ACTA ORTHOPAEDICA SCANDINAVICA
SUPPLEMENTUM NO. 94

HENRIK STØREN

Congenital Convex Pes Valgus with Vertical Talus

Chapter I

EARLY DIAGNOSIS, METHOD OF TREATMENT AND OUTLOOK WITH CLOSED REDUCTION

Chapter II

METHOD OF OPERATION AND OUTLOOK WITH OPEN REDUCTION

MUNKSGAARD
COPENHAGEN 1967

From the Coasthospital at Stavern, Norway. Former Head: H. Støren,
Present Head: K. Hadland.

For financiel support my gratefull acknowledgement goes to
Dr. Alexander Malthes Legat

PRINTED IN DENMARK
VALD. PEDERSENS BOGTRYKKERI
COPENHAGEN

In Commemoration of my Father
Distriktslæge Eilert Støren

Contents

Preface

Congenital convex pes valgus with vertical talus is a rare deformity which, remaining untreated, develops to a very troublesome and frequently disabling illness. In later age palliative operations may be the only means of treatment. Treated at an early age the child can get a normal or nearly normal foot. This may be done following ways:

Closed reduction ("conservative treatment"), described in chapter I, or operative reduction described in Chapter II.

Due to the infrequency of the malformation I have only a few cases, which are fit to be published. (Thus cases with neurological diseases are excluded). On account of the small number however it has been possible to do a more accurate observation and give a more detailed description of each individual case.

I hope that some of the observations, which have been made may help in the diagnosis and give directions for the treatment for this deformity and further that some of the given facts possibly may contribute to good results. I also hope that these observations may be useful for comparisons with later works on this subject.

CHAPTER I

Early Diagnosis, Method of Treatment and Outlook with Closed Reduction

Hohman in his book "Fuss und Bein" (1934) gives an extensive discussion of the congenital, vertical talus in connection with what he terms "der congenitte Knickplattfuss". He advocates that treatment be started as early as possible in order to avoid operation, similar to the principles applied in the treatment of the congenital club foot.

Günz (1939) at Hohmans clinic by autopsy of a still-born child with bilateral vertical talus, demonstrated that pathological changes in the tarsal joints may be present already at birth. In addition, contractures were so firm that extensive tenotomies and capsulotomies had to be done in order to restore normal position of the feet. His case evidently represented the extreme.

That conservative treatment in some cases may lead to full recovery has been demonstrated by *Hohman* (1934) and *Wainwright* (1962). However, the observation of Günz shows that full recovery cannot be expected in all cases, even if the treatment is started from birth.

Herndon & Heyman (1963) consider full clinical and roentgenological recovery to be very unlikely with conservative treatment: "In babies or very young children manipulation under anesthesia occasionally may improve the general appearance of the foot and possibly may result in fairly good function without much disability, but such manipulation is unlikely to reduce the dislocation of the navicular or to improve the roentgenographic appearance of the foot appreciably",— and further: "We now believe that if a child is seen before irreversible bone changes and contractures have developed, the preferable approach is open reduction".

Grice (1962) maintains that conservative treatment with reduction followed by plaster cast" is usually successful in restoring satisfactory alignment and a desirable appearance of the foot in the milder form of the deformity. When there is more severe deformity, it is usually not possible to bring the talus out of equinus and the navicular remains on

the dorsum of the neck of the talus". *William H. Snyder* (1962) maintains: "Conservative measures are of little avail".

These authors do not, however, state whether they have started a conservative treatment within the two first weeks after birth. This may be an extremely important point in the conservative treatment, but requires an early diagnosis.

Pes calcaneus is no rarity in the new-born, and may be so marked that the dorsum of the foot easily can be brought in contact with the anterior aspect of the leg. Usually this benign pas calcaneus can be corrected by the mother by exerting manual redressement during breastfeeding. In some cases, however, contracture of the extensor tendons may be pronounced enough to necessitate redressement under anaesthesia followed by a correcting plaster cast (Case 7 and Case 9).

The sole of the foot in cases of benign pes calcaneus is usually concave or flat, but may also present a convexity. It is than a dorsiflexion in Choparts joint, *but without a subluxation as seen by vertical talus.*

Thus the term "congenital, convex pes valgus" as used by Herndon & Heyman and others will not be correct, why vertical talus may or may not be present in every case of congenital convex pes valgus. (See Case 7, Figure 7 R, Case 8, Figure 8 L, page 19–21).

A more correct denomination is considered to be: Congenital, convex pes valgus *with vertical talus* and will be used in this paper.

As emphasized by Herndon & Heuman, the congenital vertical talus should not be confused with the vertical position of the talus seen under weightbearing in pronounced cases of the hypermobil pes planus in children and in cases of paralytic pes planus. Here the navicular articulates with caput tali, although with the dorsal aspect of its articular facet, but there is no real subluxation of the forefoot with the navicular lying with its articular facet on the dorsal part of caput or collum tali as seen in cases named congenital "vertical talus".

The congenital "vertical talus" may immediately by the clinical examination convey the impression that it is a pes calcaneovalgus. The dorsiflexion mainly taking place in the dorsal subluxated or luxated Choparts joint, and that talus, and in different extention calcaneus, occurs in equinus is not possible clinically to make out in the newborn or in early childhood.

Only the radiography ascertains the diagnosis. However, in this neonatal period the evaluation of the roentgenogram is often rather difficult. The ossification centre of the navicular gives no guidance until

the age of 1½–3 years or later, when it becomes visible on the roentgenogram.

Still the evaluation of the position of talus relative to the forefoot is possible. In order to diagnose a vertical talus in an early stage, and to settle the border-line cases, a detailed knowledge of the roentgenogram of the normal childs foot is mandatory. One must also be familiar with the X-ray findings in the "benign" congenital pes calcaneus and pes calcaneo-valgus a. o. To establish a basis for the early diagnosis of vertical talus a roentgenological study has been made in:

I. Normal feet in new-born and up to early childhood.
II. "Congenital benign" pes calcaneus and pes calcaneovalgus (this transient deformity of an otherwise normal foot probably is the result of intrauterine malposition rather than a true congenital malformation).
III. The common mobile pes planovalgus in children.
IV. A borderlinecase where the diagnosis a mild degree of vertical talus may be questionable.
V. Congenital convex valgus with a vertical talus in early age—conservatively treated.
VI. Comparison between the roentgenogram in congenital convex pes valgus with vertical talus and the rockerbottomfootdeformity seen in cases of tali-pes equinovarus congenita, which are under treatment.

All roentgenograms in lateral view are made with the feet in the maximum possible dorsiflexion. In cases where maximal dorsiflexion of different causes not is done is this mentioned.

Following parameters have been used:

1. *The talus axis:*[1] Its angle with the longitudinal axis of tibia has been measured with the foot in maximal dorsiflexion and is named the tibiotalusangle.

   Its angle with calcaneusaxis is named the the talocalcanangle in lateral view. Its relation to the cuboidal bone is noticed.
2. *The calcaneus axis:*[1] Its angle with the tibialaxis during maximal dorsiflexion of the foot is named the tibiocalcaneusangle. Its relation to the cuboidal bone is noticed.

---

[1] Implied the long axis.

Projection variations, which cause variations in angles and axes and their mutual relations, are unavoidable. It should be amphasized that for this reason the evaluation of the parameters should not be too meticulous. But the acurracy is sufficient for the purpose we need in this work.

One difficulty in evaluating the talus axis at birth is the triangular or even round shape of the ossification centre during the first days, which makes the drawing of an axis questionable, (Figure I Right). If a unilateral anomaly is present, comparison with the normal foot is very helpful (Figure 13).

Remarks Upon the Talus-Axis and the Talocalcaneusangle in Lateral View

The usual designations: Vertical talus, talus equinus, plantarflexed talus a.o., are actually misleading regarding the deformity in question. An ordinary pes equinus represents of course a plantarflexed position of talus in the anklejoint, but this is not what we here want to express. With vertical talus and the other similar designations we mean the vertical position of talus in relation to the subtalar part of the foot. In the lateral view of the radiogram this may be signified by a more vertical position of the talusaxis on the calcaneusaxis than normal, expressed by an increased talocalcaneusangle. This is frequently seen in this deformity and is then at an early age a diagnostic guide (see Figure 18, 22, 23, 24 Chapter I).

But "vertical talus" may also be seen without increased talocalcaneusangle. In most cases the reason then is an accompaning equinus-position of the calcaneus. If calcaneus, in relation to the verticality of talus, has pronounced equinus position, the talocalcaneusangle may be smaller than normal. This is most marked by the rockerbottomfoot seen during treatment of congenital clubfoot (see Case 19, Figure 52, 53, Chapter I).

Nevertheless by congenital convex valgus with vertical talus in this material the talocalcanear angle was primarily never smaller than in normal feet.

A second cause, why the enlargement of the talocalcaneusangle does not take place, is seen in cases where the dorsal mobility in Chopart's joint is large, and at the same time calcaneus only in a small degree or not at all follows the anterior part of the foot in the dorsal movement. In such cases the steeping of talus may be small in spite of a pro-

nounced deformity (Chapter II Case 2, Figure 8 p. 82). The anatomical reason is a slack connection between calcaneus and the forefoot.

Enlargement of the talocalcanear angle with normal position or only a slight steeping of the talus may be due to increased dorsiflexion of the calcaneus in cases where the achillestendon has been lengthened. Parallell to this but a size larger is this seen by the pes calcaneus following paresis of the triceps suraemuscle. In early childhood a wide talocalcanear angle in normal feet or in "benign" calcaneovalgus is caused by the physiological hypotonia of the muscles (Chapter I, Figure 2 R foot, Figure 5 L foot, Figure 7 R foot). In older normal children (3–4 years) the angle does not change by upward pressure under the anterior part of the foot.

Remarks Upon the Tibiotalus Angle in Lateral View

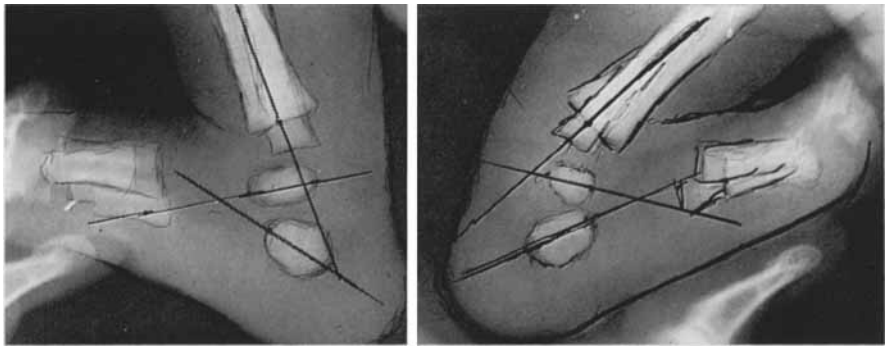
The anteriorly open angle between the tibia-axis and the talusaxis on X-ray in maximal passive dorsiflexion, expresses the position of the talus. If this angle, here called the tibiotalus angle, is wider than in normal feet, we are using the term; vertical talus. (But implying that the position of talus really is in relation to the subtalar part of the foot). The upper limit of this angle in normal feet is in this material found to be about 105 degrees. In some cases of congenital subluxation of the forefoot however we may find the tibiotalusangle to be normal. This is seen in cases with hypotonia of the plantar muscles. (See Case 2 Figure 8, Chapter II). Usually the dorsally dislocated forefoot will to a different extent push the talus down in vertical position. (See Case 16, Figure 38 and Figure 44 A, Chapter I).

I. Normal Feet in New-Born and up to Early Childhood

(Case 1, John G., new-born). *Figure 1.*

Clinically normal feet. Lateral view of the feet in maximal dorsiflexion. In the left foot the shape of talus is well defined and the talus axis evident. In the right foot talus is more pearshaped, but also here the axis may be drawn with some degree of certainty. The tibio-talus angle is 55 degrees on the right and 80 degrees on the left side. This rather great difference may be caused by more marked passiv dorsiflexion in the right ankle. Some small differences in drawing of the axes must be rechoned on too. The tibiocalcaneusangle is 15 degrees on the right and 35 degrees on the left foot. The dorsiflexion of the calcaneus is seen to be very efficient. Calcaneus during dorsiflexion essentially follows talus, as demonstrated by the

talo-calcaneus angle which is 35 degrees on the right and 40 degrees on the left respectively. On later control examinations the feet have shown normal development.



L *Figure 1.* R

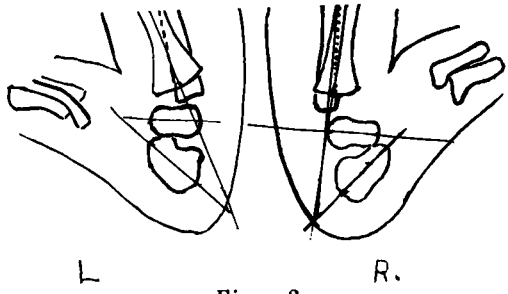


Figure 2.

(Case 2, Björn L., aged 11 days). *Figure 2.*

Clinically normal feet. Lateral view. Feet in maximal dorsiflexion.
The tibio-talus angle R. 90 degrees L. 80 degrees.
The tibio-calcaneus angle R. 35 degrees L. 25 degrees.
The talocalcaneus angle R. 55 degrees L. 30 degrees.
The case has later shown normal development.

(Case 3, Anne O., aged 5 months). *Figure 3.*

Clinically normal feet, which later have shown normal development. Lateral view. Feet in maximal dorsiflexion. The ossification centres of cuboid and cuneiform I are here well developed.

The tibio-talus angle R. 80 degrees L. 85 degrees.
The tibo-calcaneus angle R. 40 degrees L. 40 degrees.
Talocalcaneus angle R. 20 L. 30 degrees.

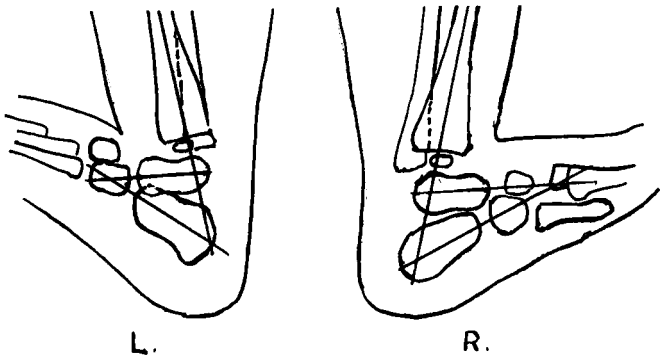


Figure 3.

The talus axis is seen to pass dorsally to the cuboid on tne right, and through the centre of the cuboid on the left foot. The more plantar course of the axis on the left foot may be caused by a stronger pressure upwards anteriorly on the forefoot on this side at X-ray, with a resulting slight dorsal movement in Chopart's joint. This will be discussed later.

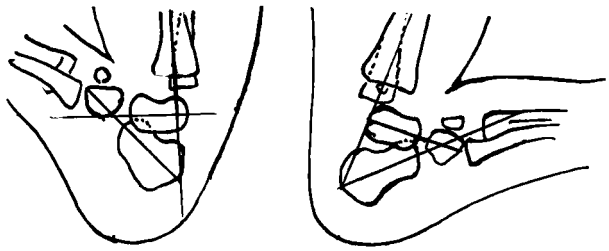


Figure 4.

(Case 4, Norum Å., aged 5 months). *Figure 4.*

Clinically normal feet which later have developed normally. X-ray in lateral view. Feet in maximal dorsiflexion. Although as old as the fore-going patient, the skeleton of the foot here is smaller and the ossification centres less developed, but present in the same number.

Tibio-talus angle R. 90 degrees L. 90 degrees.

Tibio-calcaneus angle R. 45 degrees L. 35 degrees.

Talocalcaneus angle R. 45 degrees L. 45 degrees.

The talusaxis in the right foot passes through the middle of the cuboid. On the left it touches the lower border of the bone. This more plantar course of the talus-axis in relation to the forefoot also appears to some lesser degree in both feet in the next Case 5, and is due to an increased dorsal mobility in Choparts joint. This appearance is due to the hypotonia of the muscles and ligaments which is physiologically in the early age, (more about this later).

The conclusion in this case is therefore: Roentgenologically normal feet. This is in accordance with the clinical observations and the later normal development of her feet.

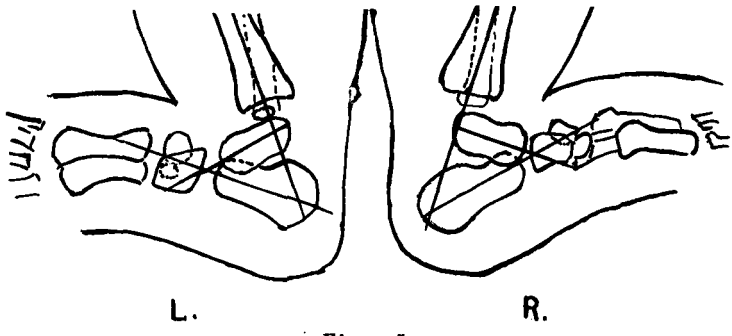


Figure 5.

(Case 5, Elin T., aged 8 months). *Figure 5.*

Clinically normal feet. X-ray in lateral view. Feet in maximum dorsiflexion. The ossification centres of cuneiforme I and II are here both visible.

Tibio-talus angle R. 90 degrees L. 95 degrees.

Tibio-calcaneus angle R. 40 degrees L. 45 degrees.

Talo-calcaneus angle R. 45 degrees L. 45 degrees.

The talus axis on both sides passes through the lower ¼ of the cuboid. The calcaneus axis cuts through the upper half of the cuboid. The later development of the feet normal.

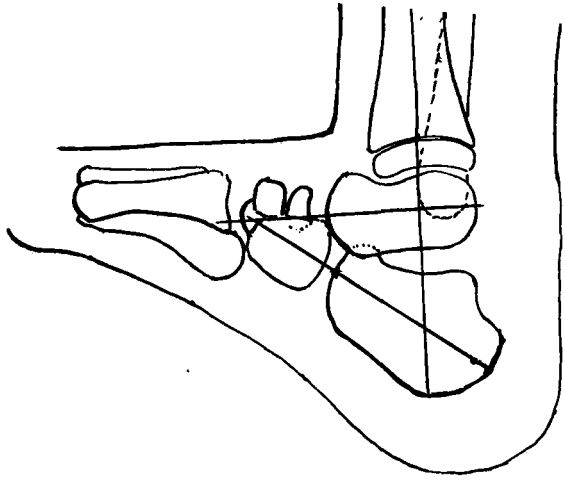


Figure 6.

(Case 6, Harald B., aged 5 years). *Figure 6.*

Clinically normal feet. Lateral view of left foot in maximum dorsiflexion. The ossification centre of the navicular are here well developed.

Tibio-talus angle L. 90 degrees.

Tibio-calcaneus angle L. 45 degrees.

Talo-calcaneus angle L. 35 degrees.

The talus axis passes through the lower half of the navicular and touches the upper border of the cuboid. The calcaneus axis goes through upper ½ of cuboid.

Discussion

In six cases of clinically normal feet in children from 0–5 years of age, roentgenograms in lateral view have been made of the feet in maximal passive dorsiflexion.

The tibio-talus angle varied from 55 degrees to 100 degrees and indicated the position of talus in the anklejoint under maximal dorsiflexion.

The tibio-calcaneus angle varied from 15 to 45 degrees.

The talo-calcaneus angle varied from 20 to 55 degrees.

