Post Surgical Tibial Sesamoidectomy

This case study examines the origins of fore foot pathology, due to surgical intervention. It is assumed for the purpose of this paper that biomechanical factors are a co-existing finding and do play a part in the development of this condition.
A morphology and R.O.M analysis is include in the case study (1)

Female: Age = 22
Medical History: Surgical intervention to the left foot

Symptoms

- Left foot
- Swelling and inflammation along the medial plantar aspect of the left 1st metatarsal head, due to Tibial sesamoidectomy 10 weeks prior to initial consultation surgery
- Patient aware of inability to weight bear on the medial boarder of the fore foot
- 4th and 5th digit dorsal irritation from foot wear
- Lateral ankle instability

Clinical Features & Observation

- Hallux flexus (Fixed)
- Contracture of E.H.L tendon
- Dorsal bursitis on hallux I.PJ
- Post-surgical Keloid scarring on dorsum of 1st M.P.J & hallux excision
- Plantarflexion of 1st M.P.J
- Recent Surgical scar, Medial plantar 1st M.P.J
- Forefoot supinatus

History

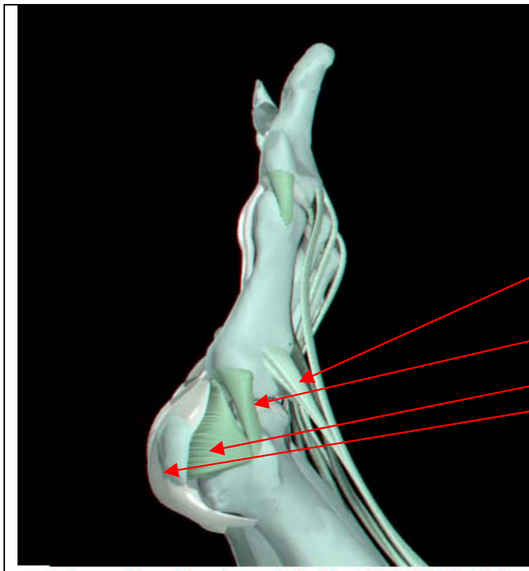
- Aged 16:

  Surgical correction of left hallux flexus deformity, shortening of the proximal phalanx of the hallux

- Aged 21

  Acute Left tibial sesamoiditis, subsequent, Surgical removal of left tibial sesamoid

Anatomy of 1st M.P.J

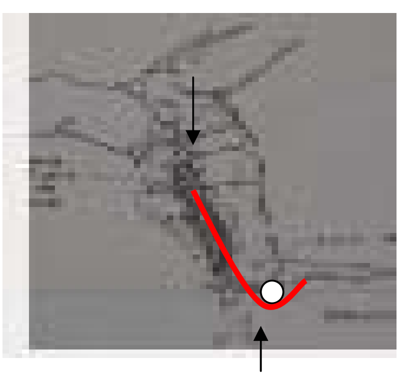


Interactive Foot and Ankle 2 © 2000 Primal Pictures Ltd.

- Ginglyomoarthrodial joint motion at the joint is hinge like with rotational glide available at the metatarsal head (2)
- Extensor hallucis longus
- 1st M.P.J collateral ligament
- Medial metarsosesamoid ligament
- Tibial sesamoid
- Plantar ligament

Crista

Interactive Foot and Ankle 2 © 2000 Primal Pictures Ltd.



The metatarsal head articulates with the base of the proximal phalanx anteriorly, and the two sesamoids inferiorly.
The inferior surface of the metatarsal head has a longitudinal ridge (Crista) and two articular grooves that the sesamoids articulate (Dykyj 1989) (Perlman 1994) The sesamoids;

- Modify the pressure of weight bearing by acting as a shock absorber
- Reduce friction, which allows the 1st metatarsal to move posteriorly during propulsion

(Valmassy 1996, pp 29)
The sesamoids serves as pulleys for the muscles
Provide a plantarflexion force for the hallux against the ground during the propulsive phase of gait

