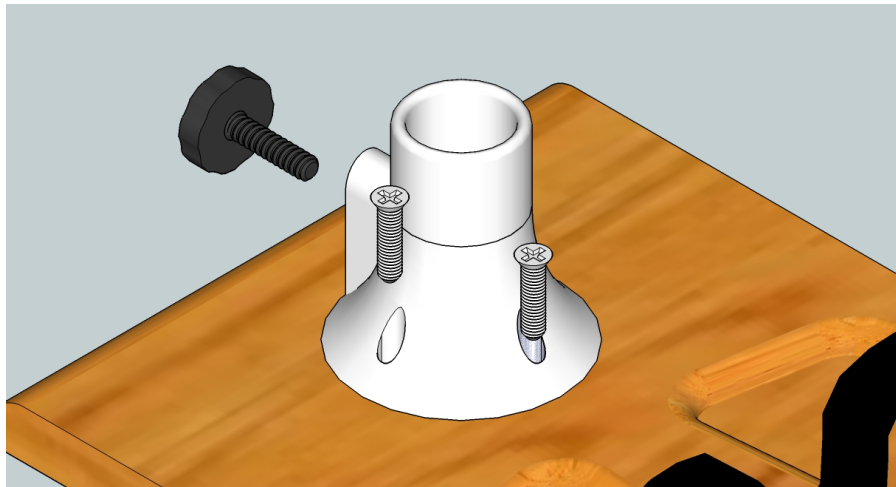
Issues

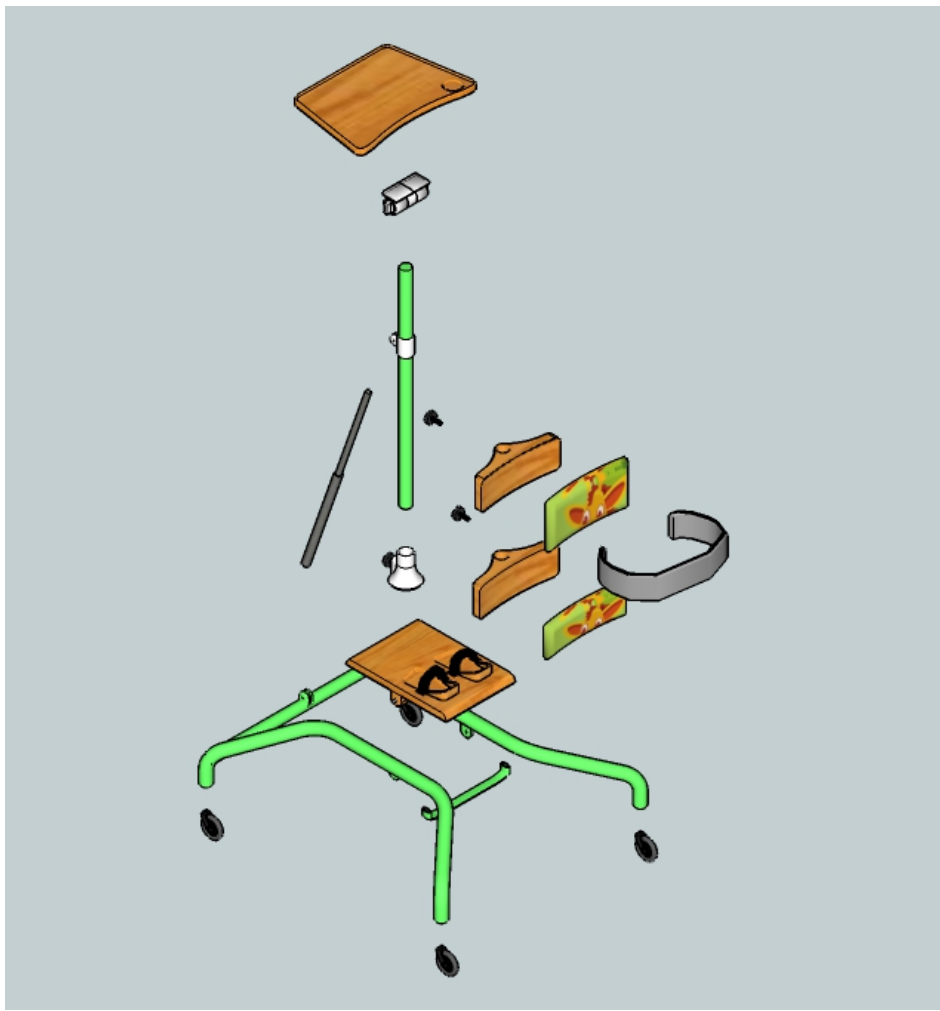
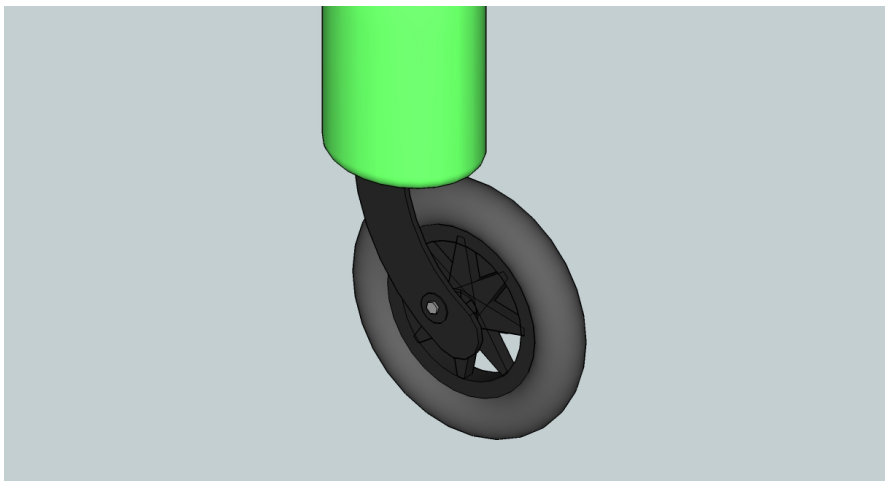
- Base junction
- Cushions for belt and stomach
- Angle Indicator
- Centre of gravity
- Cushion changing
- Mass production v making to order