Calcaneus participates in the dorsiflexion simultaneously with talus, and thereby the concavity of the footarch is maintained. The talus-axis may pass through the ossification centre of the cuboid near to its upper or lower border, varying to some extent with the degree of pressure exerted under the forefoot to obtain maximal dorsiflexion, as the normal hypotonia of muscles and ligaments in this young age-group permits an increased dorsal movement in Choparts joint. (See Figure 3, 4, left foot, Figure 5 both feet, Figure 7 right).

II. Congenital, Benign Pes Calcaneus and Pes Calcaneo-Valgus without Vertical Talus

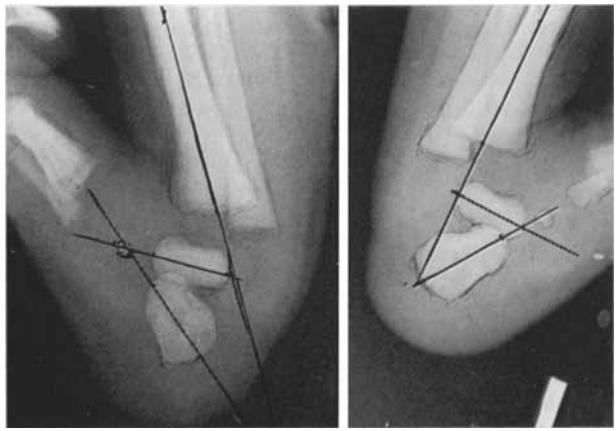
(Case 7, Heidi S., aged 7 days). *Figure 7.*

Pes calcaneus. Upon dorsiflexion the feet can be laid against the anterior aspect of the leg. The right foot shows a median prominens of the tuberosity of the navicular bone and of caput tali, the left shows no such prominens. Both feet may be passively flexed in plantar direction to a position of 25 degrees dorsiflexion, leading to a pronounced tightening of the tibialis anterior tendon. Roentgenograms with maximum dorsiflexion of both feet. Lateral view: The ossification centre of the cuboid is here visible.

Tibio-talus angle R. 90 degrees L. 75 degrees.

Tibio-calcaneus angle R. 30 degrees L. 30 degrees.

Talo-calcaneus angle R. 55 degrees L. 35 degrees.



L *Figure 7.* R

The talusaxis passes on the right side below while on the left side through the cuboidal ossification centre.

The only treatment applied, was passive stretchings exercised by the mother, and both feet developed a normal appearance. When the child started to walk, supports were given (about this time she got poliomyelitis with paresis of muscles of the feet and arms, and further control examinations have been discarded from this report).

Discussion about Case 7

The right foot shows clinical symptoms which do not exclude a congenital convex valgus with vertical talus. X-ray shows however no verticality of talus in the anklejoint, although the talus has a somewhat steep position on relation to the axis of the calcaneus. This is expressed in a quite wide talo-calcaneus angle (55 degrees). Furthermore the talusaxis passes below and behind the cuboid. It may here be justified to suspect a mild degree of dorsal subluxation of the forefoot. The evidently good result of an apparently insufficient treatment does not exclude the diagnosis: A mild degree of congenital convex talus and a slight degree of dorsal subluxation of the forefoot, where the "verticality" of the talus only refers to the calcaneus and the forefoot, not to the anklejoint. (About this see page 14 and 15.)

The most acceptable explanation however may be, that the high degree of dorsiflexion of calcaneus without a corresponding dorsiflexion of talus makes the talocalcaneus angle wide. As before mentioned the cause of this and the dorsal dislocation of the cuboid is the

hypotonia of the muscles and ligaments at this age. This view explains the good result of the apparently insufficient treatment, but it does not explain why the right foot has a steeper position of the talus in relation to the calcaneus than the left foot. A possibility of a difference uppwards pressure gives no explanation of this fact.

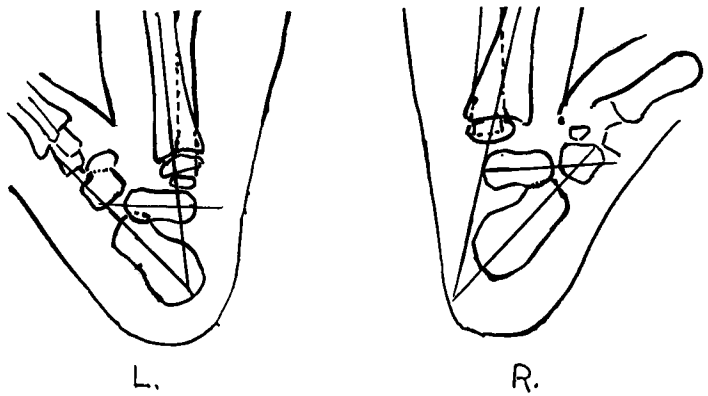


Figure 8.

(Case 8, Torill S., aged 12 months). *Figure 8.*

Pes calcaneo-valgus with slight contracture of the extensor tendons. Treated with stretching exercises and supports. Roentgenogram in maximum dorsiflexion. Lateral view. Before treatment.

Tibio-talus angle R. 80 degrees L. 85 degrees.
Tibio-calcaneus angle R. 30 degrees L. 35 degrees.

Talo-calcaneus angle R. 40 degrees L. 40 degrees.

The talusaxis passes just below the middle of the cuboid on the right side. On the left it touches the lower border. A slight rockerbottomfoot is present on the left, although no verticality is seen of the talus. As mentioned before (Case 3, 4 and 7) the pressure under the forefoot with dorsal movement in Choparts joint is the underlying cause.

Compared with the foregoing case there is in this case a normal widenes of the talo-calcaneus angle *i.e.* no verticality of talus in proposition to calcaneus.

(Case 9, Åse Kr. G., aged 11 months, borne 2 of February 1957).

Clinically a pes calcaneo-valgus was seen, with contracture in dorsiflexion of both feet. At reduction under general anaesthesia the tibialis anterior and extensor digitorum longus still offered strong resistance and the tendons prominated under the skin like backstays. The first attempted reduction was unsuccessful. A bilateral valgus position of the calcaneus of about 10 degrees was simultaneously corrected. The contracture of the extensor tendons to the 4th and 5th toe showed several relapses and had to be treated operatively when the child was 6½ year old.

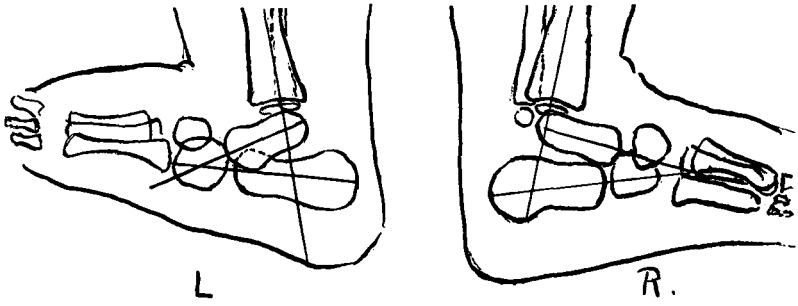


Figure 9 A.

Fig. 9 A. X-ray of the patients feet in maximal dorsiflexion in lateral view before treatment.

Tibio-talus angle R. 90 degrees L. 105 degrees.

Tibio-calcaneus angle R. 70 degrees L. 70 degrees.

The talus axis on the right side passes in the upper border of the cuboid, on the left through the middle. The calcaneus axis on both sides goes just below the middle of the cuboid. A dorsoplantar roentgenogram shows bilateral the forefoot in some abduction and a talo-calcaneus angle of 30 degrees (not illustrated).

In the lateral view no changes were seen after one year. She wore supports for the two years, and the feet developed normally, except for the above mentioned contracture of the extensor tendons to the 4th and 5th toe.

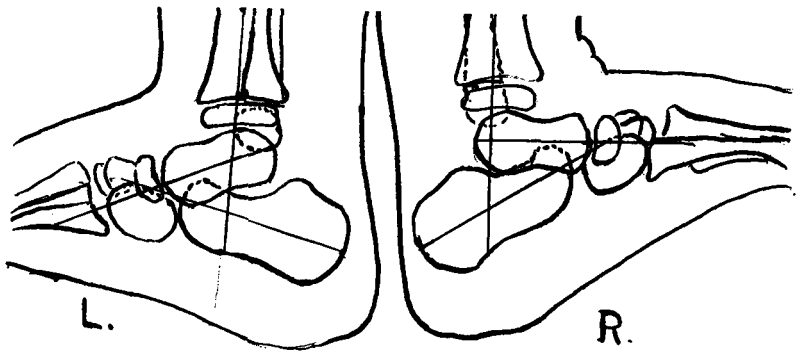


Figure 9 B.

(Case 9, Åse Kr. G., aged 4 years).

X-ray: Feet in maximal dorsiflexion. Lateral view.

Tibio-talus angle R. 90 degrees L. 100 degrees.

Tibio-calcaneus angle R. 60 degrees L. 70 degrees.

Talo-calcaneus angle R. 30 degrees L. 35 degrees.

On the right foot the talus axis goes nearly to the middle of the navicular bone-centre, which has now become visible. This corresponds nearly to the upper border of the cuboid. The calcaneus axis on both sides passes just above the cuboid. The longitudinal arch of both feet is normally developed.

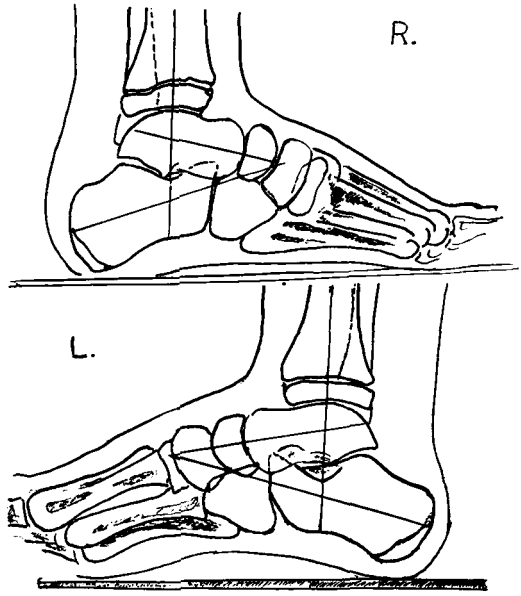


Figure 9 C.

(Case 9, aged 9 years).

Clinically normal feet.

X-ray both feet in weightbearing normal. Figure 9 C.

Summary of Case 9

The patient had congenital pes calcaneovalgus with pronounced contractures of the tibialis anterior tendon, and the extensor digitorum communis tendons. The contractures were present even under general anaesthesia. No vertical talus or subluxation of the navicular bone were present. The contractures were treated with reduction and correction in plaster cast. To the age of 11 months from the time of weightbearing supports were born for two years. There was normal development of the feet both clinically and roentgenogically. Last controll 9 years old. Figure 9 C.

III. The Ordinary Pes Planovalgus in Children

(Case 10, Knut O., aged 19 months).

Bilateral, hypermobil pronounced pes planovalgus. Feet in maximal dorsiflexion. Lateral view. Figure 10 A and dorsoplantar view B.

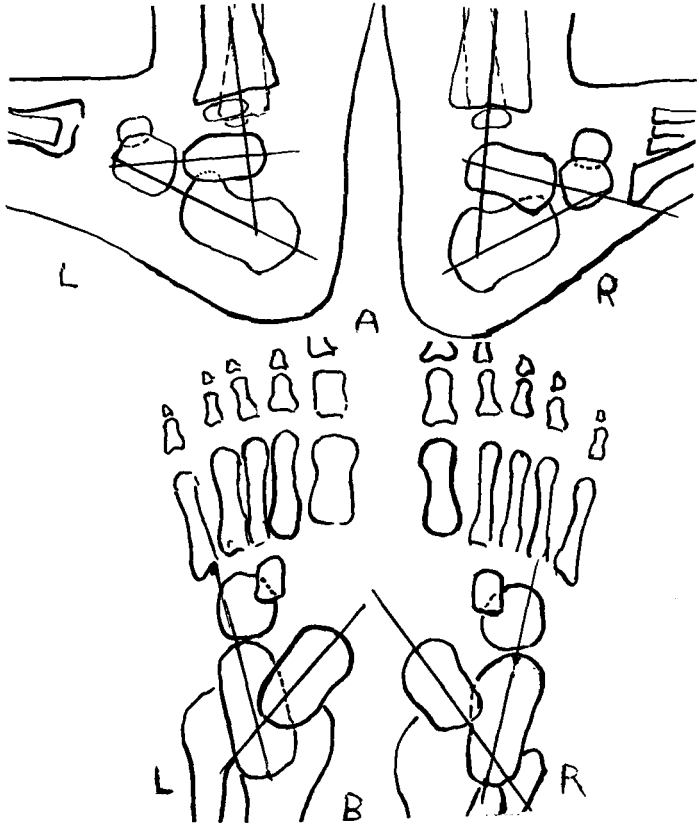


Figure 10 A and *B.*

Tibio-talus angle R. 95 degrees L. 90 degrees.

Tibio-calcaneus angle R. 60 degrees L. 55 degrees.

The talus axis on the right passes just below the middle of the cuboid, on the left through the middle. The calcaneus axis on the right passes just above the lower border of the cuboid, on the left below the middle.

The talo-calcaneus angle is 35 degrees on left foot and 40 degrees on right. The dorso-plantar talo-calcaneus angle is 50 degrees on both feet.

Summary of case 10:

Pronounced hypermobil pes planovalgus in a 19 months old child shows without weightbearing in a dorsoplantar roentgenogram a wide talo-calcaneus angle, but in the lateral view (under forced passive dorsiflexion), there is normal position of the talus and calcaneus with normal courses of corresponding axes on the left side. On the right the course of the talus-axis is too low. The corresponding angles are normal.

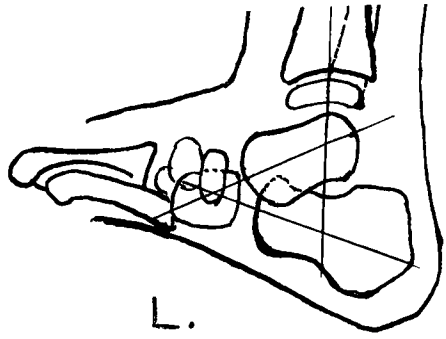


Figure 11 A.

(Case 11, Bernt S., aged 2 years and 8 months).

Clinically flexible pes planovalgus.

Xr. left foot in maximal dorsiflexion. Lateral view.

Tibio-talus angle 105 degrees.

Tibio-calcaneus angle 80 degrees.

Talo-calcaneus angle 40 degrees.

The talus-axis cuts of the lower 1/6 of the navicular and passes dorsal to the middle of cuboid. The calcaneus-axis passes through the lower 1/6 of the navicular and through the upper ½ of cuboid.

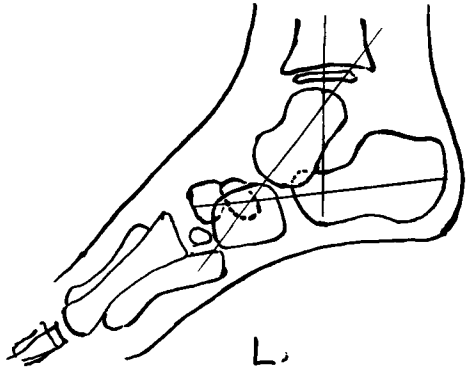


Figure 11 B.

X-ray the same foot in maximal plantarflexion. Lateral view.

Tibio-talus angle 140 degrees.

Tibio-calcaneus angle 95 degrees.

Talo-calcaneus angle 45 degrees.

The talus-axis cuts the lower ¼ of the navicular and goes above the middle of cuboid.

The calcaneus-axis passes just below the middle of the navicular and goes through the upper 1/3 of cuboid.

Discussion of Case 11

An ordinary hypermobil childrenflatfoot is examined. X-ray in lateral view without weightbearing shows in maximal dorsiflexion the wideness of the tibio-talus angle at the upper limit of what we have found in normal feet. As mentioned before however, it will be found that in some types of congen. convex pes valgus with subluxation of the forefoot we see the tibio-talus angle even smaller than here. (See Case 2, Figure 8 A, 8 B, Chapter II). But the great difference is that in those cases we have a dorsal subluxation or luxation in Choparts joint—and that don't occure in this case. With exception of the tibio-talus angle and tibio-calcan. angle the mutual relation of the axes and angles are unchanged from maximal dorsal flexion to maximal plantarflexion (Figure 11 B).

IV. A Borderlinecase where the Diagnosis of a Mild Degree of Congen. Convex Pes Valg. W. "Vertical Talus" may be Questionable

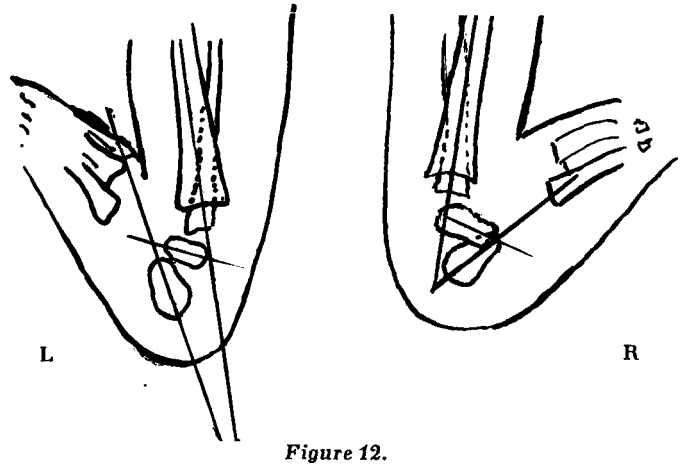


Figure 12.

(Case 12, Ole E., aged 4 days).

In the right foot was seen a severe degree of pes calcanevalgus with contracture of the tibialis anterior, the extensor digitorum communis and the peroneus brevis-tendon. Caput tali prominated medially.

Xr.: tibio-talus angle R. 100 degrees L. 80 degrees.
tibio-calcaneus angle R. 40 degrees L. 15 degrees.
talo-calcaneus angle R. 80 degrees L. 50 degrees.

The talusaxis on the right foot crosses the calcaneusaxis just anteriorly to the

calcaneus, considerably posteriorly and below the assumed location of the cuboid. In the normal left foot the talusaxis crosses the calcaneusaxis considerably anteriorly to the calcaneus and passes through the assumed location of the cuboid. Reduction was performed under general anaesthesia followed by plastercast for two weeks. During the next 5 weeks redressement exercises were performed by the mother followed by plastercast for 3 weeks and then treatment with stretchings for 3 months.

Both feet showed normal development.

Discussion of Case 13 (Compare Case 7)

The question is if this case represents a mild degree of congenital convex valgus with dorsal subluxation in Chopart's joint of the right foot. The position of talus in the anklejoint is normal, but as mentioned before, it is the steeping of the talus in relation to the calcaneus, expressed by the wideness of the talo-calcaneus angle, which decides the diagnosis. The head of talus partially covering the anterior part of calcaneus points in the same way (in accordance with the medial sliding of the head of the talus anatomically).

By imagining he location of the still invisible ossificationscentre of the cuboid we still find that the talus-axis passes considerably plantar to and behind this, and consequently we are allowed to conclude that the navicular lies dorsally to the head of the talus. The excellent result of a minimal treatment talks against the diagnosis but does not exclude it. We have too little knowledge of the effect of treatment of such borderline cases at that early age. (Compare Case 7 where the ossificationcentre of the cuboid is visible, and where the circumstances are very similar to those in this case).

