

PREFABRICATED KNEE ANKLE FOOT ORTHOSIS (PFKAFO)

A new life for people who cannot walk

Millions of people in India and other low-income countries affected by Polio or other similar neuromuscular conditions require some kind of orthoses to stand on their own feet and walk. A majority of these people need Knee Ankle Foot Orthosis (KAFO) which is also known as Above Knee Caliper/brace/splint to walk and to be in the mainstream. Statistics in India point to only 5-10% of persons with disabilities gaining access to rehabilitation facilities. The majority of people who are in need of orthoses cannot access the service or do not know about its availability. Where available, mostly people are fitted with Conventional metal calipers which are not user-friendly, very heavy and cumbersome besides they have to be worn with a typical black high ankle boot and hence not appropriate to our lifestyle. Obviously, the rejection rate of such calipers is high, especially with children. Conventional production methods and delivery to beneficiaries are expensive and slow. These kind of heavy metal calipers are in the museum of West and long ago outdated – so why to continue in India? Very little research has been carried out to improve on conventional calipers in India and abroad as orthosis unlike prosthesis (artificial limbs) are needed more by poor and not a glamorous issue as artificial limbs – no big names associated with it. The result that the rejection rate of such orthosis is very high, the disabled person becomes more dependent and less mobile and more isolated.



***Jabi Ahmed - First user of
PFKAFO***

To overcome most caused by the problems caused by heavy metal calipers, Plastic KAFOs were introduced in India some 20 years ago which are much better in appearance, more lightweight and user friendly. They have a high acceptance rate if fitted properly and can be used with any kind of footwear or for barefoot walking with some modifications. The main problem is cost and time taken to produce individually crafted plastic orthosis, which take days to make and a person needing a KAFO has to

travel long distances that too two/three times, stay a few days in the city, sacrificing their daily wage to take delivery of a KAFO. It is a fact that many orthoses are not delivered for the simple reason that people cannot come repeatedly to the workshop especially those who are poor and from rural areas. Existing resources and technology are unable to meet the demand. Polio is mostly a poor man's disease so the majority cannot buy a Plastic Knee Ankle Foot Orthosis (KAFO).

It was depressing to experience that such a good technology could not benefit millions of users simply due to the cost and time factor. One wonders if shoes, trousers all can be available prefabricated/readymade then why not KAFO? The answer is very simple, people do not think about it – it is not a priority to our scientist and the organisations working in disability sector. To overcome these problems, Mobility India worked for the last 6 years and spent millions of rupees to develop Prefabricated KAFO Technology which can fit most of the people who need such orthoses at a record time and a lower cost. Mobility India analysed about 6000 measurements to find nearly accurate dimension of the leg and foot of the people who are having polio. Computer helped a lot to standardize the dimension and shape KAFO initially for 10 sizes. Plastic machine moulded below knee, above knee components and stainless steel knee joints have been mass produced which could be easily assembled in a few hours, in a very small workshop and could be fitted immediately to make an immobile person mobile. This new technology will change the concept of using calipers to orthoses, metal bands to plastic supports, heavy boots to any footwear or even barefoot, heavyweight to lightweight, expensive to economic and non-availability to easy availability all over India and other low-income countries. A low cost, high quality system has been developed which will have high acceptance rates and will encourage more people to use orthoses and enjoy the physical and social benefits of mobility, independence and integration. The use of PFKAFOs will increase mobility, reduce further disability and dependence on family and communities. Children will be able to go to school and adults can go to work; another step towards a more inclusive society.

Greatest advantage of PFKAFO is that anyone coming for an orthoses can avail it on the very same day at a lowest possible cost. It can be worn with any kind of footwear or even bare foot walking which is appropriate to lifestyle and means of most rural poor people with disabilities. This system will reduce more than half the cost of producing an orthoses compared to the conventional methods. The orthoses would have no loose parts and the number of parts will be less compared to conventionally fabricated ones, thus the system is designed for low maintenance. Knee joints are

made out of stainless steel and do not require any maintenance. Technical skills or training required to assemble and fit are easily transferable and require minimum tools and equipment. It is a fact that it will not fit 100% population but even if we say that it would fit 60-80% that means new life for millions. MI decided to use High Density Polyethylene for its unique property especially for durability and remoulding character in making the mass produced Below knee and above knee components. With little heat one can remould it to fit the contour of the leg to give optimal fit and comfort which is a must for every user.

