

Pes Cavus Classification: A Simplified Approach

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I. DEFINITION

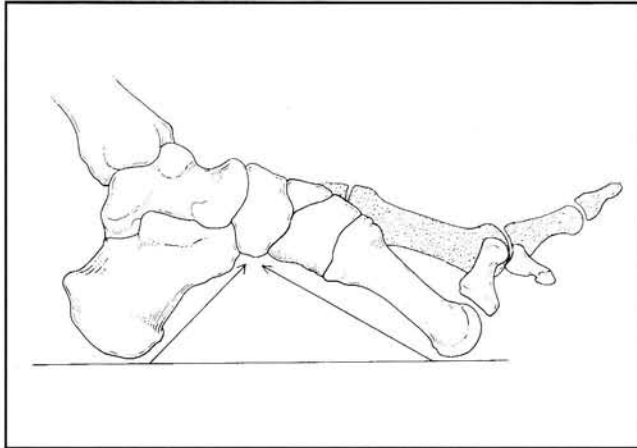


Figure 1. The pes cavus deformity is primarily a sagittal plane foot deformity in which there is an excessive plantar declinated attitude of the forefoot (or given part of the forefoot) relative to the rear foot.

II. OVERVIEW OF PES CAVUS

The cavus foot is truly a “foot” deformity, since the definition is describing the relationship of the forefoot to the rearfoot which causes a high arch in the sagittal plane. From a different perspective, the pes cavus could be accurately described as an excessive dorsiflexory attitude of the rearfoot, relative to the forefoot (posterior cavus). However, the more traditional description of relating the distal structure to the more proximal structure (anterior cavus) will be used for the most part in this paper. Note that the muscle imbalance that causes cavus, occurs from muscles that insert distal to Chopart’s joint.

Regardless, the deformity is truly a foot deformity—the relationship between the forefoot and the rearfoot. Therefore an excessively plantar declinated attitude of the forefoot relative to the rearfoot cannot exist without a co-existing excessive dorsiflexory attitude of the rearfoot relative to the forefoot. Anterior cavus and posterior equinus are both terms describing a pes cavus foot type.

III. CLASSIFICATION OF PES CAVUS BASED UPON THE APEX OF THE DEFORMITY

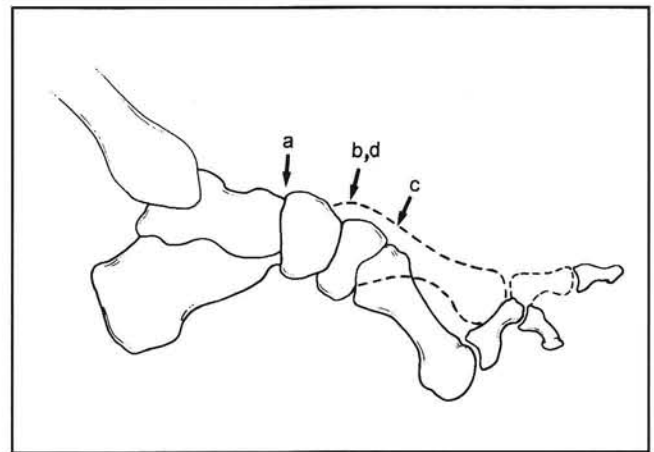


Figure 2

- A. Forefoot cavus (apex at Chopart’s joint)
- B. Lesser tarsal cavus (apex over the lesser tarsal bones)
- C. Metatarsal cavus (apex at LisFranc’s joint)
- D. Combined pes cavus (apex generalized to the lesser tarsus)

IV. CLASSIFICATION OF PES CAVUS BASED UPON FLEXIBILITY OF THE DEFORMITY

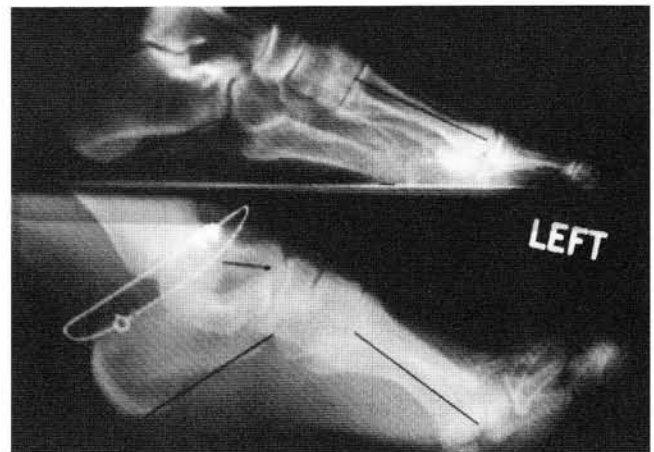


Figure 3

- A. Flexible pes cavus (primarily reducible with weight bearing) as shown in this illustration
- B. Rigid pes cavus (little reduction of cavus with weight bearing). This may lead to “pseudoequinus”, a functionally tight heel cord.
- C. Semi-rigid pes cavus (significant reduction of cavus with weight bearing but maintaining a moderately increased calcaneal inclination angle)