V. Congenital Convex Pes Valgus with Vertical Talus in Early Age. Conservatively Treated

(Case 13, Jon K. Borne May 9. 1961, aged 7 days).

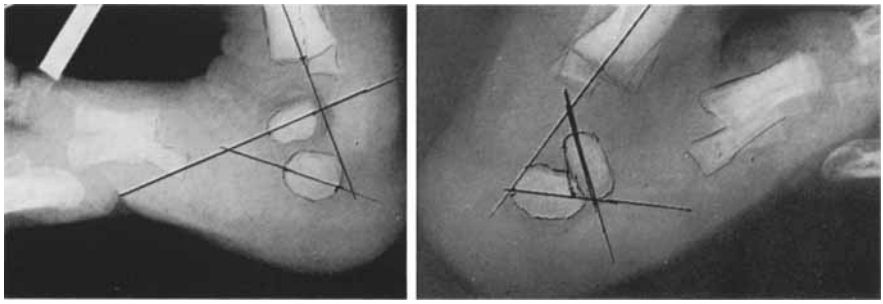
Clinically a pronounced convex pes planovalgus was found on the right side. Left foot normal. X-ray of both feet under maximal dorsal flexion, lateral view. Figure 13.

Tibio-talus angle R. 125 degrees L. 90 degrees.

Tibio-calcaneus angle R. 75 degrees L. 45 degrees.

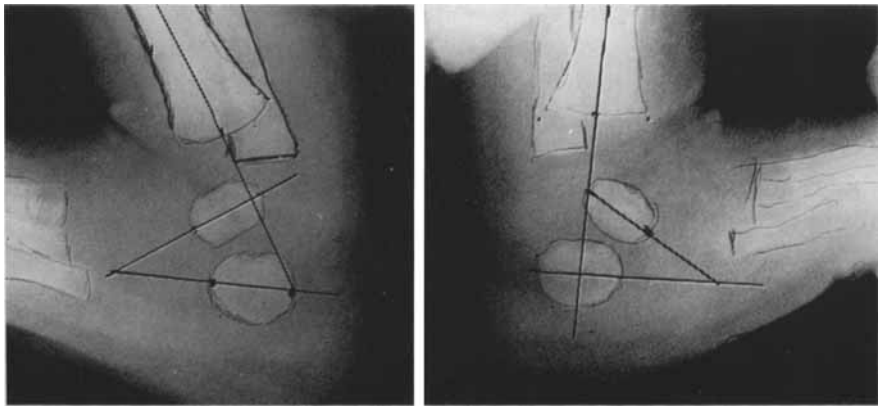
Talo-calcaneus angle R. 75 degrees L. 45 degrees.

It is seen that on the right side the talusaxis passes very close to the anterior end of calcaneus and that talus has a rather vertical position in relation to calcaneus.



L *Figure 13.* R

The *calcaneus-axis* on the right foot has a somewhat plantar direction while on the left it paralells the longitudinal axis of the foot. Reduction was performed and corrective plastercast was applied for 7 weeks followed by stretching exercised by the mother.



L *Figure 14.* R

(The same case, 13, age 5 weeks).

Figure 14. Xr. in lateral view.

Tibio-talus angle R. foot slightly reduced to 115 degrees.

Tibio-calcaneus angle R. increased to 90 degrees.

Talo-calcaneus angle R. reduced to 35 degrees.

The cause of the increased tibio-calcanear angle is here a decreased dorsiflexion in the anklejoint and the real reduction of the tibio-talus angle is in relation to this more than 10 degrees. The talusaxis now passes considerably in front of the calcaneus. The calcaneusaxis, however, still points towards planta pedis. That is: roentgenologically a moderate degree of rockerbottomfoot is still present. The normal foot is unchanged.

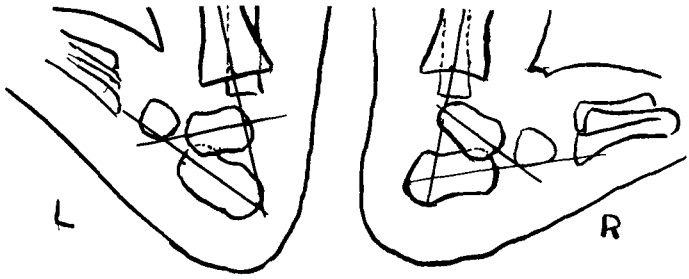


Figure 15.

(The same case, 13, age 10 months).

The cuboidial ossificationcentre is now well developed.

Tibio-talus angle R. 110 degrees L. 90 degrees.

Tibio-calcaneus angle R. 85 degrees L. 45 degrees.

Talo-calcaneus angle R. 50 degrees L. 45 degrees.

The talusaxis on both sides touches the lower border of the cuboid. The calcaneus-axis on both sides touches the lower border of cuboid. The patient started to walk at the age of one year and has since used supports. He still displays pronounced bilateral flexible pes plano-valgus. When not bearing weight, the feet look normal.

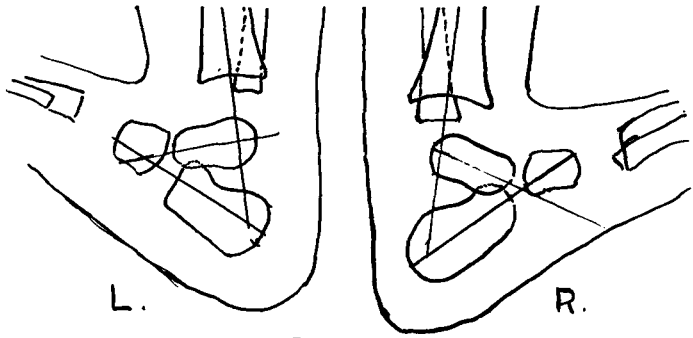


Figure 16.

(The same case, 13, age 2 years).

Tibio-talus angle R. 105 degrees L. 95 degrees.

Tibio-calcaneus angle R. 50 degrees L. 50 degrees.

Talo-calcaneus angle R. 55 degrees L. 45 degrees.

The talusaxis on the right side touches the plantar edge of the cuboid,—on the left the axis cuts off a small segment. The calcaneus axis on both sides passes the lower ½ of cuboid. Both feet have roentgenologically attained a concave longitudinal arch.

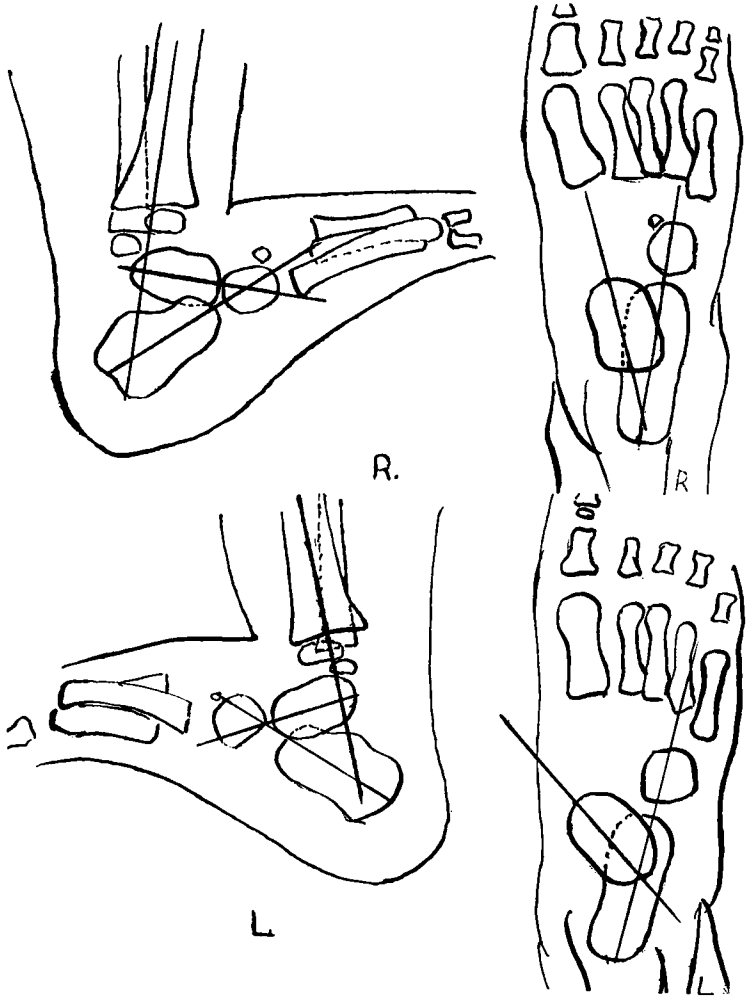


Figure 17 A and *B*.

The same case (13) aged 2¾ years.

Clinically a bilateral flexible pes planovalgus of moderate degree was seen. Without weightbearing the feet appeared normal.

The patient is using supports.

A. X-ray Right and Left foot in lateral view.

B. X-ray Right and Left foot in dorsoplantar view.

Tibio-talus angle R. 95 degrees L. 95 degrees.

Tibio-calcaneus angle R. 45 degrees L. 40 degrees.

Talo-calcaneus angle R. 40 degrees L. 50 degrees.

The talusaxis on the right goes through the middle, on the left through the lower 1/3 of the cuboid.

The calcaneus-axis on the right goes through the middle of the cuboid, on the left through the upper 1/3.

On the dorso-plantar roentgenogram the talo-calcanear angle is R. 35 degrees L. 50 degrees.

Summary of Case 13

A case of clinical as well as roentgenological rightsided rockerbottomfoot *with vertical talus*. Conservative treatment was applied from one week after birth. With minimal treatment the vertical position of talus and the equinus of the calcaneus, and hereby the rockerbottomfoot was corrected. Aged one year he started walking and since then used supports. The patient is left with an ordinary pes planus upon weightbearing, which at the age of 2¾ years is more marked on the left non treated "normal" foot (indicated by the large talo-calcaneus angle in dorso-plantar X-ray, Figure 17 B).

Discussion of case 13

The roentgenological findings were clinically manifested as a rockerbottomfoot on the right and a normal concave planta on the left. Thus the diagnosis of rightsided congenital convex pes valgus with vertical talus was in this case made by the following criteria:

1. Clinical finding of a rockerbottomfoot.
2. Tibio-talus angle markedly increased.
3. The talo-calcaneus angle well above normal in spite of equinus of the calcaneus (Figure 13).

The talus-axis passes the calcaneus-axis near the anterior pole of calcaneus, at the same time as the roentgenological projection of caput tali partly covers the anterior part of calcaneus (Figure 13).

Notice that the equinus of calcaneus is spontaneously recovered at the age of two years. (Don't be too eager to lengthen the tendo Achilles).

Notice further that the small degree of dorsal subluxation which still was seen when the child was aged 1–2 years (see Figure 15 and 16) has disappeared on the right foot at the age of 3 years. (See Figure 17 A). As this subluxation still at the age of 2 years (Figure 16) was present in the normal left foot too, it is an obvious conclusion that this late subluxation on the right foot does not be a consequence of the original congenital deformity, but is caused by the physiological ligamentary laxity seen at this age.

Conclusion of Case 13

His rightsided congenital convex pes valgus with vertical talus is changed to a common hypermobile pes planovalgus, in children, with a tendency to spontaneous healing. The treatment is then supports.

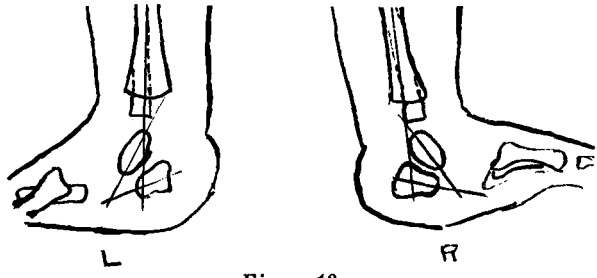


Figure 18.

(Case 14, Tom H., aged 14 days. Borne April 24, 1957. *Figure 18).*

Clinical bilateral congenital rockerbottomfoot was seen. The feet may be bent upwards so the dorsum contacted the anterior aspect of the legs. The childs struggle prevented maximal dorsiflexion during X-ray examination, and this has been taken into account on evaluating the pictures. Talus is elipsoid, but the longitudinal axis may still be evaluated.

Tibio-talus angle R. 145 degrees L. 155 degrees.

Talo-calcaneus angle R. 40 degrees L. 35 degrees.

Both calcaneus-axies points towards the plantapedis, in an equinusposition. Correction was performed, followed by plastercast for 14 days, and later stretchings were exercised by the mother. 1½ year old, when he started to walk, supports were applied. The patient was followed up for 5½ years.

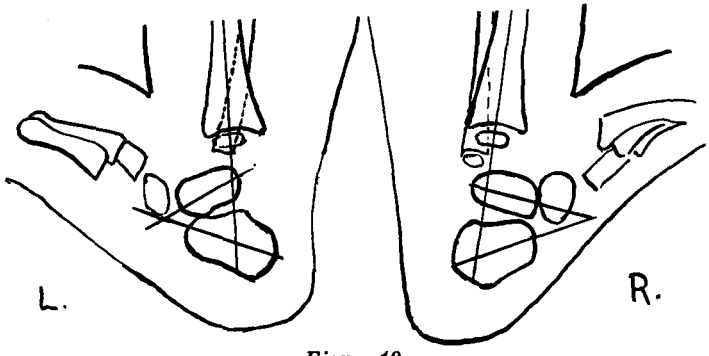


Figure 19.

(The same case, 14, age 10 months). *Figure 19.*

Feet in maximal dorsiflexion, lateral view.

Tibiotalus angle R. 95 degrees L. 110 degrees.

Tibio-calcaneus angle R. 60 degrees L. 70 degrees.

Talo-calcaneus angle R. 35 degrees L. 45 degrees.

Talusaxis on the right goes through the lower 1/5 of cuboid, on the left plantar to the cuboid, *i.e.* a steeping verticality of the talus is still present on the left foot, and a dorsal subluxation of the forefoot is present on both feet, although more pronounced on the left.

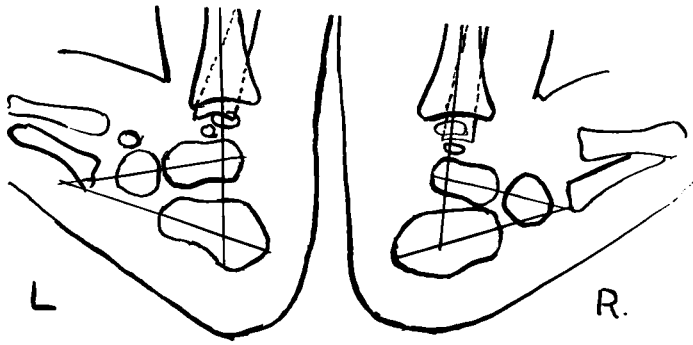


Figure 20.

(Case 14, May 27. 1958, age 15 months). *Figure 20.*

Tibio-talus angle R. 95 degrees L. 95 degrees.

Tibio-calcaneus angle R. 80 degrees L. 75 degrees.

Talo-calcaneus angle R. 30 degrees L. 25 degrees.

The talus-axis passes on both feet near the middle of cuboid.

Calcaneus-axis passes on right foot the lower border of cuboid, on left foot it passes below the cuboid.

Conclusion

Bilateral at this time no vertical position of talus, but the calcaneus-axes have still some degrees of plantar direction. The subluxation of the forefoot is not pronounced as seen half a year ago.

(Case 14, age 5½ years). *Figure 21.*

Feet in maximal dorsiflexion. Lateral view.

Tibio-talus angle R. 90 degrees L. 90 degrees.

Tibio-calcaneus angle R. 60 degrees L. 60 degrees.

Talo-calcaneus angle R. 30 degrees L. 25 degrees.

The talusaxis on both feet passes near the middle of the ossification centre of the navicular, which has now become visible on the roentgenogram. It further passes

well dorsal to the cuboid. The calcaneusaxis goes through the middle of the cuboid. *I.e.* all roentgenological findings are normal (see Figure 6, page 18, which shows a normal foot to the same age).

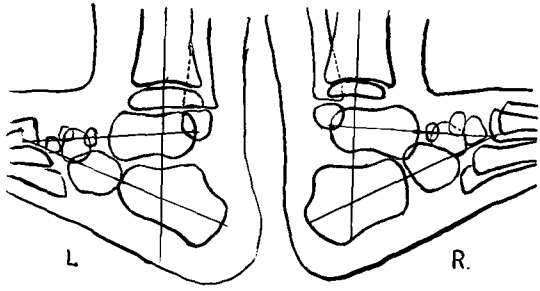


Figure 21.

Summary of Case 14

Bilateral congenital convex pes valgus with vertical talus, treated conservatively with reduction at the age of 14 days, followed by plaster-cast worn for 14 days. Later stretchings exercised by the mother. Supportive soles when he started to walk at the age of 1½ year. Control examination at the age of 5½ year shows normal feet.

Discussion of Cases Cured in Spite of a Short Conservative Treatment

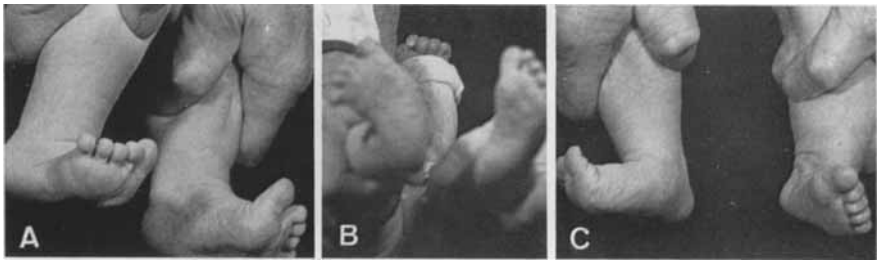
Cases 12–13–14 all show a complete clinical and roentgenological healing of their congenital convex valgus with vertical talus by only a minimal treatment. Owing to this the diagnosis may be questioned. The diagnostic facts have consequently been particulary discussed in each case.

Case 12 is characterized as a borderline case which is considered as mild.

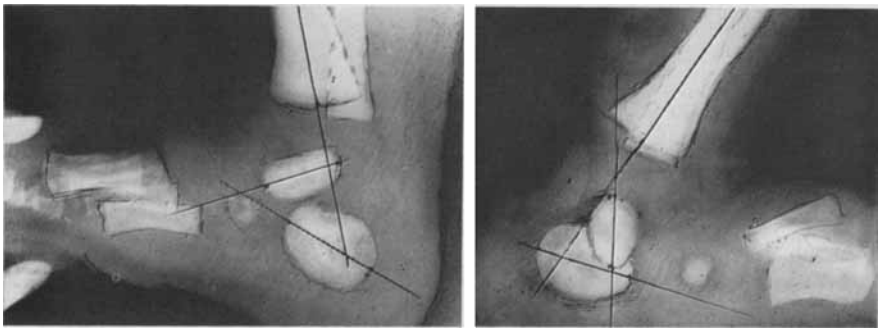
Case 13 shows criteria of having a more pronounced deformity. In case 14 the shapes of the bonecentres of talus and calcaneus are irregular, and the reliability of the axes may be questioned. But the X-rays shows later a conspicious subluxation of the forefoot as late as the age of 10 months (Figure 19).

The common characteristic of these three cases is the reduction taking place in the first days after birth. The reason why a more pronounced case as case 13 is cured by a minimal conservative treatment, when other cases of apparently the same degree needs a pro-

tracted, thorough treatment in spite of an early start, may be the great anatomical variations in this deformity, even though the outward appearance is the same.