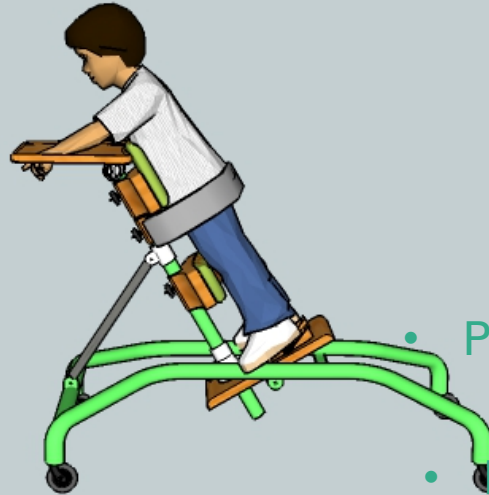








Operation



- Evaluation
- Therapy
- Stander preparation
- Parent lifts the child from back
- Ped -1 straps the feet
- Ped - 2 straps the back strap
- Ped – 1 holds the child
- Ped - 2 operate the slider
- Ped – 1 adjusts the angle



Comparison

- Two posture support
- Supports different sized children
 - Rounded Corners
 - Foot & Hip strap
 - Easy storage
 - Cushions
- Occupies less space
- Right sized activity tray
 - Light weight tray
- Single person operation

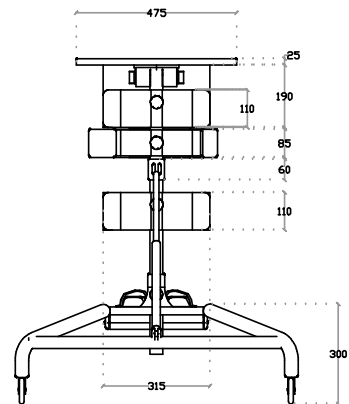
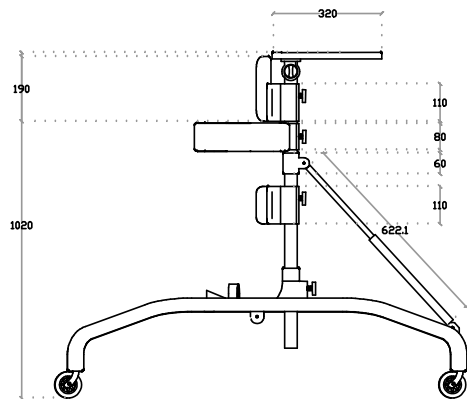
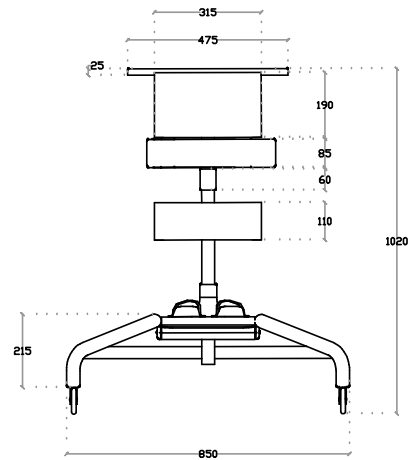
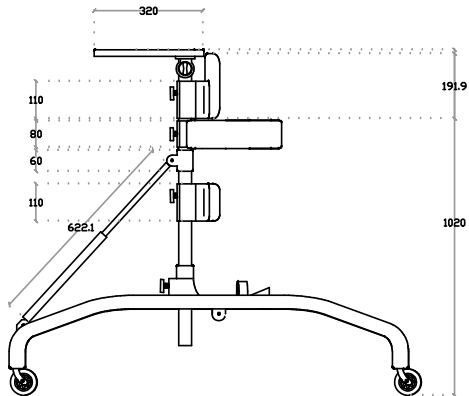
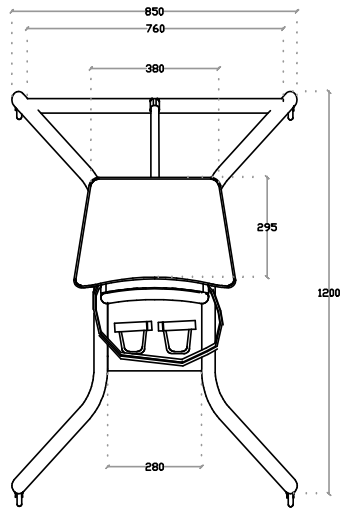


Costing

1. Aluminium base and the Aluminium post - ₹1000 - ₹1500
2. Steel slider - ₹300
3. Plastic Platform and tray - ₹1000 (Wooden Platform and tray - ₹300)
4. Plastic Knee and chest rest - ₹1000 (Wooden Knee and chest rest - ₹400)
5. Cushion x 2 - ₹400
6. Wheels x 4 - ₹900
7. Fabrication - ₹2000

Total cost would be around - ₹7000 Approx.

Hospital/NGO Selling cost - ₹7500 if not less including shipping.



Drawings

Thank you