V. CLASSIFICATION OF PES CAVUS BASED UPON ETIOLOGY

There is a high degree of neuromuscular disease noted in pes cavus patients)

- A. Neurologic (spastic or flaccid)
 - 1) Rapidly progressive (i.e. some forms of cord tumors)
 - 2) Slowly progressive (i.e. some forms of Charcot-Marie-Tooth disease)
 - 3) Non-progressive (i.e. polio) May have progressive structural (musculoskeletal) deformity due to the non-progressive muscle imbalance.
- B. Traumatic
- C. Congenital
- D. Idiopathic

VI. CLASSIFICATION OF PES CAVUS BASED UPON ASSOCIATED PLANES OF DEFORMITY (FRONTAL, TRANSVERSE) IN THE FOREFOOT AND THE REARFOOT—INDIVIDUALLY OR COLLECTIVELY

- A. Forefoot varus—pes cavus (pronated high arch foot-lateral column cavus)
- B. Forefoot valgus-pes cavus (pronated high arch or supinated high arch foot depending on the compensation mechanism—medial column cavus)
- C. Plantar declinated first ray-pes cavus
 - 1) Metatarsals 1-5 in varus
 - 2) Metatarsals 1-5 perpendicular to the rearfoot
 - 3) Metatarsals 1-5 in valgus
- *D. Metatarsus adductus - anterior cavus
- E. Ankle equinus-pes cavus (limited ankle dorsiflexion)
- *F. Rearfoot varus anterior cavus
- *G. Rearfoot supinatus anterior cavus (i.e. clubfoot)
- *H. Muscle weakness

*associated deformities most commonly seen with the cavus foot

VII. ANKLE EQUINUS AND PES CAVUS



Figure 4.

Do not confuse ankle equinus with pes cavus. Ankle equinus is a limitation of dorsiflexion of the foot on the leg through the ankle. It is not truly a foot deformity. The pes cavus deformity occurs with an excessive dorsiflexory attitude of the rearfoot relative to the forefoot. Because of the different reference points (the rearfoot vs. the leg, the rearfoot vs. the forefoot), it is not inconsistent that an individual might have a concomitant pes cavus and ankle equinus as is demonstrated in this figure.

VIII. COMPENSATION FOR THE SAGITTAL PLANE PES CAVUS DEFORMITY

Consequently, increased pressure occurs across the metatarsal heads.

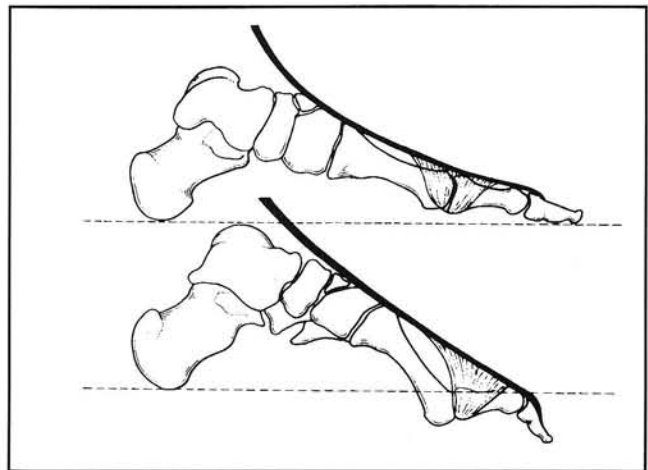


Figure 5A. Contraction of the toes.