A. Rightsided rockerbottomfoot.
B. Notice the pronounced abduction contracture on the right foot.
C. Medial projection of caput tali on right foot.



L *Figure 22.* R

(Case 15, Kjersti A., age 4 days. October 29. 1962).

Clinically a rightsided convex pes valgus with contracture of the tibialis anterius, peroneus brevis and the toe extensor tendons. There was a pronounced abduction of the forefoot (Figure 22 A, B, C). The left foot was normal.

X-ray: Lateral view in passive maximal dorsiflexion. The cuboidal ossification-center is allready visible (Figure 22 D).

Tibio-talus angle R. 150 degrees L. 90 degrees.

Tibio-calcaneus angle R. 80 degrees L. 45 degrees.

Talo-calcaneus angle R. 85 degrees L. 40 degrees.

The talusaxis on right side crosses the anterior part of calcaneus. Caput tali covers the upper aspect of this part. The calcaneusaxis goes plantar to cuboid, pointing towards the planta pedis (corresponding with the rather large lateral tibiocalc. angle). The left side is clinically and roentgenologically normal.

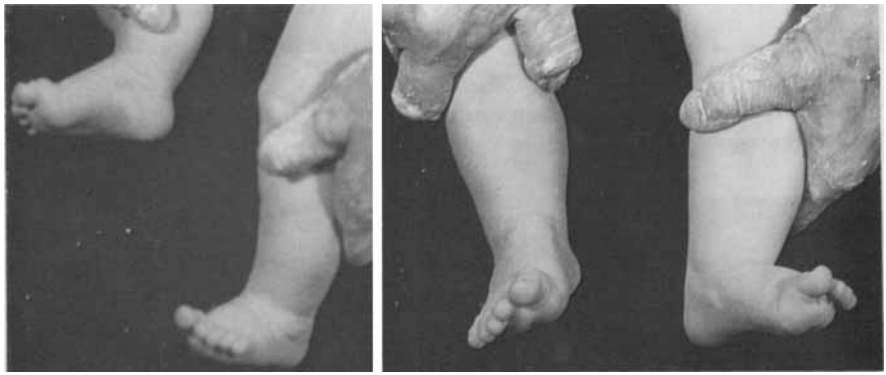
Treatment started at once with reduction under anaesthesia and following plastercasts.

Discussion about Case 15

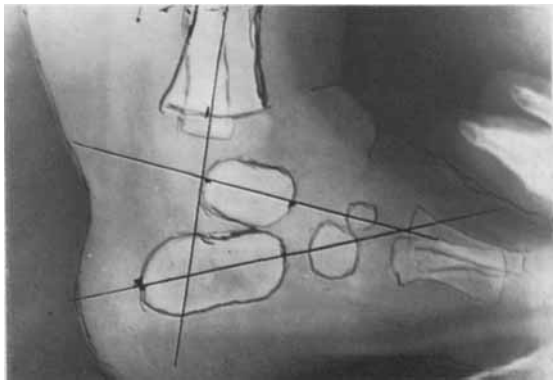
Right foot shows clinical and roentgenological symptoms of a congenital convex pes valgus cum vertical talus:

A large tibiotalusangle, a large tibiocalcaneus angle, and a large talocalcaneus angle. Cput tali covers partly the upper anterior aspect of calcaneus.

Calcaneus sshows some degree of equinus. The position of cuboid in relation to the head of talus proves that here is a dorsal luxation in Choparts joint.



A



B

Figure 23.

(Case 15, February 13. 1963, age 3½ month).

Clinically a normal looking foot (Figure 23 A). It was felt that a maximal dorsiflexion at this time might produce a reluxation and the radiography was therefore

made with the foot in 90 degrees position. The cuneiform ossificationcentre is no visible.

X-ray (Figure 23 B).

Tibio-talus angle R. 95 degrees.

Tibio-calcaneus angle R. 70 degrees.

Talo-calcaneus angle R. 25 degrees.

The talusaxis goes dorsally to the upper cuboidal border.

The calcaneusaxis passes the dorsal ½ of cuboid.

The longitudinal arch of the foot is concave. *l.e.* on control examination at age 3½ months the foot *appears clinically as well as roentgenologically normal—after treatment with closed reduction* followed by pastercast-fixation, from 4 days after birth.

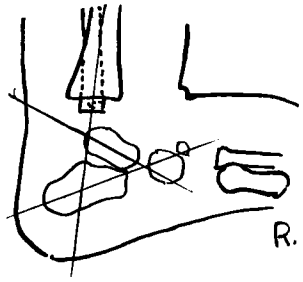


Figure 24.

(Case 15, Kjersti A., February 27. 1963, age 4 months).

A small slip was felt at the moment of careful dorsiflexion. The picture was taken with approximately 10 degrees dorsiflexion of the foot and demonstrates that the tibio-talus angle has increased to 110 degrees in spite of the increased dorsiflexion of the foot as compared to that on Figure 23. The talusaxis goes now near the lower border of the cuboid, the calcaneusaxis passes above the middle part. The talo-calcaneus angle has increased from 30 degrees to 50 degrees.

I.e. an imminent relapse is indicated by the roentgenological findings: increased tibio-talus angle, talo-calcaneus angle and the low passage of the talusaxis. The cause of the relapse is supposed to be the passive dorsiflexion prematurely made.

A corrective plastercast was again applied.

(Case 15, April 10. 1963, 6 weeks later, treated with plastercast). *Figure* 25.

The right foot in 10 degrees dorsiflexion. The roentgenological signs of an imminent relapse, as described in Figure 24, have disappeared.

Tibio-talus angle R. 90 degrees.

Tibio-calcaneus angle R. 70 degrees.

Talo-calcaneus angle R. 30 degrees.

The talusaxis passes above the cuboid, the calcaneusaxis through the upper half of the cuboid. On the *dorsoplantar* view, the *talo-calcaneus angle is approximately*

10 degrees (which is less than 1/3 the normal value, however, no adduction of the forefoot is present). *I.e.* the axes and the angles of the foot on the lateral view are normal. The plastercast was now omitted.

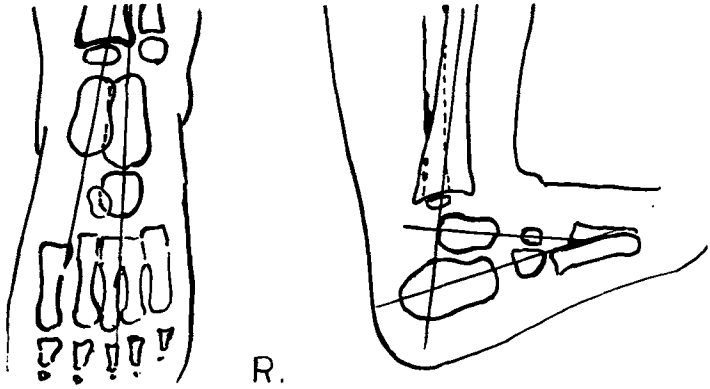


Figure 25.

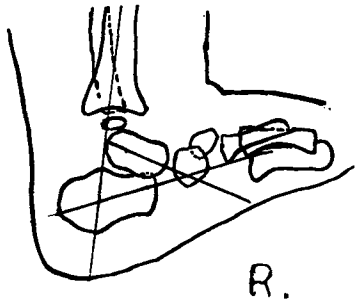


Figure 26.

(Case 15, June 12, after 2 months without plastercast). *Figure 26.*

Right foot in the same dorsiflexion as in Figure 25. X-ray in lateral view. The tibio-talus angle has increased to 105 degrees, while the tibio-calcaneus angle is unchanged (70 degrees). The talusaxis again goes near the lower border of the cuboid, as does the calcaneusaxis. The condition is very like to that before the last plastercast was applied (Februar 27, 1963, see Figure 24). However, a plastercast was not applied on this occasion, although a relapse was obviously threatning as judged by the roentgenological findings.

(Case 15, August 8. 1963, age 9 months).

Clinically a normal footarch by pressing the foot against the ground representing an attempt to replace weightbearing (why she not still has commenced standing) Figure 27 A.

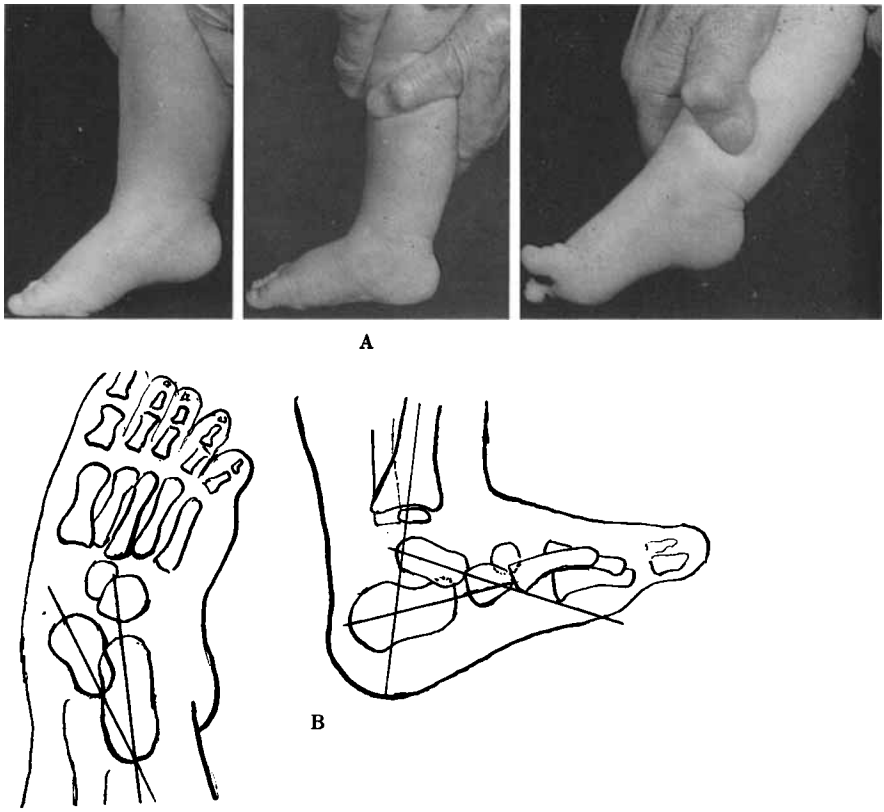


Figure 27 A and *B.*

Figure 27 B. Radiography of the right foot in dorsiflexion 10 degrees as in foregoing figures.

Tibio-talus angle R. 100 degrees.

Tibio-calcaneus angle R. 70 degrees.

Talo-calcaneus angle R. 30 degrees.

The talusaxis passes above the middle of the cuboid, the calcaneus-axis just below the middle. X-ray in dorsoplantar view demonstrates a considerable abduction of the forefoot.

The talusaxis passes considerably medial to the basis of the 1th metatarsal, but in spite of this the talo-calcaneus angle is only 25 degrees. *The reason is the adduction-position of calcaneus, and the abduction taking place in Choparts joint—not in the subtalar joints as the case is in an ordinar pes planovalgus.*

(Case 15, September 9, 1963. 10 months of age).

Clinically the abduction of the forefoot and the contracture persist. The head of the talus is prominating medially. Upon weightbearing the longitudinal arch of the foot sinks, resulting in a considerable planovalgus. X-ray lateral view. Figure 28 A.

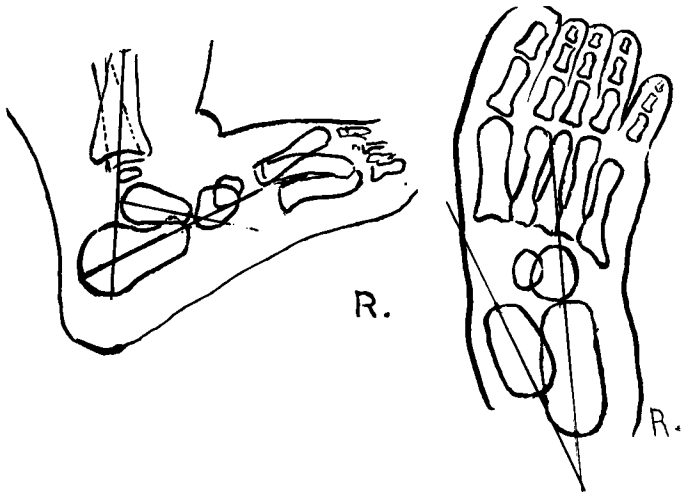


Figure 28 A.

Tibio-talus angle R. 95 degrees.
Tibio-calcaneus angle R. 60 degrees.
Talo-calcaneus angle 40 degrees.

The talus and calcaneus axes both goe below the middle of the cuboid. On the *dorsoplantar* roentgenogram the talo-calcaneus angle has increased during one month from 20 degrees to 40 degrees. Under general anaesthesia redressement was now done of the contracture and a plastercast was applied extending above the knee.

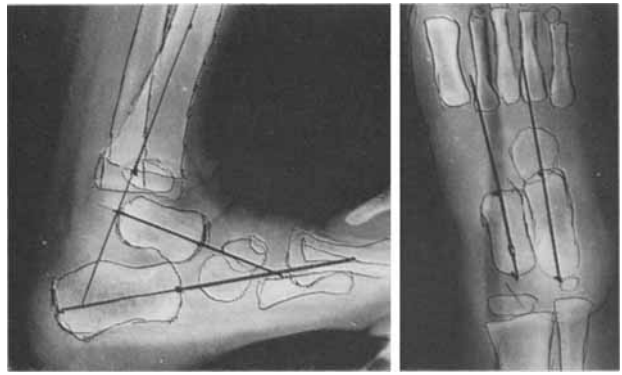


Figure 28 B.

(Case 15, October 23. 1963). *Figure 28 B.*

Shows the situation after reduction and treatment with plastercast for 6 weeks. The foot can now tolerate a dorsiflexion of more than 15 degrees which is demonstrated by:

Tibio-talus angle R. 90 degrees.

Tibio-calcaneus angle R. 60 degrees.

The talo-calcanneus angle 30 degrees (10 degrees diminished in relation to the foregoing X-ray 6 weeks ago). The talusaxis passes dorsally to the cuboid. The dorsoplantar roentgenogram now demonstrates that the talo-calcaneus angle is zero and the axis of the foot is straight. A plastercast was applied for another 6 weeks, followed by supports made after a carefully molded cast.

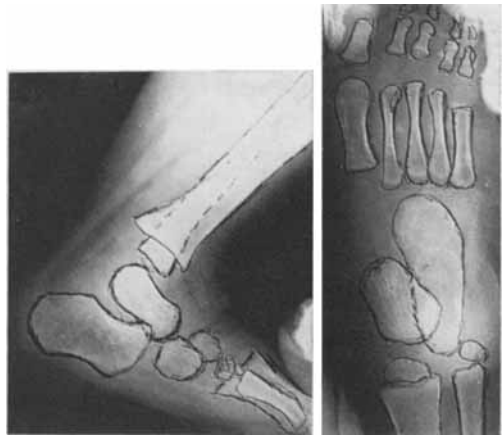


Figure 28 C.

(Case 15, December 16. 1963. 6 months later). *Figure 28 C.*

Clinically both feet appear normal. Roentgenogram of right foot in 15 degrees, of dorsiflexion, lateral view: (The unchanged X-ray of the normal left foot does not here be repeated).

Tibio-talus angle R. 90 degrees L. 95 degrees.

Tibio-calcaneus angle R. 55 degrees L. 60 degrees.

Talo-calcaneus angle R. 35 degrees L. 30 degrees.

The talusaxis on the right foot cuts off the upper $^1/_5$ of the cuboid, on the left the same.

The calcaneusaxis on the right goes near to the lower border of the cuboid, on the left a little above the middle.

Dorsoplantar X-ray shows a small tendens to abduction. The talo-calcaneus angle of 30 degrees shows that the abduction partly takes place subtalo as by an ordinary flatfoot. The plastercast is now omitted, and she starts wearing the supports.

(Case 15, Kjersti A., March 18. 1964). *Figure 29 A.*

She has worn supports since her plastercast was omitted, 16. 12. 63, 12 weeks ago. Her mother has observed that her right foot is ever more ill-looking.

There is now during weightbearing a medial prominens of the head of talus. X-ray right foot in *lateral* view and dorsiflexion 5 degrees shows:

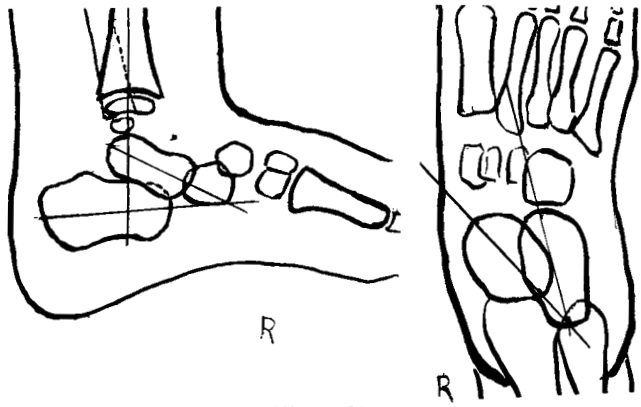


Figure 29 A.

Tibio-talus angle R. 115 degrees.

Tibio-calcaneus angle R. 85 degrees L. 40 degrees.

Talo-calcaneus angle R. 30 degrees.

The talusaxis passes the lower 1/3 of cuboid. X-ray in dorsoplantar view shows a pronounced medial direction of the talusaxis (in spite of a talo-calcaneus angle of 30 degrees) and the forefoot shows an increased abduction. Conclusion: Clinically and roentgenologically, an incipient relaps.

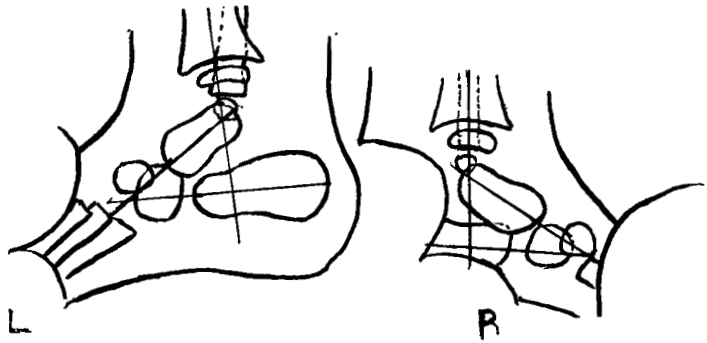


Figure 29 B.

(Case 15, Kjersti A., at the same time).

X-ray in anaesthesia. The forefoot is adducted, pronated and flexed in plantar direction and a press upwards is done under the anterior part of calcaneus. (The plantarflexion in the ankle is in this position here ca. 20 degrees).

We are seeing how the subluxation in this position is quite corrected. The criterium for this is the passing of the talusaxs near by to the dorsal border of cuboid. (Cfr. X-ray of the normal left foot). The child got plastercast in corrected position.

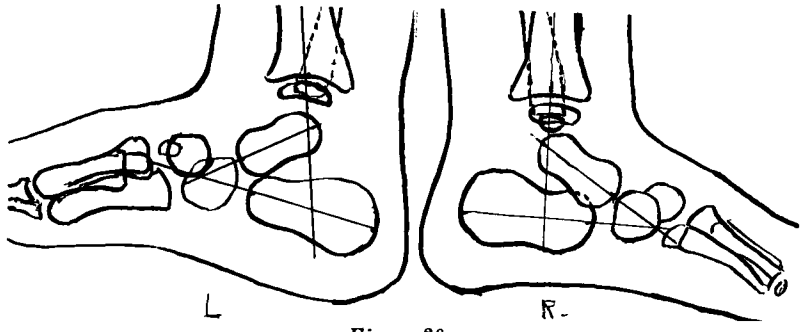


Figure 30.