Though the components are made to make KAFO, but spin off this technology will also help people to make other orthoses like Ankle Foot Orthoses (AFO), Knee Orthoses (KO), Night splints etc. – an opportunity for millions. Besides polio, this would also help people who have similar problems with various other kinds of neuromuscular disorder.

We are grateful to all our funders and supporters who helped us to develop this technology especially CAPART-Government of India, Jaipur Limb Campaign–UK, KaR-DFID-UK and Christoffel Blinden Mission-Germany. We are also grateful to all the persons with disabilities who helped us to develop this technology. MI feels proud to declare that this technology is available to all in 10 different sizes (left & right).

Thank-you for choosing to use the Pre-Fabricated KAFO. We hope it has been a positive experience for you. To enable us to develop the product and improve it further, please send us your feedback. Enclosed is a check-out and feed back form for professionals (technician) and a feedback form to be filled by the user of the PFKAFO during his first follow up visit. Please fill in these forms and send them to Mobility India.

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This manual highlights

1. Checklist components
2. Instructions for assembling Prefabricated Knee Ankle Foot Orthosis
 - Measurement & Tracing
 - Expansion
 - Height Compensation
 - Size Selection
 - Fixing Bar & Joint
 - Trial
 - Initial Fitting
 - Alignment
 - Final Finishing
3. Advantages of Prefabricated KAFO
4. Annexure 1- Lower Limb Orthotics Measurement form
5. Annexure 2- Lower Limb Orthosis Check-out / Feed back form

PFKAFO kit

Components check list

1	Thigh shell	1 No.
2	Leg Shell	1 No.
3	Contour upright	2 Nos.
4	Straight upright	2 Nos.
5	Droplock Knee Joint	2 Nos.
6	Strap	5 Nos.
7	Screw Nut & Washer	20 Each
8	Copper Rivets	24 Nos.
9	Ethaflex	2 Sheet
10	D-Ring	5 Nos.
11	Stockinette	1 meter
12	Press Button	15 Nos.



Note: Individual components are also available on request

Our Vision is that "An inclusive society where people with disabilities have equal right and quality of life."

More than 95% of the people do not have access to good quality/ affordable mobility aids, like orthoses/ calipers, crutches, wheel chairs etc.

INSTRUCTIONS

Assembly of the PFKAFO

Measurement and tracing : Take medio-lateral width and height measurement at different landmark mentioned in the measurement form (see Annexure-1). Finally trace the affected limb on brown paper, which helps in alignment.



Taking medio-lateral width of Ankle



Tracing the affected knee

Size selection

At present there are 10 sizes available. The specifications of the available sizes are mentioned in the table given below, follow this to select appropriate size.

Size	Height Crotch to Heel	Height Knee to Heel	Foot Length	ML Crotch	ML Above Knee	ML Calf	ML- Ankle	ML- Heel	ML Ball of Foot
0	41-45	27-30	17-18	7-7.5	5.5-6	4.5-5	5.2-5.4	4.1-4.3	5.3-5.6
1	46-50	30-33	18-19	7.5-8	6-6.5	5-5.5	5.4-5.6	4.3-4.5	5.6-5.9
2	51-55	33-36	19-20	8-8.5	6.5-7	5.5-6	5.6-5.8	4.5-4.7	5.9-6.2
3	56-60	36-39	21-22	8.5-9	7-7.5	6-6.5	5.8-6	4.7-4.8	6.2-6.5
4	61-65	39-42	22-23	9-9.5	7.5-8	6.5-7	6-6.4	4.8-5	6.5-6.7
5	66-70	42-45	23-24	9.5-10	8-8.5	7-7.5	6.4-6.8	5-5.2	6.7-7
6	71-75	45-48	24-25	10-10.5	8.5-9	7.5-8	6.8-7.2	5.2-5.4	7-7.3
7	76-80	48-51	25-26	10.5-11	9-9.5	8-8.5	7.2-7.6	5.4-5.6	7.3-7.6
8	81-85	51-54	26-27	11-11.5	9.5-10	8.5-9	7.6-8	5.6-5.8	7.6-7.9
9	86-90	54-57	27-28	11.5-12	10-10.5	9-9.5	8-8.4	5.8-6	7.9-8.2

Note:-All measurements are in centimetre

ML: Medio-Lateral distance

Initial fitting : Take shells from selected size kit and cut the front portion using Jigsaw. Take initial trial to mark trim lines and cut accordingly. Finally cut the shell for 95° knee movements.