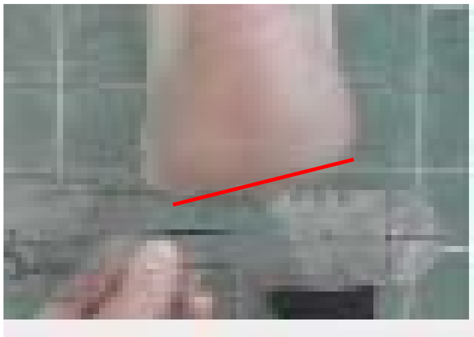
Anatomy contd. The 1st MPJ has a complex support structure, which allows the metatarsal head to move within it. The main motion of the joint is plantarflexion & dorsiflexion, the proximal Phalanx has some transverse plane mobility on the metatarsal head	**Flexor hallucis brevis sesamoids** *pulley mechanism* **Adductor& Abductor hallucis** *transverse stability* **Flexor hallucis longus** *plantar stability* **Peroneus longus** *Plantar flexion 2nd class lever*

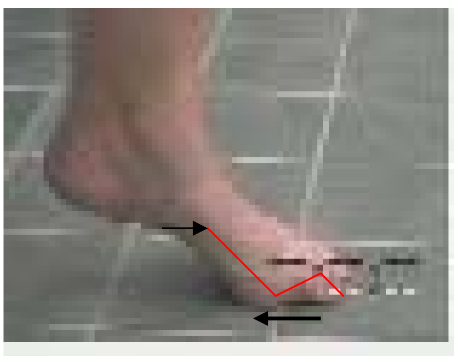
MORPHOLOGY & RANGE OF MOTION DATA ANALYSIS							
Patient's Name	**Case Study 2**		**D.O.B**		21 years		
Occupation			**Sex**		Female		
Chief complaint							
Left 1st metatarsal removal of tibial sesamoid- Post operative therapy Dorsal left hallux eburnation of Proximal IPJ							
EVALUATION OF MOTION & POSITION			***PATIENT SUPINE*** **LEFT**		**RIGHT**		
LEG LENGTH							
HIP ROM	EXTENDED		INT EXT	**30** **30**	INT EXT	**30** **30**	
	FLEXED		INT EXT	**30** **40**	INT EXT	**20** **40**	
COMMENTS	*MORPHOLOGY & VARIATIONS*						
Strength 0-5		*Thomas test*					
Tone		*Ober test*		**2**		**3**	
Bulk		*External rotators*		**3**		**4**	
KNEE	FRONTAL	GENU VARUM					
		GENU VALGUM					
	TRANSVERSE	HIP FLEX	FLEX	**120**	FLEX	**130**	
			EXT	**140**	EXT	**140**	
		HIP EXT	FLEX	**100**	FLEX	**110**	
			EXT	**140**	EXT	**140**	
MALLEOLAR TORSION				**23**		**19**	
COMMENTS	*MORPHOLOGY & VARIATIONS*						
Q Angle			**Medial displacement**				
Muscle function VMO				**2**		**4**	

	Hamstrings				
	Mc Murray' s Test				
	Clarke's Test				
EVALUATION OF MOTION & POSITION				***PATIENT PRONE***	
Patient's Name	**Clinical case**				
				LEFT	**RIGHT**
ANKLE	**DORSIFLEXION**	KNEE EXTENDED		**10**	**5**
		KNEE FLEXED		**15**	**15**
COMMENT	Anterior draw				
SUBTALAR JOINT ROM		INVERSION		**20**	**20**
		EVERSION		**0**	**0**
		ROM		**20**	**20**
		NEUTRAL	INV	**4**	**INV** **2**
			EV		**EV**
	AXIS POSITION		MED		
			LAT		
			NORM		
COMMENT					
MIDTARSAL JOINT ROM		VARUS	1-5 METS		
			2-5 METS	**5**	**4**
		VALGUS	1-5 METS		
			2-5 METS		
	AXIS POSITION			**Low**	**Low**
COMMENT	*MORPHOLOGY & VARIATIONS*				
Muscle function					
0-5	Plantar flexors Squeeze test				
	Tibialis posterior			**3**	**3**
	Dorsiflexors			**3**	**3**
	Peroneals			**1**	**3**
1ST RAY ROM			Equal	**DORS/PL**	**DORS/PL**
COMMENTS	No movement available at left hallux				