(Case 15, Kjersti A., April 29, 1964. Age 2 years and 2 months).

X-ray right foot in lateral view in 5 degrees plantarflexion. She had her plaster-cast from March 18. 1964 (6 weeks). X-ray shows that her foot can stand a correction from the stronger equinus to this position without reluxation of the forefoot.

Criteria for this by judgement of the picture are:

1. Talus-axis is dorsal to the middle of cuboid.
2. Talo-calcaneus angle is unchanged 30 degrees.

The reason why the tibio-talus angle on right foot is 120 degrees is of course that the anklejoint on this side, instead of being dorsiflexed, is 5 degrees plantarflexed. Compared to the normal left foot which is radiographed in 10 degrees dorsiflexion and shows a tibio-talus angle of 105 degrees, the real position of talus at the right foot is nearly to the same as on the left.

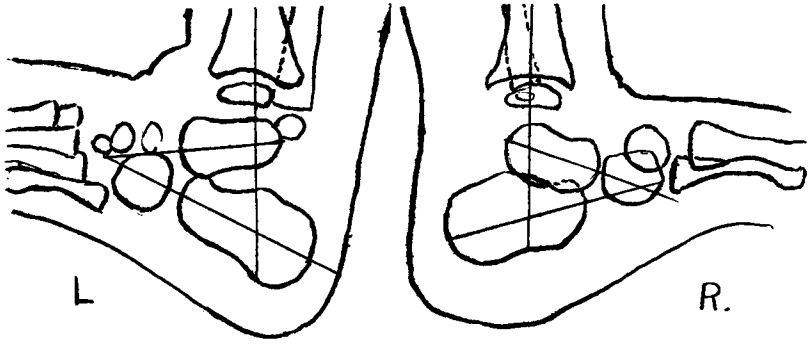


Figure 31 A.

(Case 15, Kjersti A., September 23. 1964, age 2½ years). *Figure 31 a* and *B.*

The preceding examination 5 months ago. The early 3 of these months she had a walking plasterbandage and the last 2 months she had supports.

Clinically: Both feet shows flatfoot by weightbearing. Without weightbearing a normal longitudinal arch.

X-ray: right and left foot in lateral view in dorsiflexion 10 degrees. The navicular centre is now visible on the left foot.

Tibio-talus R. 105 degrees L. 95 degrees.

Tibio-calcaneus R. 80 degrees L. 60 degrees.

Talo-calcaneus R. 35 degrees L. 35 degrees.

The talusaxis passes now cuboid below the middle (on the left foot it touches the dorsal border).

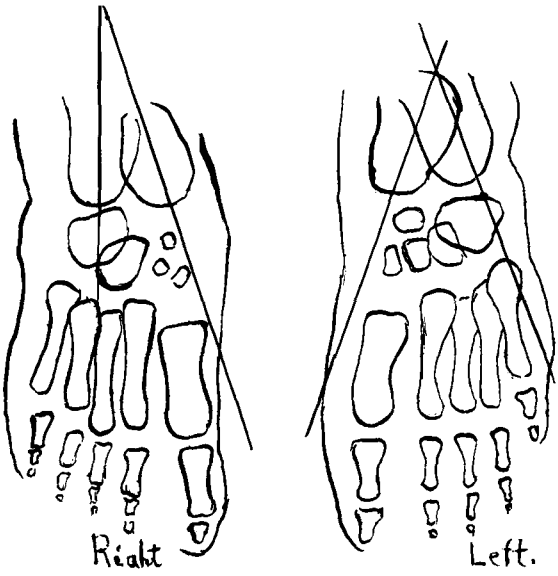


Figure 31 B.

(At the same time).

X-ray both feet in dorsoplantar view.

Talo-calcaneus angle R. 30 degrees L. 40 degrees.

Discussion

Clinically we have now on both feet a picture like that by hypermobile children-flatfoot.

The small degree of dorsal sliding in Chopart's joint seen by passive dorsiflexion on X-ray in lateral view is, as to be remembered, seen by flexible flatfoot in childhood too (see Figure 10, Case 10. P. 24).

The proportionally small dorsoplantar talo-calcaneus angle seen at the right foot is, as mentioned before due to the adduction position of the calcaneus in this deformity.

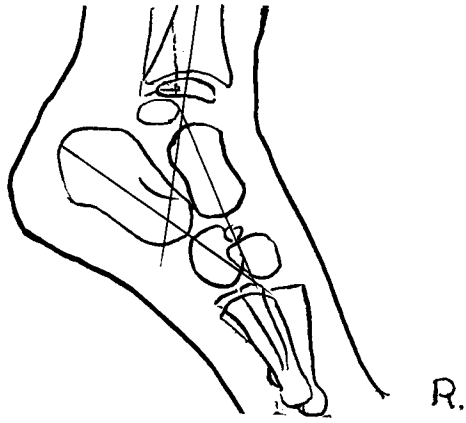


Figure 32 A.

(Case 15, Kjersti A. November 1964). She has now used her supports for 4 months.

X-ray right foot in plantarflexion 150 degrees.

The navicular centre is now visible on the right foot too. In this position there is as expected full reduction! The talusaxis is going dorsally to cuboid and through the navicular. The talo-calcaneus angle is in this position decreased to 25 degrees. The calcaneus-axis goes nearly to the middle of the cuboid.

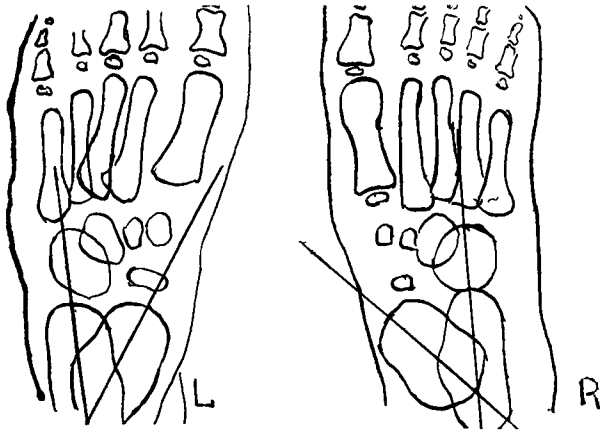


Figure 32 B.

The dorsoplantar talo-calcaneus angle is increased to 45 degrees. (Left 35 degrees).

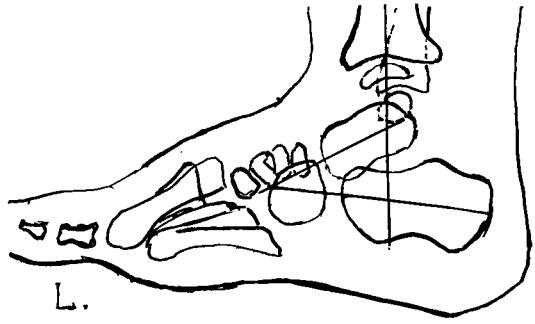


Figure 32 C.

X-ray of the left foot at the same time in lateral view gives no ideal comparison as we only have got it in 90 degrees angle in anklejoint. The talusaxis passes the dorsal 1/6 of cuboid and the lower edge of the navicular. The calcaneusaxis goes dorsal to the middle of cuboid. Lateral talo-calcaneus angle is 30 degrees. Tibio-talus angle 105 degrees. Tibio-calcaneus angle 80 degrees.

It is to be noticed that the patient last year not is examined or treated of the author, and December 11. 1964 when she was aged 22 months a lengthening of her Achilles tendon was done on right foot, as a tightness of this tendon was assumed.

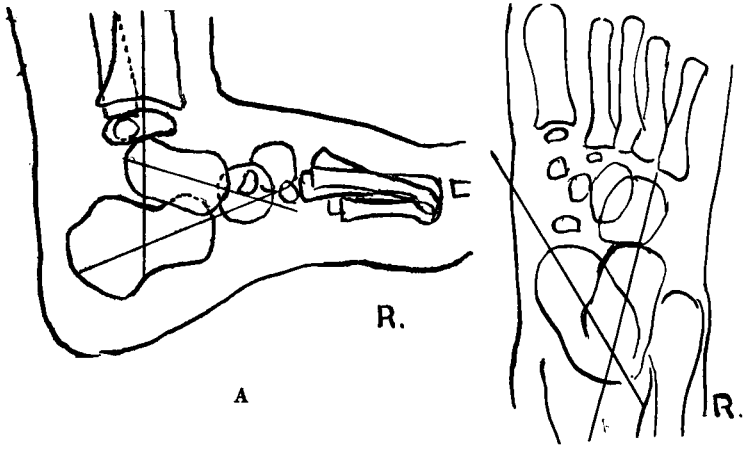


Figure 33 A and *B.*

(Case 15, Kjersti A., 5½ week after Achillestendon lengthening).

X-ray in lateral view in 10 degrees dorsiflexion.

Tibio-talus angle 100 degrees. Tibio-calcaneus angle R. 75 degrees.

Talo-calcaneus angle 35 degrees.

Talusaxis goes just below the navicular and through the middle of cuboid.

Figure 33 B.

Dorsoplantar talo-calcaneus angle 40 degrees.

The abduction located to the Choparts joint is corrected. But it is a wide talo-calcanear angle due to a *subtalar* abduction as by an ordinar hypermobile flatfoot in children.

Some Reflexions on the Lengthening of the Achillestendon

Comparisons of the X-ray 31 A before lengthening of the achillestendon with X-ray after lengthening (Figure 33 A) shows no tangible differences. The only new thing found is a more dorsal directed calcanear axis relatively to the forefoot. Because of this the longitudinal arch is a little more accentuated. This appearence is identically with the increasing of the arch following the pes calcaneus we may see by informity of the triceps-suraemuscle (f. inst. by paresis), and that does not represent a real reinforcement of the arch (see Chapter I, Case 15 Figure 35 C, Case 16 Figure 50 L). Due to the lesser resistance of the triceps surae, the dorsiflexion in the anklejoint has increased but the in lateral view not changed talo-calcanear angle, proves that the mutual relation between the talus and the calcaneus in this case are unchanged. (In other cases of similare conditions appears enlarging of the talo-calcanear angle. See page 14. "Remarks about the talocalcanear angle"). This is in accordance with experiences later mentioned in this paper, (see Chapter II, Case 1, page 79) where lengthening of tendo ach. did not be indicated, although the lengthening before the operative correction had been deemed inavitable. In consequence of these reflections I do not be quite convinced of the necessity of the lengthening of the tendon made in right foot Case 15.

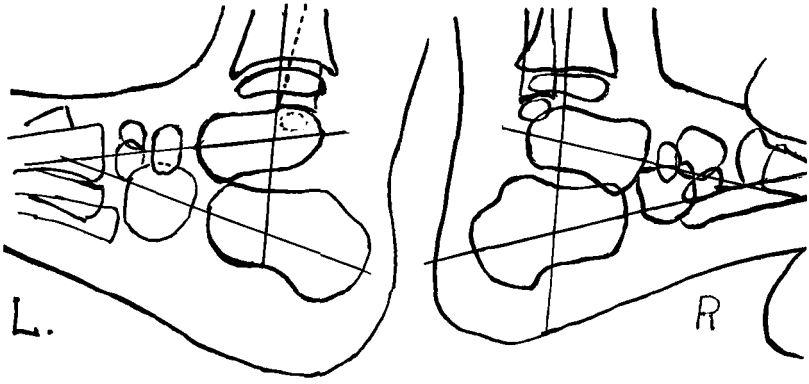


Figure 34 A.

(Case 15, Kjersti A., October 5, 1965, age 3 years and 7 months). *Figure 34 A.*

She has walked with her supports.

Clinically without weightbearing the footarch is normal. With weightbearing the footarch in some degree sinks down. There is too some degree of abduction of the forefoot.

X-ray: Tibio-talus angle R 95 degrees. The normal L 95 degrees.
Tibio-calcaneus angle R 65 degrees. The normal L 65 degrees.
Talo-calcaneus angle R 30 degrees. The normal L 30 degrees.

On right foot the talusaxis passes the lowest 1/3 of the navicular and the upper edge of cuboid. There is no subluxation of the forefoot and no steeping of talus.

I. e. X-ray right foot in maximal dorsiflexion lateral view—as on a normal foot (compare left foot on the same picture).

X-ray in dorsoplantar view right foot shows a slight abduction of the forefoot and a narrow talo-calcaneus angle (15 degrees). The talusaxis has a somewhat medial course and the calcaneusaxis has relative hereto some medial direction too. (This picture is not represented here).

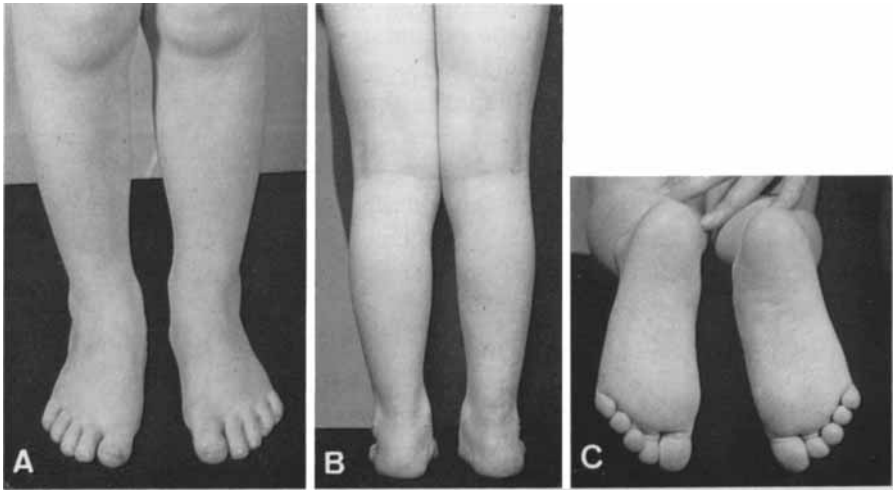
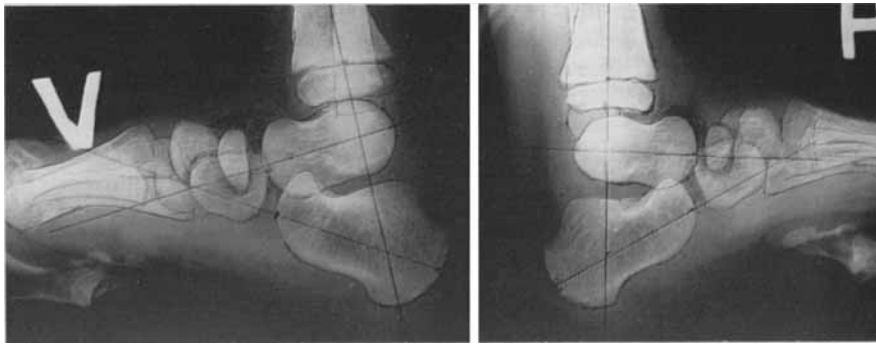


Figure 35 A.

(Case 15, Kjersti A., May 10, 1966, aged 4¼ years).

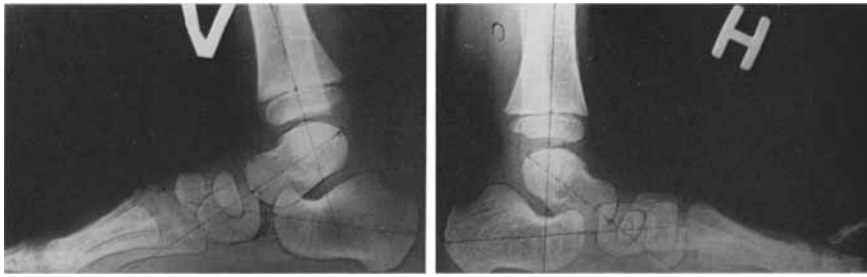
Last examination 7 months ago. She is wearing supports but they are now a little to small. Due to the Achilleslengthening the right leg is considerable thinner than the left, there is a tendency to pes calcaneus, and the dorsiflexion is in some degrees wider than on the normal left foot. The right foot is smaller and the forefoot is abducted, but the abductionposition sitting in the Choparts joint is reducible without anaesthesia—no valgus of the heels (Figure 35 A, a, b, c).



L *Figure 35 B.* R

(Case 15, Kjersti A., May 10, X-ray lateral view both feet in maximal dorsiflexion).
Right foot Tibio-talus angle 90 degrees. Left 90 degrees.
Right foot Tibio-calcaneus angle 50 degrees. Left 50 degrees.
Right foot Talo-calcaneus angle 30 degrees. Left 35 degrees.

The talusaxis passes the lower 1/6 of navicular and the upper half of cuboid on both feet. The calcaneusaxis passes the lower half of cuboid. With the exception of small differences owing to the slight variations in the roentgenological projections, —which are not possible to prevent,—show the X-rays of the right and the left foot now a marked resemblance.



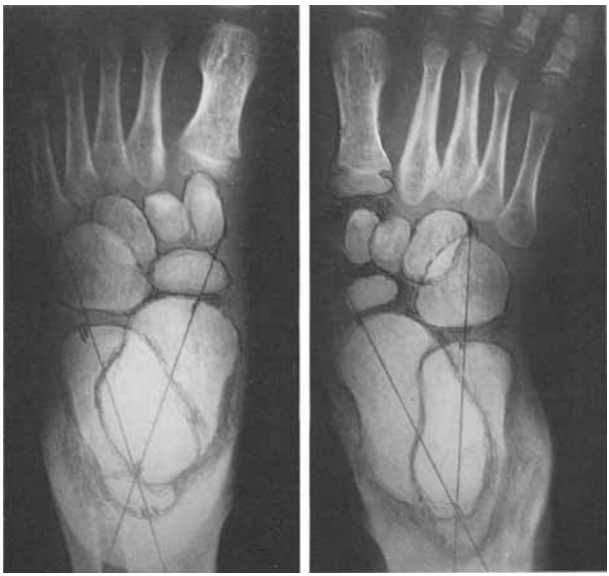
L *Figure 35 C.* R

(Case 15, at the same time X-ray both feet in lateral view *in weightbearing).*

Right foot shows a tibiotalus angle in 120 degrees. The position of the ankle is then 90 degrees. The tibio-talus angle by maximal dorsiflexion (10–15 degrees) will then be about 105–110 degrees. Left foot have an ankle position of 10–15 degrees dorsiflexion and shows a tibio-calcaneus angle of 100–105 degrees. The tibio-calcaneus angles are on the same reason 95 degrees on the right and 80 degrees on the left foot. That talus on the right side has no real steeping is signified by the talo-calcaneus angles which on both feet are 45 degrees.

Further the talus axis passes on both sides the lower ¼ of the navicular. On the

right foot is the navicular bone in its whole extention projected on cuboid, at the left side it is partly projected onto the roentgenological circumference of cuboid. The cause of this might be some difference in the roentgenological photographic rightsetting. But the projection in the other parts of the photographs of right and left foot are very homogeneous. In all probability the reason then must be the *sinking down of the navicular* as we see it in an ordinary flatfoot,—and which is here the cause of the abrogation of the footarch, contrary to the occurrence by cong. convex pes valgus with vertical talus, where the *dorsal subluxation* of the forefoot in Choparts joint is the cause of the flattening, or, in more pronounced cases, the rockerbottomfootposition.