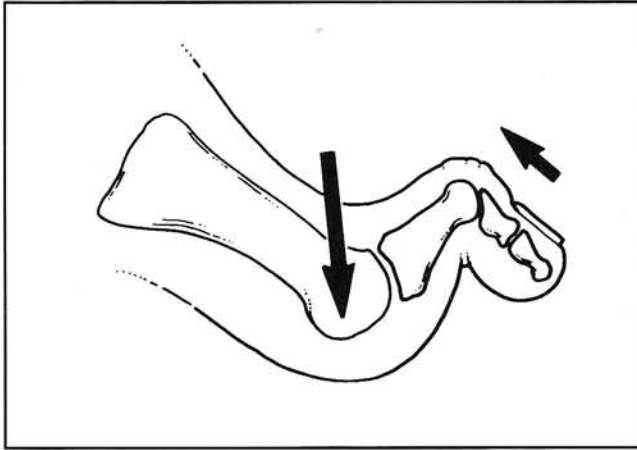


Figure 5B. Reverse buckling of the metatarsal phalangeal joints

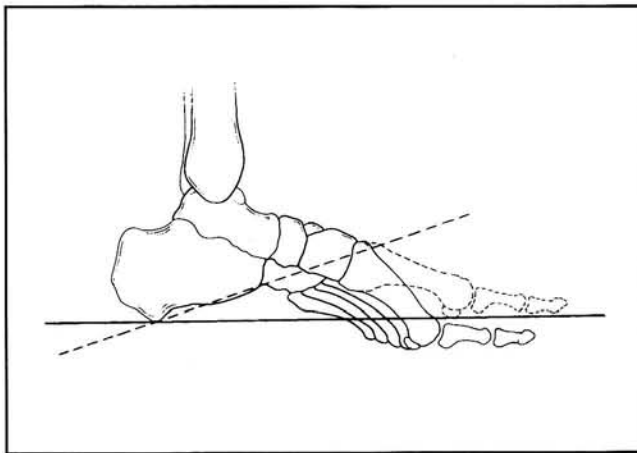


Figure 5C. Tarsal sagittal plane flexibility (extensor substitution)

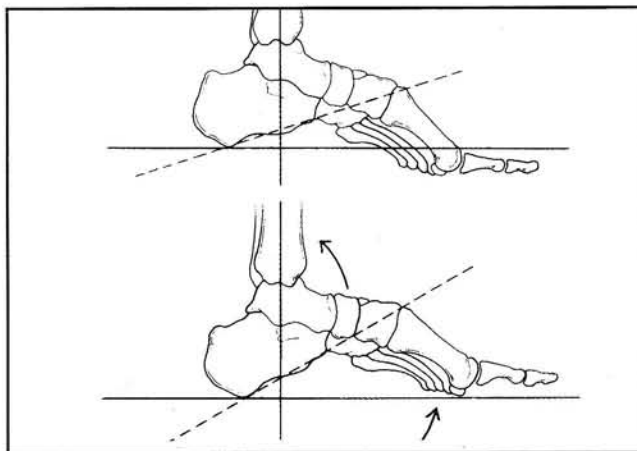


Figure 5D. Reverse buckling at the ankle joint (pseudoequinus)

IX. X-RAYS OF THE PES CAVUS



Figure 6.

X-rays of the pes cavus differ in several ways from the normal foot. Based on a rigid or semi-rigid pes cavus deformity, the following radiographic findings are expected.

- A. No evidence of subtalar joint supination or pronation is seen (in the pure sagittal plane pes cavus). If radiographic evidence of supination or pronation is noted, additional deformity (frontal, transverse) must be present in combination with the pes cavus.
- B. The calcaneal inclination angle is increased (normal calcaneal inclination angle is 24.5°)
- C. Talar declination angle is decreased (normal talar declination angle is 21°)
- D. Lateral talocalcaneal angle is normal
- E. Most other x-ray findings and angles will fall within normal limits

X. CALCANEAL INCLINATION ANGLE

Normal	24.5°
Severe pes cavus	> 40°
Moderate pes cavus	> 30-40°

Normal	18-30°
Moderate pes planus	10-18°
Severe pes planus	< 10°

The calcaneal inclination angle is the single most effective structural angle to determine the severity of the rigid pes cavus. This angle changes very little with supination and pronation. The angle can reduce significantly over time with structural instability due to plantar subluxation of the rearfoot (talus and calcaneus together) on the forefoot.

**XI. CLARIFICATION OF TRADITIONAL CLASSIFICATION OF PES CAVUS.
HISTORICALLY THIS HAS BEEN BASED ON THE COMPENSATED
POSITION OF DEFORMITY**

PLANES OF DEFORMITY	TRADITIONAL	STRUCTURAL (RIGID)	POSITIONAL (FLEXIBLE)
Sagittal	Local Cavus	Plantar flexed 1st ray (rigid)	Plantar flexed 1st ray (flexible)
	Global Cavus	Metatarsal cavus Lesser tarsal cavus Forefoot cavus Combined cavus	Metatarsal cavus Lesser tarsal cavus Forefoot cavus Combined cavus
	Equinocavus	Ankle equinus Osseous Gastrocsoleus Gastroc + pes cavus	Spastic triceps surae + pes cavus
	Calcaneal Cavus	Severe pes cavus	Paralysis of Triceps Surae
Frontal	Cavovarus	Forefoot valgus (medial column cavus compensated by STJ supination)	Rearfoot supinatus + pes cavus
		RF varus + pes cavus	
	Cavovalgus	Forefoot varus + cavus (lateral column cavus)	Rearfoot pronatus + pes cavus (could have spasm associated)
		Forefoot valgus + cavus (compensated by MT supination)	
		Rearfoot valgus + cavus	
	Transverse	Cavo Adductus	Metatarsus abductus + pes cavus
Cavo Abductus		Metatarsus Rectus + pes cavus	Forefoot abductus + pes cavus