1ST MPJ ROM	DORSIFLEXION	**92**	**130**
COMMENT	L 1st Proximal Phalanx surgically shortened- EHL shortening		
LESSER METATARSAL *COMMENT*	*MORPHOLOGY & VARIATIONS*		
EVALUATION OF MOTION & POSITION		***STATIC***	
Patient's Name			
		LEFT	**RIGHT**
RELAXED CALCANEAL STANCE		**4 EV**	**4Inv**
NEUTRAL CALCANEAL STANCE		**0**	**6 Inv**
FRONTAL PLANE TIBIAL POSITION		**10**	**3**
HUBSHER MANOUVER	0 - 3	**0**	**2**
ANGLE & BASE OF GAIT		**Wide base of gait**	
TRENDLENBERG			

Origins & Etiology





(Fuller 2000, pp44)
A sesamoid apparatus or joint capsule that was bound down, could easily create the proximal pull to prevent dorsiflexion of the hallux

<u>Pre tibial sesamoidectomy</u>

- Gastrocnemius equinus
- Flexible forefoot valgus
- Flexor substitution for Gastrocnemius, subsequent hallux flexus deformity
- Surgical
    Physiological shortening & fixation of the proximal phalanx
    Shortening of the EHL
- Resulting in fixed plantar flexion of 1st metatarsal
- Reduced hallux dorsiflexion (3)

(Durrant *et al* 1993)
Proposed that any soft tissue structure that;

1. Crosses the transverse axis of motion of the 1st MPJ
2. Attaches to the proximal phalanx
3. Exerts a force that is parallel to the long axis of the 1st ray

Can restrict dorsiflexion of the hallux at the 1st MPJ

(Roukis *et al* 1996, pp543)
Discussed, that any functional or structural deformity that increased GRF under the 1st metatarsal during midstance period of gait, results in, maximum compensatory MTJ inversion and latent dorsiflex of the 1st Ray.

Origins & Etiology

(Valmassy 1996)
Removal of the tibial sesamoid reduces the lever arm for a plantarflexion force of the hallux against the ground. (3)

(Fuller 2000,pp44)
Removal of the tibial sesamoid will induce a force couple (forces not directly aligned).
The forces acting on the proximal phalanx will cause an abduction moment on the hallux. The forces acting on the metatarsal create a moment that will increase the risk of hallux valgus deformity.

This will be further exacerbated mechanical advantage of the fibular sesamoid attachments of adductor hallucis and the deep transverse metatarsal ligament

<u>Post tibial sesamoidectomy</u>

- Removal of Tibial sesamoid
- Patient had required a forefoot supinatus as a result of Pre-operative pain avoidance

(Roy et al 1986,pp 390)
Forefoot supinatus is an acquired Contracture in which the forefoot is inverted upon the rearfoot
(Roy et al 1986,pp 394)
A plantarflexed or excessively long 1st metatarsal may acquire a dorsiflexed contracture about the 1st ray and midtarsal joint axes.

(Hicks 1954)(3)
Failure of the Windlass mechanism, due to reduced hallux dorsiflexion

(Richardson 1987)
Stated that removal of the tibial sesamoid can result in hallux valgus deformity.

Conclusion

This case study highlights the clinical and biomechanical significance of identification of the origins of a soft tissuse contracture of the fore foot. This interesting case highlights the irrevocable biomechanical effect of surgical intervention, and reinforces the laws of static and dynamic equilibrium that govern foot function.

To establish an appropriate treatment plan (biomechanical objectives-target (4)), in accordance to the patients biomechanical requirements/needs.
A paradigm of foot function that combines biomechanical principles and conventional perspectives (origins), can assist the practitioner to correlate the effect of surgery, with the patients biomechanics and thereby, minimise the long term debilitating effects of structural and functional imbalance of the lower extremity

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