L *Figure 35 D.* R

(Case 15, X-ray in dorsoplantar view shows the abduction of the forefoot in Chopart's joint on right foot).

The talo-calcaneus angle is only twenty-five degrees, although we have some medial deviation of the talusaxis. The cause of this is, as earlier in this paper frequently maintained, the adduction of the calcaneus which has been clearly demonstrated.

The only remainder of her primary congenital deformity is now the abduction position of the forefoot, while the dorsal subluxation of her forefoot in Chopart's joint—her congenital convex pes valgus with vertical talus,—is considered to be healed or changed to an ordinary flatfoot.

Summary of Case 15

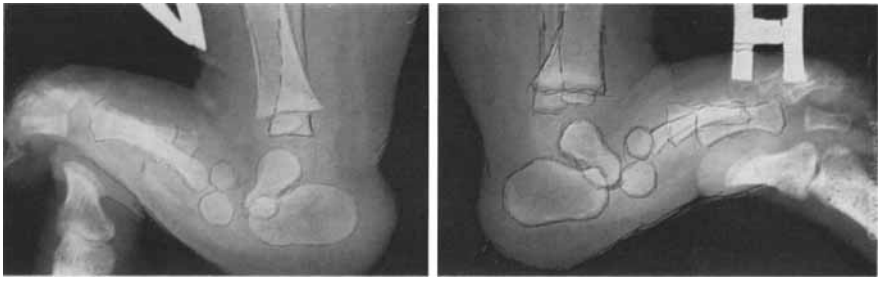
Rightsided congenital convex pes valgus with vertical talus is treated with closed reduction in anaesthesia and followed by plastercast from the age of 4 days. X-rays showed normal proportions of the bone centres continually after 3½ month. But when the plastercast at that time prematurely was omitted, and likely too caused by an incautious passive dorsiflexion of the forefoot, symptoms of relapse appeared. New casts were applied. This was repeated over and over again because of a threatening relapse also at the time when the child began to walk with supports.

One of the components of the deformity, the abduction contracture in Chopart's joint, showed a particular tendency to relapse. This abduction contracture in Chopart's joint is not to be confounded with the abduction-contracture which takes place in the subtalar joints in an ordinary flatfoot.

Examination of the child aged 3 years and 7 months shows clinically the picture of a hypermobile children flatfoot. Roentgenologically without weightbearing we find a normal foot. Examination at the age of 4¼ year shows clinically an abduction-contracture of the forefoot which can be corrected without anaesthesia. On weightbearing there is a flattening of the footarch.

X-ray in lateral view without weightbearing shows a quite normal foot. With weightbearing there is no real steeping of talus and no dorsal subluxation of the forefoot but the picture of an ordinary flatfoot.

This and the tendency to abduction-contracture in Chopart's joint still has to be treated with supports (or orthopedic shoes) and physiotherapi, (manual corredtions of the abduction-contracture and adjusted exercises).



L *Figure 36.* R

(Case 16, Ann Gun H., borne February 23, 1962).

First examination May 1962, near 3 months old.

Bilateral pronounced rigid rockerbottomfoot, (see Chapter II, Case 4, Figure 16 a, b, c, d, X-ray Figure 17, page 92–93).

Medial prominens of the caput tali and with abduction of the forefoot. (Left foot where it was necessary to do an operative reduction is treated of in Chapter II as Case 4.—In cause of the comparison will right foot in that chapter be partly described parallell to the operated too).

X-ray May 16, 1962, Figure 36.

Tibio-talus angle R. 170 degrees. L. 175 degrees.

Tibio-calcaneus angle R. 105 degrees. L. 105 degrees.

Talo-calcaneus angle from side R. 45 degrees. L. 55 degrees.

The talusaxis on the both feet cuts the upper anterior aspect of the calcaneus.

The right calcaneusaxis goes through the lower border of cuboid while the left axis passes slightly above the border. *I. e.:* There is roentgenologically a moderate equinusposition of the calcaneus. The deformity is roentgenologically more pronounced in the left foot. Attempt at correction under generel anaesthesia was at once done on both feet followed by fixation in plastercast in a position attained as near to a corrected position as possible. However for 15 weeks repeated attempts of reduction were made, and following plastercasts were applied, without success. The deformity remained uncorrected. Figure 37. September 25. 1962.

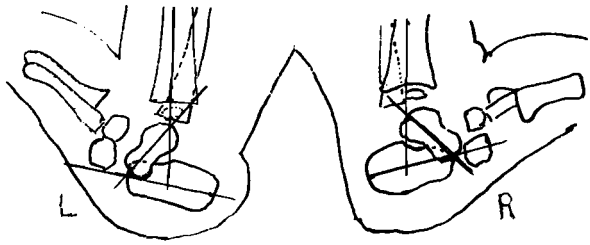


Figure 37.

The same treatment was never the less continued for another 3 months, thus giving a total time of treatment of 6½ months.

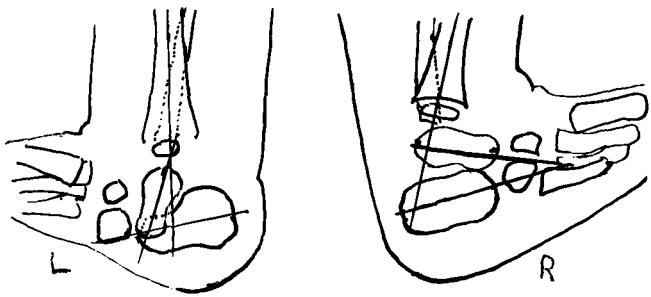


Figure 38.

(Case 16, December 19, 1962. The child was then 10 months). *Figure 38.*

Demonstrates that the *right talus now has achieved a normal position,* while the left talus is unchanged. The plastercasts was now tentatively omitted on the right foot, and control 4 months later showed the foot still normal.

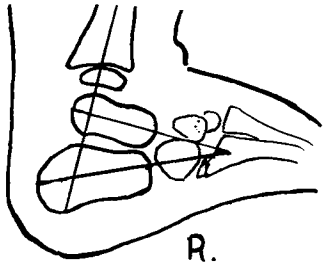


Figure 39.

(Case 16, April 24, 1963. The child now 14 months). *Figure 39.*

The tibio-talus angle is 90 degrees. The talo-calcaneus angle is 25 degrees. The talusaxis touches the upper border of the cuboid, while the calcaneusaxis cuts of the lower ½ of the bone. The minor difference in the axes, as compared to Figure 38. is caused by a slight difference in projection as demonstrated by the different position of the metatarsal bones.

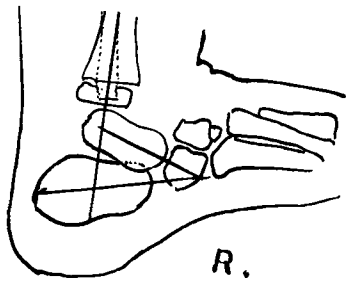
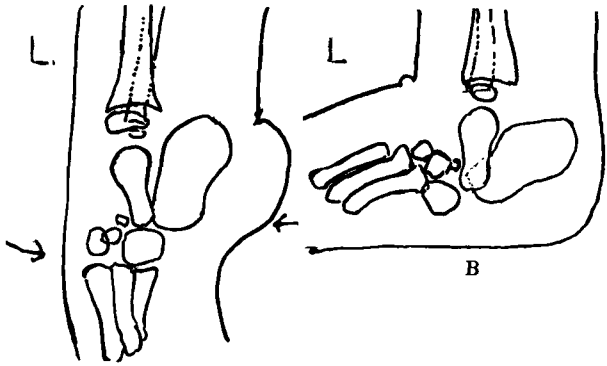


Figure 40.

(Case 16, June 5, 1963. Age 15 months X-ray in 10 degrees dorsiflexion of the ankle).

Now, after 9 months without the plastercast, the tibio-talus angle is seen to have increased from 90 degrees to 100 degrees. The talusaxis goes through the middle of the cuboid. The calcaneus axis goes through the lower part of the cuboid as before, but still more plantarly. *I.e.* There are signs of threatening relapse. Therefore a plastercast is anew applied on the right foot.

On the left foot attempts of closed reduction still were made. Figure 41 A and B shows X-ray made during the reduction manipulations in the last attempt. The anterior part of calcaneus is pressed dorsally, the forefoot just distal to the Chopart's joint is pressed plantarly with the foot kept in maximal equinus.



A *Figure 41 A* and *B.*

Why no closed reduction succeeded, open reduction on the left foot had to be performed on July 30, 1963. (See Chapter II, Case 4, page 92).

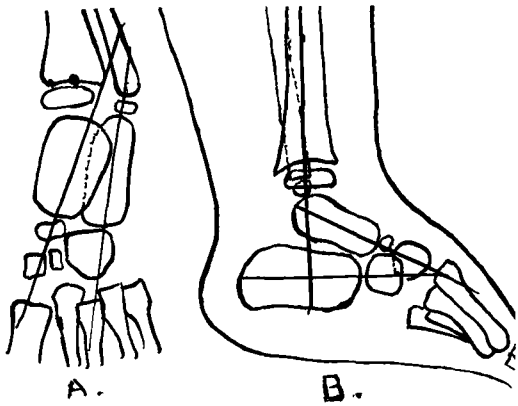


Figure 42.

(Case 16, August 21, 1963. Age 18 months).

X-ray: Right foot in 15 degrees plantarflexion, lateral view. Dorsal flexion was avoided at this moment. The ossification center of the navicular is visible.

Tibio-talus angle R. 105 degrees. (When corrected for the plantarflexion in the ankle: 105 degrees ÷ 15 degrees = 90 degrees).

Tibio-calcaneus angle from side R. 85 degrees. (When corrected for the plantarflexion: 85 degrees ÷ 15 degrees = 70 degrees).

Talo-calcaneus angle 30 degrees.

The talusaxis passes over the cuboid, and just through the plantar part of the navicular. The calcaneus axis goes just below the middle of cuboid. Figure 42 B. The dorsoplantar talo-calcaneus angle 10 degrees. Figure 42 A.

Plastercast was applied.

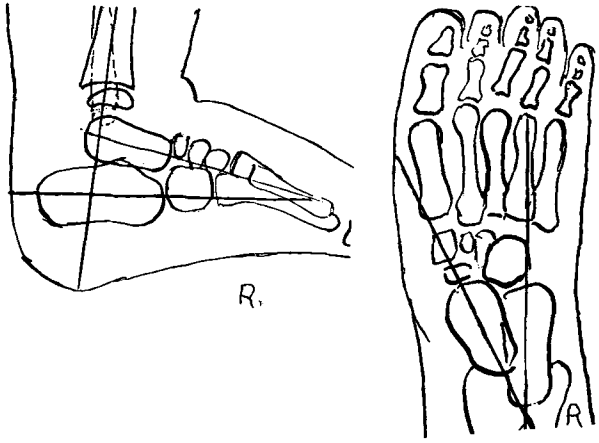


Figure 43.

(Case 16, September 18, 1963. Age 19 months).

After another month in plastercast, dorsal flexion to 90 degrees was carefully done.

Tibio-talus angle R. 95 degrees.

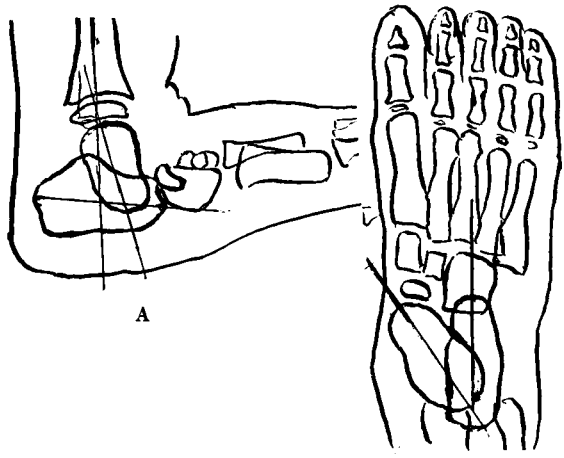
Tibio-calcaneus angle R. 85 degrees.

Talo-calcaneus angle 20 degrees.

The talusaxis passes over the cuboid, but touches the lower navicular border. The calcaneus axis goes below the middle of the cuboid. In the dorsoplantar view, the talo-calcaneus angle is 35 degrees, and there is a slight tendency towards abduction of the forefoot. The relation between the talusaxis and the navicular indicates a tendency to dorsal subluxation, and the foot was therefore immobilized in plastercast with the forefoot in plantar flexion, adduction and pronation. The cast was removed from both feet on November 6, 1963, for control examination (roentgenogram did not be made). Both feet looked nearly normal, but on the right there was a slight abduction of the forefoot and some slight medial prominens of the head of talus. A new plastercast, extending above the knee, was applied on both feet, after a plastermould for the making of supports had been made.

(Case 16, December 18, 1963. Age 22 months).

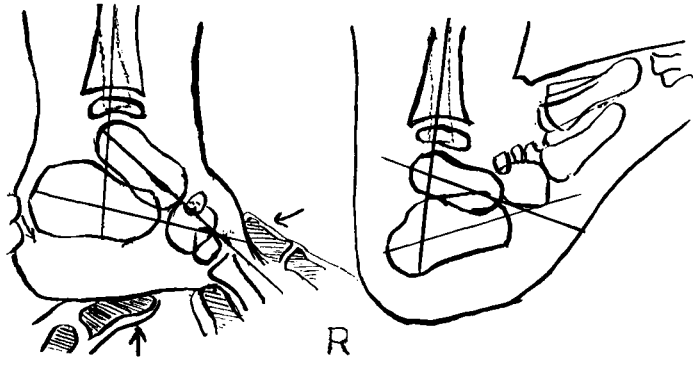
Plastercast removed. Clinically before roentgenography both feet look good. Roentgenogram with "slight" dorsiflexion, lateral view: *There is complete redislocation on right foot.* The navicular ossificationcenter is lying upon the dorsal aspect of caput tali. Talus is pressed into a vertical position of 170 degrees by the dorsally dislocated forefoot. The head of talus has also been dislocated medially to calcaneus. (There was no doctor present when the roentgenogram was taken, and the child was struggling. Figure 44 A and B.



A B

Figure 44 A and *B.*

In the dorsoplantar view, the talocalcaneus angle is 40 degrees. There is abduction in Choparts joint with a medial prominens of caput tali. The redislocation could easily be reduced without anaesthesia.



C D

Figure 44 C and *D.*

After reduction in plantarflexion it is seen that the talusaxis touches the lower border of the navicular and cuts off the upper 1/3 of the cuboid. The navicular in this position is seen to be located anteriorly to the upper ½ of the articular facet of caput tali, *e.g.* in the same position as before the re-dislocation (compare Figure 42). It is further seen, in Figure 44 C that *in spite of a pronounced plantarflexion in the ankle joint, the vertical position of talus has been reduced from 170 degrees to 135 degrees.* When correction is made for the plantarflexion in the ankle, the real tibio-talus angle in this position will be close to normal. The talo-calcaneus angle is reduced from 80 degrees to normal 35 degrees.

Figure 44 D.

Rigth foot in maximum dorsiflexion after reduction. Both talus and calcaneus are seen to have been flexed in dorsal direction.

The talo-calcaneus angle has parallell to this only increased from 30 to 40 degrees.

Tibio-talus angle R. is 105 degrees.

Tibio-calcaneus angle R. 70 degrees (normal).

The navicular lies in a subluxated position against the dorsal part of the articular facet. The dorsal pressure exerted against the talus does not longer be so effective that talus is bent into the vertical position seen in Figure 44 A.

The cause of this is that the dorsal luxation does not now longer be total. It is now a subluxation and the pressure of the forefoot acts now in a oblique direction in stead of the in first occurrence rightangled direction relatively to the talusaxis.

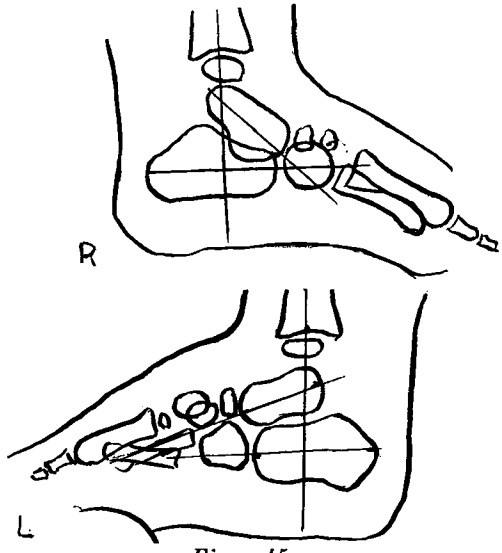


Figure 45.

(Case 16, Gun H., January 29, 1964. Age 23 months). *Figure 45.*

6 weeks past the acute relaps on right foot was on both feet without weightbearing clinically seen a good longitudinal arch. In weightbearing sinks the arch down on right foot.

X-ray both feet in plantarflexion 5 degrees shows on right side some steeping of talus and subluxation of the navicular.

Tibio-talus angle 135 degrees ÷ 5 degrees (plantarflexion in the ankle) ÷ 10 (value of the maximal dorsiflexion in the ankle) = 120 degrees. Proportionally to the verticality of talus is the talo-calcaneus angle enlarged to 40 degrees.

On left side there is no steeping of talus.

(105 degrees ÷ 5 ÷ 10 = 90 degrees) and the talo-calcaneus angle is 20 de-

grees. In accordance with this the talusaxis on right side passes through the lower half of cuboid. On left it passes dorsally to the upper border of it, but just below the navicular bonecenter. New plastercasts were applied for 6 weeks.

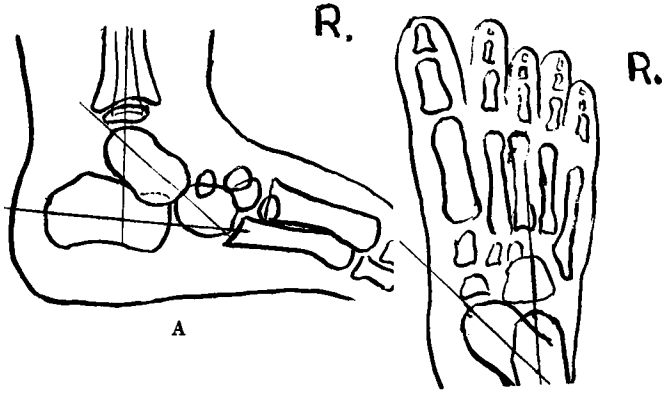


Figure 46 A and *B.*

(Case 16, Gun H., April 22, 1964. Age 26 months).

She has now been without plastercasts in 6 weeks.

X.r. with the ankle in position 90 degrees. Figure 46 A.

It is relaps of the subluxation of the right forefoot and on the left too there is a slight degree of subluxation and roentgenological rocekrbottomfoot. (See Figure 18, Chapter II, page 93).

Tibio-talus angle R. = 135 ÷ 10 = 125 degrees L. = 95 degrees.

Talusaxis goes on right foot a great deal plantar to the navicular and passes cuboid below the middle. On left it goes plantar to the navicular and goes dorsal to cuboid. (See Figure 18, Case 4, Chapter II). X. r. Figure 45 B. Dorsoplantar view, right foot shows the talo-calcaneus angle 40 degrees (left 10 degrees) and the talusaxis has a wide medial direction.