Cutting front portion of shell



Marking trim line



Cutting according to the trimlines



Cut the Shell for 95° knee movement

Note : In case lower shell is not fitting due to fixed deformity in foot, make AFO part custom made and use upper shell prefabricated.

Expansion :- Use hot air gun or blower to expand the area, if it is pinching. Use ethafoam to fill gaps

Fixing bar and joint: - Fix the bar with joint and rivet it with 3mm copper rivet provided in the kit.



Local heating for modification



Fixing bar and joint

Alignment- Use tracing to do alignment and match the aluminum bar with contour of plastic shell. Initially use 3mm-screw nuts to fasten bar and straps with plastic shell



Align the joint bar assembly with shell



Bending aluminum bar

Height compensation-Use rubber sole to give height compensation from inside upto 12mm and outside upto 60mm if required.

Trial- Take a trial and check for out any alignment problem, If any realignment is required correct it by unscrewing the screw. Give the required gait training and do the necessary check out (See annexure-2).



Inside height compensation



Trial in walker

Final finishing- Make holes in plastic for ventilation, rivet the bar with plastic shell using 3mm copper rivet. Fasten the straps with plastic shell using press button provided in the kit.

Advantages of Prefabricated KAFO:

- .. Economical.
- .. Fabrication is quick and easy and requires fewer tools.
- .. The technician does not require much training.
- .. Cosmetically more appealing than conventional KAFO.
- .. Lightweight and thus more comfortable.



ANNEXURE -1

Lower Limb Orthotic Measurement Form

Ref : Date

Name :

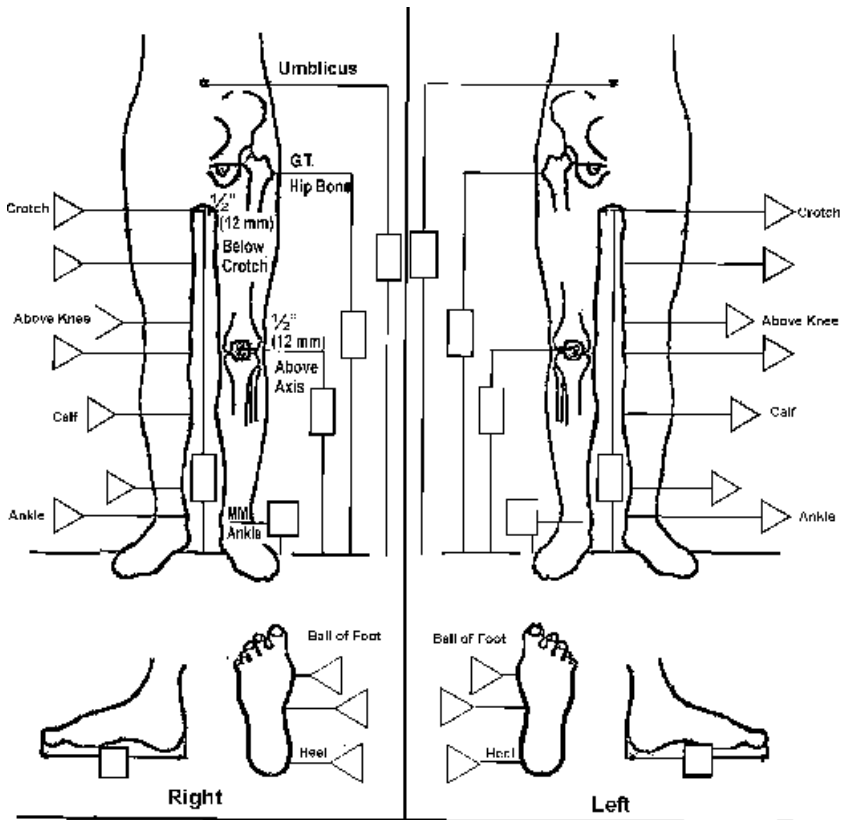
Age: Sex : Disability :

Address :

Remarks.....

D/M : D/T:..... D/D.....

Recipient..... Orthosis.....



△ — Medio-lateral (ML) width

□ — Height / Length

Please use all measurements in cm