PARTIAL FOOT

AN ILLUSTRATIVE GUIDE

Design & Fabrication for a Partial Foot Prosthesis that will...

- Reduce Friction
- Reduce Shearing
- Reduce Pressure
- Restore Propulsion
- Restore Limb Length
- Preserve Residual Limb

allard USA
Support for Better Life
Introduction
This book is in response to requests from practitioners interested in a comprehensive prosthetic program to manage partial foot amputations.

Reimbursement Codes
Any reference to reimbursement codes are based on suggestions from practitioners using these techniques and are not suggested by Allard USA or validated by any reimbursement agency.

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Applicable Amputation Levels
The concepts in this book apply to any partial foot amputation first ray or shorter.

About three-quarters of all PFA involve the toe(s) and/or disarticulation of the metatarsophalangeal joint.

Metatarsal (MTP), Transmetatarsal (TMT), Tarsometatarsal (Lisfranc), Transtarsal (Chopart)
PARTIAL FOOT CHALLENGES

1. Loss of Propulsion

Without the first ray windlass mechanism, the foot is considered “apropulsive”.

The term ‘windlass’ comes from sailing where it is the winch mechanism where the rope is wound around a drum, so in the foot the windlass is the plantar aponeurosis being wound around the metatarsal head.

2. Shearing Forces

Lever arm is the distance between the point of application of force and pivot.

Normally calf group muscle strength is balanced by foot lever arm length.

With amputation, muscles overpower the shortened lever arm, shearing connective tissue creating calluses.
Options

Foot Prosthesis or Short AFO

A foot prosthesis or short AFO with filler prosthesis cannot replace the lost propulsive lever arm.

Immobilization

Immobilization can’t help restore the propulsive lever arm and is proven to induce disuse atrophy.

Carbon Fiber Footplate

A carbon fiber footplate can only partially lengthen the propulsive lever arm, still allowing shearing leading to callus formation.

Carbon Fiber Footplate WITH a Lateral Strut

A footplate with a lateral strut leading into a tibial tubercle height pretibial shell can minimize or eliminate shearing forces by augmenting the shortened lever arm.
Managing Friction

Friction can be managed by making sure the socket isn’t too large and shoes aren’t too big.

Managing Pressure

Pressure can be managed by making sure the socket isn’t too small or shoes aren’t too tight.

Residual Foot Preservation

Studies have shown destructive forces are distal to the residuum using BlueROCKER®, thereby preserving the residual foot.

Foot Preservation Summary

To optimize residual foot soft tissue integrity it is important to make sure it is protected from:

- Friction
- Pressure
- Shearing forces
MANAGING LIMB LENGTH

Range of Motion

Nominal ROM at the ankle is 20° dorsiflexion and 40° plantarflexion.

Calcaneal Angle

With the ankle at neutral, the normal calcaneal angle is 40°.

TMA

At TMA level amputation, expect 3/8 to 1/2” acquired limb length deficit.

LISFRANC

At Lisfranc level, expect 1/2 to 5/8” acquired limb length deficit.

CHOPART

At Chopart level, expect 7/8 to 1 3/8” acquired LLD. Note acquired bulbous heel associated with ankle plantarflexion.

Determine leg length discrepancy

Measure limb length from fibular head to floor on both involved and uninvolved sides to determine acquired LLD.

Determine if restoring calcaneal angle can resolve LLD. Have patient stand on end of 1X4 board and lift the other end. Note/document calcaneal angle.
MANAGING LIMB LENGTH

Adjust for leg length discrepancy

Wedge anterior aspect of calcaneous to previous measurement. If LLD is not fully resolved, it will be necessary to post the heel section of the socket. See page 8, step 5 for illustration.

NOTE:
A calcaneal angle of 40° will return the ankle to neutral and should resolve any acquired LLD and eliminate or minimize an acquired bulbous heel.

GAIT RESTORATION

Data show that at TMA level, the ankle loses 85% of propulsive power. At Lisfranc and Chopart, the loss is 100% due to lack of a propulsive lever arm.

Compensations include hip-hiking, trunk lean, shorter sound side step length, and increased trunk torsion to advance the involved side limb through space.

Management of any partial foot amputation requires restoration of the propulsive lever arm.

Restore Propulsion

Tibial tubercle height pre-tibial shell, lateral strut and kinetic return footplate help restore propulsion.
1. Cast

Cast residual foot. Also cast contralateral foot so the prosthesis can be built to match.

2. Positive Model

Make positive model of residual limb.

3. Distal Cushion

Mold 1/8” Impression Puff™ (25 Durometer Shore A EVA) for distal cushion (L5668).

4. Mold Socket

Mold 1/8” black co-polymer for the socket (included in base code L5020).

5. Post

Post anterior aspect of socket to restore ankle neutral, and post posterior aspect if there is any residual LLD (see page 6).

6. Trim Lines

Trim anterior aspect of socket at start of filler prosthesis. Trim posterior aspect as a foot orthosis.
7. Align to BlueROCKER

Align socket to BlueROCKER®, trimming to accommodate lateral strut if necessary.

8. Laminate Layers of Microcell Puff®

Laminate 1/4” layers of Microcell Puff Lite to build the filler prosthesis, conforming it to the rocker footplate.

9. Shape Foot and Socket

Shape to match the length, width and sagittal plane profile of the contralateral foot.

10. Add Interface

Line pretibial shell with SoftKIT, ComfortKIT, or Custom Interface to protect tibial crest.

11. Align Tibial Shell

Align pretibial shell to tibial crest for equal top to bottom pressure distribution before securing prosthesis to footplate.

NOTE: Do NOT bill for the BlueROCKER®. This is an ultra light-weight tibial tubercle height carbon composite component that is covered by the base L5020 code. The ultra-lightweight code (L5785) is used at practitioner’s discretion.
SHOE SELECTION & EXERCISES

Shoe Selection

Footwear requirements include adequate heel/toe height differential, and toe rocker sole. A well constructed shoe (firm counter and shank) will produce better results. Flat-soled shoes (dress, court or deck shoes) are contraindicated.

Exercises

These exercises will help the wearer acclimate to their new environment by learning to take advantage of the energy return properties of the prosthesis. The importance of doing these exercises prior to walking cannot be overstated.

BABY SQUATS

Baby squats (heels stay on the ground). Illustrated are sagittal, rotate right and rotate left squats.

TRI-PLANAR LUNGES

Step out, step ahead and cross-step, making sure both knees are flexed.

TRI-PLANAR HIP EXCURSION

Determine excursion distance frontal plane, and then rotating forward and rotating to the back.
Robert H. Meier, CO, BOCO whose dedication, contribution, and love of the O&P industry made this illustrative guide possible.

David Scurti, CPO, for his early pioneering in partial foot prosthetic lever arm principles.

Dennis Amtower, CP, for continuous input on partial foot prosthesis fabrication.

Seamus Kennedy, BEng (Mech), CPed, for his expertise in foot biomechanics relating to the windlass mechanism and loss of propulsion secondary to partial foot amputation.

Ryan Feltman for the high quality professional illustrations.
BlueROCKER® is recommended for all PFA shorter than 1st ray.

For a stable ankle and no other proximal deficits, ToeOFF® may be considered for 1st ray amputations.

### AFO Selection

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### Interface Selection

**BlueROCKER® 2.0 & ToeOFF® 2.0**

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**GliderKIT™**

Select Left or Right based on desired D-Ring position. Fits ToeOFF® 2.0 and BlueROCKER® 2.0.

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