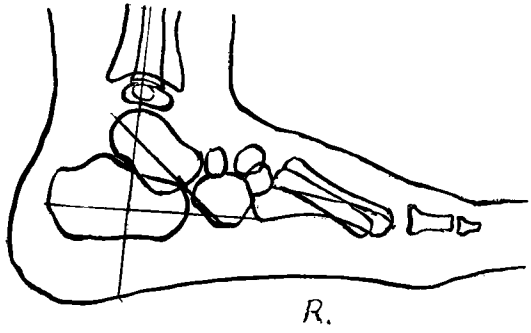


Figure 47.

(Case 16, Gun H.. July 29, 1964. Age 28 months). *Figure 47.*

She has walked with supports in 5 months. Clinically on right foot some medial projection of caput tali. (This not on left).

X. r. in 10 degrees dorsiflexion shows:

Tibio-talus angle R. 135 L. 105 (Chapter II, left foot Figure 19, page 93).

Tibio-calcaneus angle R. 90 L. 90.

The talusaxis cuts on right foot a lower small part of cuboid and formes a still more steep angle, with the calcaneusaxis at the same time as it goes at a great deal of distance plantar to the navicular which have a more dorsal position to the head of talus. *I. e.* the subluxation of the forefoot has progressed. (Left foot, see Chapter II, Figure 19 shows a normal picture).

She uses continuously her supports.

(Case 16, Gun H., November, 18, 1964. Aged 31 months).

Clinically: Right foot shows by weightbearing medial convexity and medial projection of the head of talus. Left foot shows a quite good longitudinal arch.

X-ray seen page 95, Figure 21 B, Chapter II shows quite unexpected a considerable improvement. The talusaxis passes the upper border of cuboid and the lower border of the navicular. The talo-calcaneus angle has decreased from 45 degrees to 30. The tibio-talus angle has decreased from 135 degrees to 100 degrees.

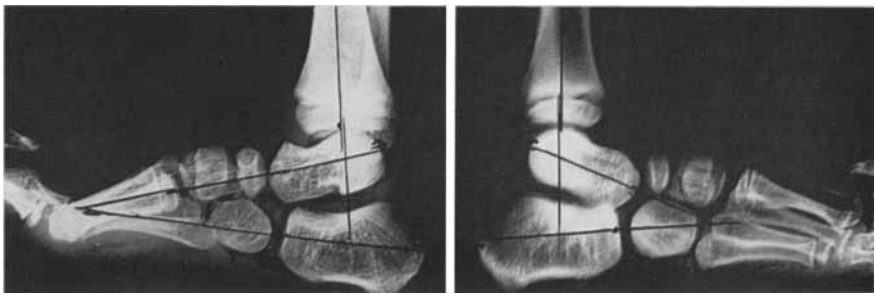


Figure 48.

(Case 16, September 29, 1965. Age 3 years and 7 months).

Clinically in weightbearing. Right foot: As before the medial longitudinal arch flattened. Leight abduction of the forefoot. Left foot: The longitudinal arch is here in leight degree at hand. From behind is seen some valgus both heels.

X-ray Figure 48. Both feet maximal dorsiflexion in lateral view. The dorsal subluxation which in November 1964 (compare Chapter II, page 95, Figure 21 A and B) showed a considerable improvement does not still show relapse, but the navicular has to high position. The tibio-talus angle is 105 degrees—the talo-calcaneus angle in lateral view has decreased to the normal 30 degrees. The same with the dorsoplantar talo-calcaneus angle to 35 degrees (see Figure 21 C, Chapter II, page 96.)

X-ray: Left foot is normal.

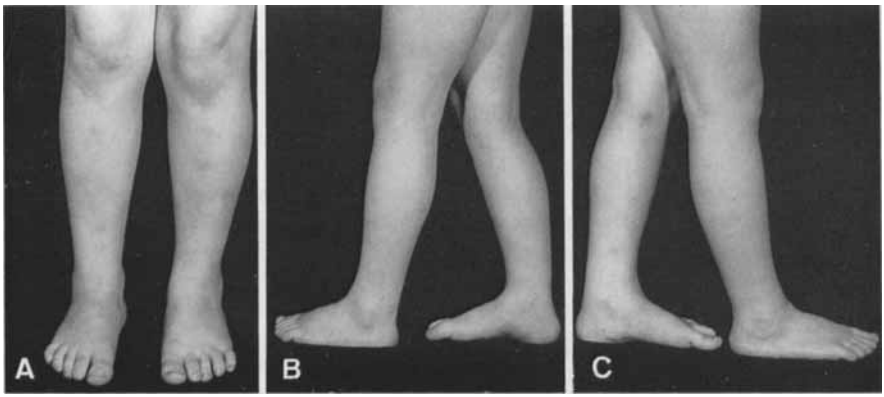


Figure 49.

(Case 16, Anne Gun H., May 10, 1966. Age 4¼ years).

Figure 49. (Case 16, Anne Gun H., May 10, 1966, age 4¼ years).

Clinically in weightbearing the footarch sinks in some degrees down, but the child is during full weightbearing able activity to elevate it. The plantar muscles are on *right* foot very well developed—and on direct inspection the footarch therefore looks flatter, than it realy is. The right foot alltogether looks more powerfull than the left operated foot. Left foot shows a rather high footarch and there is in weightbearing only a slight sinking down of it, as seen in normal feet. In plantar view shows the left foot some excavatus.

The axes of the feet looks straight.

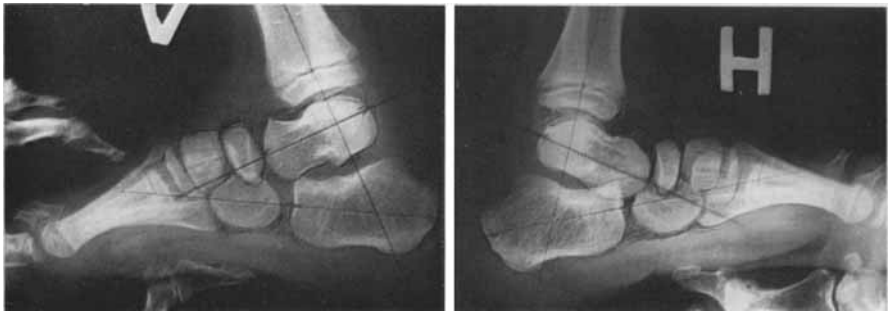


Figure 50.

(Case 16, May 10, 1966).

X-ray both feet in lateral view maximal dorsiflexion. Right foot: The dorsiflexion is more pronounced than on the picture seven months ago (Figure 48). The tibio-talus angle is 95 degrees (left 90 degrees). The tibiocalcanear angle 60 degrees (left 60 degrees).

The talo-calcaneus angle has, in spite of a smaller tibio-talus angle, increased to 35 degrees due to an increased relative dorsiflexion of the calcaneus. This suggests a stronger ligamentar connection between calcaneus and the anterior part of the foot and points to a development towards a normal state. The talusaxis touches the plantar edge of the navicular. (On the left side it cuts the plantar ¼). *I. e.* X-ray of the right foot does not show such an ideal condition as on the left foot, but there is no real subluxation. A picture like this we can see by ordinary children-flatfoot (see Chapter I, Figure 11 A, page 25).

L *Figure 51 A.* R

(Case 16, at the same time).

Figure 51 X-ray both feet in lateral view *in weightbearing.*
Tibio-talus angle right foot 115 degrees. Left 110 degrees.
Tibio-calcaneus angle right foot 90 degrees. Left 90 degrees.
Talo-calcaneus angle right foot 45 degrees. Left 30 degrees.
The talusaxis right foot passes the plantar edge of naviculare.
The talusaxis left foot cuts the plantar 1/3 of naviculare.
The talusaxis right foot passes the dorsal ¼ of cuboid.
The talusaxis left foot touches the dorsal border of cuboid.
I. e. The position of navicular with and without weightbearing is practically unchanged on both feet.

(Case 16, at the same time).

X-ray both feet in dorsoplantar view. Figure 51 B, page 52.
Right foot: Slight abduction in Choparts joint. Talo-calcaneus angle 20 degrees. Left foot slight degree of adduction of the foot with navicular in supination position and talo-calcaneus angle zero.

Summary and Discussion of Case 16

Submitted for treatment at the age of 2¾ months. Pronounced bilateral congenital convex pes valgus with vertical talus, slightly more marked on the left than on the right foot. After repeated, but unsuccessful attempts to reduce the malformation without operation, fol-

L *Figure 51 B.* R

lowed by periods of correction and immobilization in plastercast for a total of 6½ months, the right foot rather unexpectedly became reducible, and talus stabilized in a normal position (Figure 38–39). The left foot, however, still withstood all attempts at reduction, and had to be operated. The right foot was observed without plastercast for 3½ months, after which time a plastercast was again applied although the position had remained. After another 4 weeks the cast was again omitted, but after 6 weeks without the plastercast signs of relapse were present, as demonstrated by the talus axis crossing the lower part of the cuboid while on earlier examinations it went close to its superior border. Further, the tibiotalus angle has increased (Figure 40). To meet this threatening relapse a plastercast was again applied. In control examination 3 months later, dorsiflexion of the foot was carefully omitted, and therefore the roentgenogram was taken in plantarflexion. Normal position of the tarsal bones were seen (Figure 42). The navicular ossification center had now become visible. After another 4 weeks in plastercast, a roentgenogram was taken with the foot in approximately 5 degr. dorsiflexion. The talus axis now goes just below the navicular, which has remained near to its former position at the superior half of the articular facet of the caput tali. However, it appears to be located slightly more dorsally. A dorsoplantar roentgenogram

shows a slight abduction of the forefoot. Although the tibiotalus angle in lateral view was 95 degrees, one did not feel that the stability of the achieved reduction should be trusted, and a new plastercast was again applied, to avoid re-dislocation. The foot was immobilized with the forefoot in marked plantarflexion, adduction and pronation. On control 4 weeks later the position was to some extent improved. The navicular lies at the upper part of the articular facet of caput tali, but except for this slight deviation, conditions are satisfactorily with normal axes (Figure 43).

Upon changing of the plastercast 5 weeks later, a roentgenogram was not taken, but a note was made that there was some abduction of the forefoot on inspection. This indicates that the stability at this time was unsafe. Moulds were made for supports to be made, and the plastercast continued. Though the feet upon removal of the plastercasts 7 weeks later clinically "looked nearly normal", *the following radiography showed a dorsal complete reluxation of the forefoot accompanied by a marked vertical position of talus* (Figure 44 A, B). The clinical picture at the same time was quite changed according to this.

The anxious child has been struggling during the X-ray examination, —and the explanation of the acute relapse is that this struggling has brought about a too vigorous passive dorsiflexion by keeping the foot in site during the X-ray procedure, when no doctors were present. However, the dislocation could now easily be reduced without anaesthesia contrary to the situation before the first reduction succeeded one year ago (Figure 44 C). After the reduction an erection of talus was observed.

An attempt of dorsiflexion was cautiously made too the try the stability. The complete dislocation did then not occur,—only a subluxation, and some steeping of talus occured parallell to this (Figure 44 D). The condition of the right foot should be considered satisfactorily from the time full reduction was supposed to have succeeded. Nevertheless, the navicular remained in its somewhat dorsal position in front of the upper part of the articular facet of caput tali, but this may also be seen in normal feet (see Case 6), and the navicular in Case 16 remained above the talus axis even after what appeared to be a complete correction of the redislocation achieved by maximal plantarflexion of the forefoot (see Figure 44 C). As the patient came for treatment relatively late and reduction did not succeed until 6½ months later, the position of the forefoot achieved at the correction must have been very unstable, due to the before mentioned changes

that occur of the caput tali. Therefore, passive dorsiflexion past 90 degr. should not have been exerted on control examinations at that time. By the dorsal luxation of the forefoot talus had been forced into the vertical position at the moment of dislocation, its distal part being pressed from above.

As pointed out above, this is a demonstration of how the primary congenital dorsal subluxation or luxation in Chopart's joint produces a secondary vertical talus. *This implicates certain therapeutic consequences.*

The further development of the right foot after the total reluxation shows that a safe position was not achieved for a long time.

By using supports a good improvement was certainly obtained, but the navicular always remained positioned a little too high (Figure 45, 46, 47 Chapter I, Figure 21B, page 95, Chapter II). This was also seen during the first time after operation at the operated left foot. (Figure 18, Chapter II). But on this side an improvement to a normal foot took place quite quickly, while on the right side treated with closed reduction a tendency to relapse persisted until the child was about 3 years.—Then a tardy improvement occured.

No other treatment than supports was used. After 4 years the improvement to an ordinary reducible flatfoot of common type is incontestable. She is able to elevate the footarch actively in full extension (Figure 49 B, C).

And X-ray in full weightbearing shows no dorsal subluxation of the navicular although it is not so accurately centered to the articular facet of the head of talus as on the operated left foot.

The somewhat steep position of talus in weightbearing (Figure 51) is not more than seen by ordinary soft childrenflatfoot (compare Figure 11 A). The continuous treatment is supports or orthopedic shoes, and full recovery to a quite normal foot is to be expected in the future.

VI. Comparison Between the Roentgenogram in Congenital Convex Pes Valgus with Vertical Talus and the Rockerbottomfoot Deformity Seen as Complicatien in Cases of Talipes Equinovarus Congenita which are under Treatment

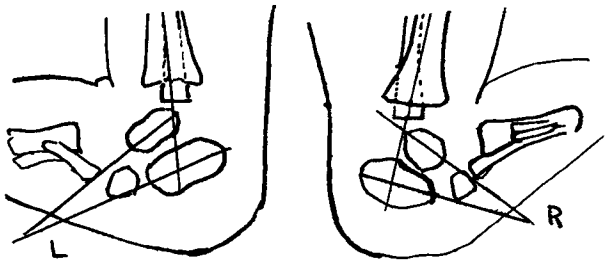


Figure 52.

(Case 19, Morten H., 7 weeks old).

Treated for bilateral clubfoot. Bilateral rockerbottomfeet have occurred during this treatment.

Roentgenogram in maximum dorsiflexion. Lateral view.

Tibio-talus angle R. 105 degrees L. 110 degrees.

Tibio-calcaneus angle R. 90 degrees L. 110 degrees.

Talo-calcaneus angle R. 20 degrees L. 10 degrees.

The talusaxis on the right passes the upper border of cuboid, on the left it passes considerably more dorsally to the bone.

The calcaneus axis touches the lower border of cuboid on both feet.

The size of the tibio-talus angle and the tibio-calcaneus angle differentiates not mutually very much as the equinus position of calcaneus expressed through the tibio-calcaneus angles here is relatively wide. In consequence of the small difference between the two mentioned angles, the talo-calcaneus angles will be small.

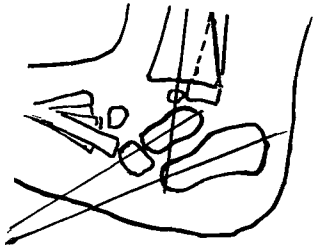


Figure 53. L

(Case 20, Hilde H., 18 weeks old).

Left-sided clubfoot with secondary rockerbottomfoot.

Roentgenogram of left foot in forced dorsiflexion.

Tibio-talus angle L. 120 degrees.

Tibio-calcaneus angle L. 110 degrees.

Talo-calcaneus angle L. 5 degrees.

The talusaxis cuts off the upper ¼ of cuboid. The calcaneus axis goes considerably below it.

I. e. like in preceding case we here see a very small difference mutually in the size of the tibio-talus to the tibio-calcaneus angle and the talo-calcaneus angle is consequently very small. The passing of the talusaxis proportinally in the upper part of cuboid contradicts a dorsal subluxation in Chopart's joint.

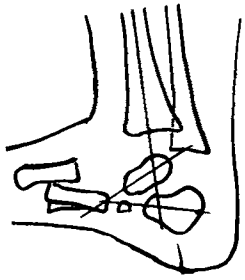


Figure 54.

(Case 21, Jon J., aged 6 weeks).

Clubfoot, successfully treated without the occurrence of a rockerbottom deformity. Roentgenogram in dorsiflexion.

Tibio-talus angle 115 degrees.

Tibio-calcaneus angle 85 degrees.

The talusaxis and the calcaneus axis cross at a 45 degrees angle. The talusaxis passes dorsally to cuboid the calcaneus axis goes through the upper border of cuboid.

Summary and Discussion

The here demonstrated three cases of corkerbottomfoot occuring during treatment for congenital talipes equinovarus have the following peculiarities in common: The equinus of talus is relatively small as compared to that of calcaneus. Further the equinus of calcaneus is bigger than the one commonly observed in congenital convex pes valgus with vertical talus. The consequence of the mentioned facts is that the talo-calcaneus angle is small or even non-existing.

In congenital vertical talus and in cases of successfully treated clubfoot (see Figure 54) like normal feet there is a marked convergence between the talus- and calcaneus axes, which cross each other at angles of 25–40 degrees or more. Correspondingly the articular space is supposed to become narrower anteriorly. It is further seen that the

talusaxis by the rockerbottomfoot by clubfoot in spite of the steeping of talus constantly passes dorsally to or through the superior part of the cuboid, in contrast with the finding in congenital convex pes valgus with vertical talus. The cause of this may be that by the secondary rockerbottomfoot in pes equinovarus generally no or only a slight dorsal subluxation in Chopart's joint is present, whereas this in cong. convex pes valgus w. vertical talus is the most important appearance.

Survey of the Material of Chapter I and Discussion

A favourable result by conservative treatment in congenital convex pes valgus with vertical talus depends on an early diagnosis and an early start of the treatment.

When on clinical examination a congenital rockerbottomfoot is seen, the disorder may be suspected, but the diagnosis of a vertical talus can only be settled, through roentgenological examination.

During the first days after birth the roentgenogram often shows only the ossification centres of talus and calcaneus, which in addition may display irregular forms at this early stage. Therefore the roentgenological diagnosis at this time may often be rather difficult. In order to arrive at the correct diagnosis, it was deemed necessary for the sake of comparison to establish the pattern in normal feet, as well as in conditions which clinically may resemble the picture of vertical talus.

The investigation has shown that the time for the roentgenological appearance of the ossification centres of the tarsal bones vary considerably (*Köhler* 1953). In the present material the centre of the cuboid became visible on the roentgenogram from the 3rd–4th day and up to the 20 th day after birth. The cuneiformI–II and III become visible later than the cuboid, but considerably earlier than the navicular, and therefore may be misinterpreted as being the navicular by an unexperienced examiner.

The navicular centre appears from 1½–4 years of age and its lower ⅓–¾ or more is often covered by the cuboidal ossification centre. A homogenous rightsetting in making the X-ray photographs is obviously difficult to obtain, and this must of course be taken into consideration by judgement of the pictures.

In order to decide the vertical position of talus in the anklejoint and mutual position of caput tali and the navicular, before the appearance of the actual ossification centres, the earlier mentioned axes and angles have been applied.

To establish a comparable and constant basis for comparison of the vertical position of the talus in the different cases, all feet have been photographed in the lateral view in maximal dorsiflexion, except in a few cases where certain circumstances prevented this. The tibiotalus angle in the present material of normals varied from 50 degr. (Figure 1) —105 degrees. (Figure 5). The tibio-calcaneus angle normally varied from 10–75 degrees. This maximal value is probably too low, but valeus above 85 degrees consistently seem to indicate equinus position of calcaneus presupposed that the foot has been X-rayed in maximal dorsiflexion. (See earlier notes about the evaluation of the parameters). The posteriorly open angle between the axes of talus and calcaneus (the talocalcaneus angle) was normally found to be in average 25–35 and always less than 55 degrees. In cases of congenital convex pes valgus with vertical talus this angle generally is wider than normal and may reach values of 80–90 degrees (Figure 22 and Figure 44 A). In simultaneous equinus of the calcaneus the angle will be decreased, and obviously more the higher the degree of equinus of calcaneus and the less the verticality of talus. But even in cases with relatively moderate vertical position of the talus and equinus of calcaneus, the angle in the present material by v. talus wes never observed to be less than 40 degrees (as compared to the observed limit of 50 degrees in normal feet). (Figure 7 R shows 55 degrees but is an exception, see page 20). Case 16, page 59, Figure 48 right foot shows the talocalcaneus angle diminished from 70 degrees to 30 degrees after conservative treatment, and the left to 25 degrees after operative treatment. About the enlarging of the talocalcaneus angle by increased dorsiflexion of calcaneus, but without changing in the position of talus, following lengthening of the Achillestendon and other causes of reduction of the achillesfunction see page 14. "Remarks about the talocalcan. angle, and page 47". Some reflexions about lengthening of the achillestendon". In cases rocker-bottomfoot seen during treatment for congenital clubfoot, the talocalc. angle was only a few degrees or non-existing (Figure 52 and Figure 53). The equinus position of calcaneus in these cases was rather dominant in relation to the vertical (or: "equinus") position of the talus. For the evaluation of the position of the imaginary bone center of the navicular, and thereby diagnosing a dorsal subluxation in Choparts joint, an examination was made of the mutual relationship between the longitudinal axis of the talus and the ossification centre of cuboid. In maximal dorsiflexion the talus axis normally cuts through the middle of cuboid or through the upper half of the bone (Figure 3 L) or passes

the bone dorsally (Figure 3 R). In early childhood and by hypermobile flatfeet by children when on X-ray a vigorous pressure is exerted under the forefoot, the resulting talus axis may cut through the lower half of cuboid (Figure 5) and even touch the lower border of the bone (Figure 8 left) or pass just below it (Figure 4 left foot). This is due to a yielding of the hypotonic ligaments, resulting in a dorsal movement in Chopart's joint but without any real subluxation. When examined four years later, in aequal situation the talus axis was found to touch the *upper* border of cuboid. The former hypotonicity of the ligaments, which permitted the abnormal dorsal movement in Chopart's joint was assumed to have disappeared spontaneously at this time, leading to the observed change in the course of the talusaxis proportionally to cuboid. Concerning the talusaxis, the same findings as in normals are seen in cases with "benign" pes calcaneus in the new-born (Figure 7 L and 8), in congenital pes calcaneovalgus (Figure 9 A, 9 B and 9 C) and in pes planus in children (Figure 10 A, 11 A, B).

In the presence of vertical talus, the long axis of the talus will pass below and behind cuboid (Figure 12 right, Figure 13 right, Figure 22 right foot and Figure 36 both feet), and may cut through the anterior part of calcaneus or pass the bone anteriorly rather close to its anterior border (Figure 22, Figure 36 and Figure 13 right foot). During treatment, when the dorsal subluxation of the forefoot in Chopart's joint and the vertical position of talus are being gradually reduced, one can observe how the talus axis gradually changes its course and cuts through the cuboid more and more dorsally (right foot on Figure 13, 14, 16 and 17). However, *one must keep in mind that the vertical course of the talus axis does not alone decide its relation to the cuboid,* but the extent of the subluxation of the forefoot has a considerable influence on this relation. As it is evident from Case 2, Figure 8 B, page 83, a considerable luxation of the forefoot is by particular circumstances followed by only a small steeping of the talus. In this event the talusaxis is passing below cuboid independent of the small extent of the steeping. As before maintained, the greatest difficulty that may be encountered in attempting to diagnose a vertical talus immediately after birth, is the triangular or even circular shape of talus sometimes seen at his early age, making the drawing of the longitudinal axis questionable (Figure 1 R). An elipsoid form of the ossification centre makes the drawing of the axis much easier (Figure 18 L). In all cases treatment with reduction of the rocekrbottomfoot and with corrective plastercast may be started at once, as if a vertical talus had been diag-

nosed, and in a short time, when the ossification centre of talus had achieved a shape that permits the drawing of a more unquestionable axis, the diagnosis can be reviewed. More doubtful cases should not, however, be *listed* as congenital convex pes valgus with vertical talus, because this will lead to a better prognosis for conservative treatment than deserved.

Also calcaneus may during the first days after birth present a radiological shape that makes the drawing of the longitudinal axis difficult (Figure 18 L). In the present study, the observations made at later ages seemed to prove that the axis drawn at the early examinations were correct.

Pronounced congenital pes calcaneo-valgus with contractures, which clinically presented a rockerbottomfoot but *radiologically without vertical talus or subluxation,* was demonstrated in an otherwise healthy girl aged 10 months (Case 9). The contractures in this case (of tibialis anterius, the long toe extensors and the peronei) were so firm, that they could only be corrected by using a considerable force under general anaesthesia and after two reductions. Figure 9 A demonstrates that the skeleton of the foot is normal. Observation at the age of 9 years shows a normal development of the foot. Congenital convex pes valgus with vertical talus is most often accompanied by pes abductus, with a medially prominating caput tali(Chapter I, Figure 22 B). The dorsoplantar roentgenogram, however, demonstrates a *reducion* of the talocalcaneus angle, contrary to what is found in the ordinary pes planovalgus. The reason for this is, that a concommittant adduction of calcaneus is present in a great part of cases with congenital dorsal subluxation in Chopart's joint, that more than outweighs the increase of the dorsoplantar talo-calcaneus angle caused by the medial deviation of the talus axis, and thus leading to a resulting decrease of this angle. As demonstrated in Case 15 this reduction of the talo-calcaneus angle is accentuated after correction has been performed, when the angle may be reduced to 5–10 degrees or even to zero, the axes running a parallell course (Case 15, Figure 28 A, B). Essentially there is an anatomical difference between the abduction seen in cases with congenital vertical talus and those in ordinary pes planovalgus. In the first case the abduction mainly or entirely takes place in Chopart's joint. In the second case the abduction is part of an ordinary pronation movement: Calcaneus, connected with the forefoot, makes an abduction in relation to the talus, which is fixed in the ankle joint. As known thereby the angle between calcaneus and talus (in the dorsoplantar view) is

increased. In some cases of vertical talus, however, there is no adduction of calcaneus and then the dorsoplantar talocalcaneus angle is wider Chapter II, Case 1, Figure 3 B, Case 7, Figure 8 C left, page 83).

Treatment

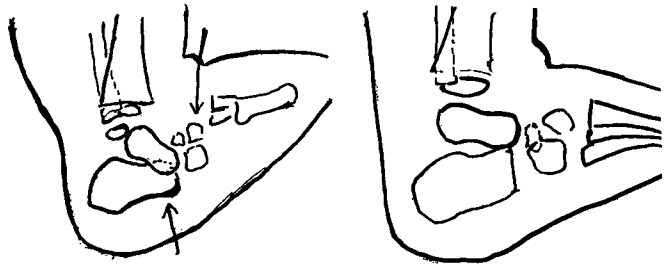
A distinction is made between the cases that permit non-operative ("closed") reduction and those where an operation is needed to achieve reduction ("open red."). The age of the patient is decisive as to whether the disorder will need operative treatment or not. In the present material, non-operative reduction was possible in all cases where *purposeful* treatment was started during the first days after birth. That this may not always be the case, was clearly demonstrated by *Günz* (1939), who reported the post mortem findings in a new-born of rigid contractures that could only be lessed through extended tenotomies and cutting of ligaments (see page 11). In addition to the cases treated of an early age, non-operative reduction was achieved in one patient where treatment was started at an age of 2½ month, but the reduction did not succeed before the age of 9½ month. (Case 16, Figure 36 R). This case was the only one where closed reduction at such a high age succeeded, but at the same time it displayed a more marked tendency to resubluxation compared to the operatively reduced foot. The explanation for this is the persisting pull of the not intersected ligaments.

It looks however as if the tendency to re-subluxation successively is decreasing, when the child is using suports preferably combined with increased height of the heels of the shoes, Figure 57. It is then provided that a real reduction has originally been performed. Elimination of the resistance brought about by the contracted ligaments is the key to a successful reduction both in non-operative and operative treatment. The teno-muscular resistance may relatively easily be overcome.

The ligaments mainly involved (see Chapter II, Figure 1 and 2) are: lig. talonaviculare dorsale and lig. tibio-naviculare, which at operation are found to be hypertrophied, preventing reduction of the dorsal component of the dislocation. Further the lig. talo-calcaneare interosseum which resists reduction of the laterally dislocated calcaneus. And finally, the lig. calcaneocuboideum tends to prevent reduction of the abduction of the forefoot seen in Chopart's joint (Figure 1 a, b, section II, page 76).

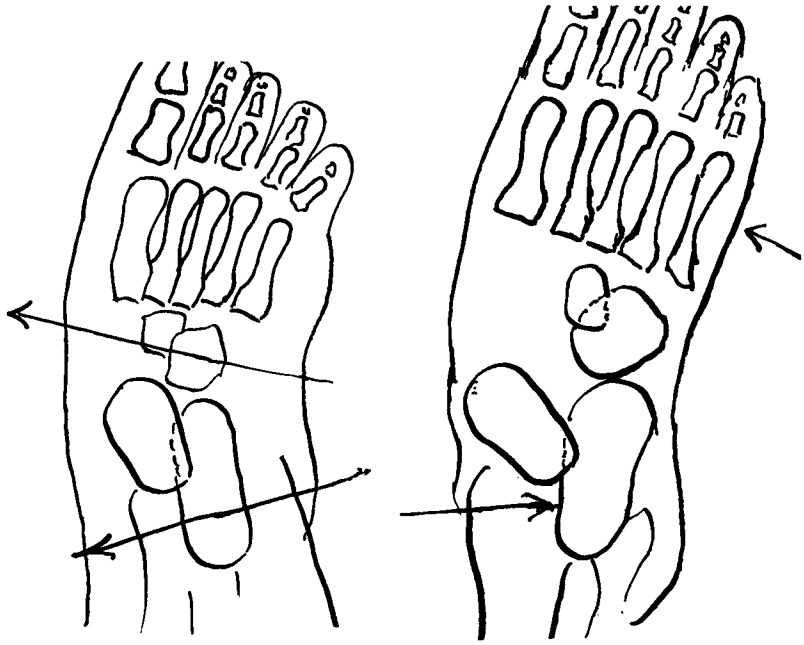
Successful closed reduction is achieved through stretching of these ligaments. By operative reduction the ligaments are incised to the needed extent.

Reductionmanoeuvres by Closed Reduction



A *Figure 55.* B

The reduction manoeuvres are performed by exerting a downwards pressure upon the dorsally dislocated forefoot, which may be felt as a prominence just in front of the anterior curve of the ankle. Simultaneously a counter-pressure is exerted upon the plantar and anterior aspect of calcaneus in a dorsal direction Figure 55 A. The forefoot is then forced into a maximal plantarflexion and also adducted and pronated.



A *Figure 56 A* and *B.* B

If the dorso-plantar roentgenogram demonstrates a small talo-calcaneus angle (*e.g.* adduction of calcaneus), both the forefoot and the processus posterior calcanei are forced in a medial direction (Figure 56 A) (eventually by using a Lorenz' ingot).

If the dorso-plantar talo-calcaneus angle is wide(*e.g.)* abduction of calcaneus with median position of processus posterior of calcaneus), this must be forced in a lateral direction, but still the forefoot is to be pressed in a medial direction. (B) The foot is immobilized in the plastercast with the forefoot in maximal adduction, plantarflexion and pronation, and is molded into a well defined plantar concavity, *carefully avoiding* an *upward pressure anteriorly* to the corpus calcanei which might lead to redislocation.

The second important point in the treatment is maintenance of the achieved position after reduction. Also concerning this part of the treatment, the early treated cases have proved more favourable. This is in keeping with what has been reported earlier about the changes which gradually occur in the articular surfaces. Of special importance is the dorsal recession of the caput tali, which is caused by the pressure of the dorsally dislocated os naviculare.

This dorsal flattenedgeing of the head of talus will after reduction offer poor support to the navicular which is readily re-dislocated dorsally. This difficulty is met in both closed reduction (Case 16, Figure 47) and operative reduction (Figure 9 L, Chapter II, page 85).

As emphasized (page 85) must no vigorous dorsiflexion of the forefoot be made, and a dorsiflexion should not at all be done during the controle X-ray by the changing of plastercasts and not before a long time after the cast has been omitted.

This rule is formed on the basis of experiences made in the most pronounced cases(Case 15 and 16) conservative treated in this material. It is plausible in Case 15 and 16 to assume that the recovery by the primary well succeeded closed reduction on right foot has been lengthened by a later insufficiently systematical accomplished treatment. Evidently milder cases as 12, 13, 14 show that an apparently insufficient treatment in early age can give good results—and it may be permitted to try a shorter but excactly controlled treatment in equal cases. Case 16 demonstrates how total relapse occurred upon uncontrolled forced dorsiflexion during X-ray examination. In the same illustration it is shown how the forefoot, at

(please turn over)

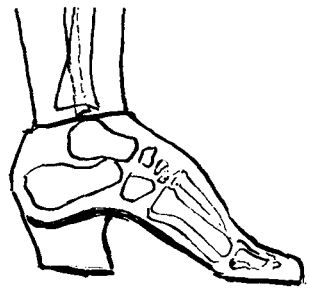


Figure 57.

The Figure 57 shows the principle of the high heeled shoe in aftertreatment of reducted congenital convex pes valgus W. vertical talus. The heel part of the sole shall have an *anteriorly* upward direction with its main supports under the anterior part of calcaneus *but posteriorly* to the forefoot. The fateful unrolling of the forefoot from the ground is considerably reduced by this shoe.

the occurrence of re-dislocation, forces talus into a vertical position. Since the steeping of talus is considered to be secondary, the transposition of muscles and ligaments in order to keep it erected may not be indicated. This material, as well the conservative treated as the operative proves this.

The same material contradicts the necessesity of lengthening of the achilles-tendon in the most cases.

CHAPTER II

The Operative Reduction of Congenital Convex Pes Valgus with Vertical Talus

The purpose on the operative reduction is in operative way to eliminate the tension of ligaments and tendons which prevents reduction and than do the reduction under direct vision.

In the present cases full reduction has been achieved after a plained cutting of the ligaments. Lengthening of tendons or operations upon the osseous tissue have not been necessary. To obtain full reduction, the navicular must be brought into correct position to the articular facet of the head of talus.

Operative reduction has been used, when closed reduction has failed. The age of the patients has varied from 9 months to five years. Operative *reduction* should be distinguished from operations which are performed to *prevent recurrencies*. However, at the time of open reduction, stabilizing corrections as well may conveniently be done, and may be considered an advantage of using the operative treatment. Further, in cases where primary conservative reduction succeeded, but a tendency to recurrence persisted good results may be achieved only by discision of mainly the tibio-navicular ligament, which is believed to promote recurrence by maintaining a constant pull of the reducted forefoot in an unfavourable direction.

Operative Technique

The protruding, dorsolateral part of the forefoot is exposed through a lateral longitudinal incision. The protrusion indicates the site of the dislocated os naviculare. The tendons of the muscles extensor digitorum longus are retracted mainly. The short muscles of the dorsum pedis are detached at their origin. The lateral part of ligamentum talo-naviculare dorsale is now exposed. The ligament is often found to be hypertrophic, forming a bridge between the dislocated os naviculare and talus. Connected with this ligament is the less distinct ligamentum

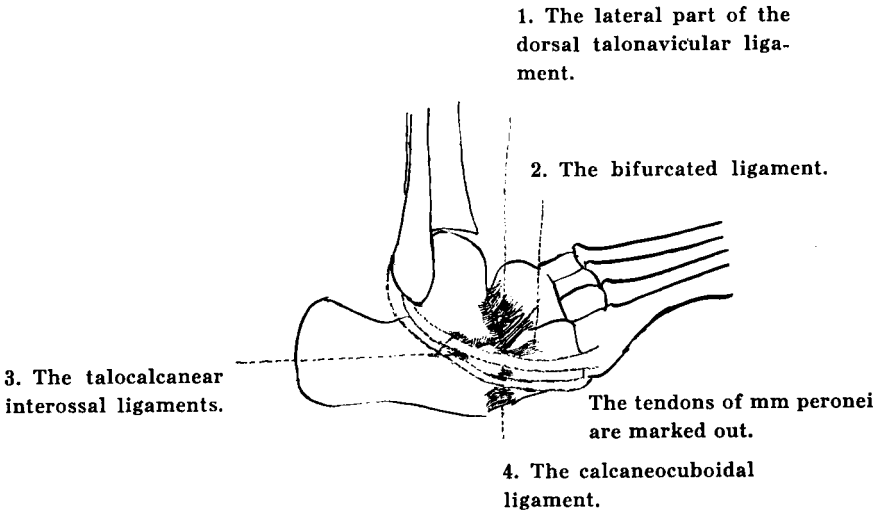


Figure 1 A. Scema of the actual ligaments right foot in lateral view.

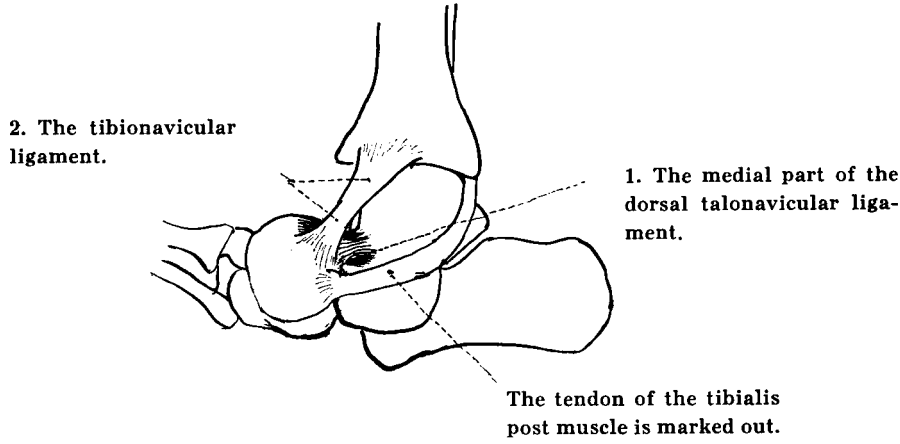


Figure 1 B. Right foot in medial view.

bifurcatum, located between the upper lateral part of calcaneus, os naviculare and cuboid (Figure 1 A).

Through the same or a parallel incision the medial and dorsal part of the ligamentum talo-naviculare is exposed by retracting laterally the tendons of musculus extensor digitorum longus and tibialis anterior.

Simultaneously is exposed the ligamentum *tibio-naviculare which on*

plantar-flexion of the foot pulls os naviculare dorsally as related to caput tali (Figure 1 B) thereby forming a major obstacle to successful reduction. This ligament is part of the anterior part of the deltoid ligament. A less distinct part of he deltoid ligament is located further anteriorly and is bridged between tibia and collum tali. Tenotomy is *only* performed of the tibio-navicular ligament, *and neither of the tibio-talar* nor the posterior tibio-calcanear parts of the deltoid ligament.

Apart from the above mentioned ligaments, ligamentum talo-calcaneum interosseum may also prevent successful reduction, mainly by preventing reduction of the laterally sub-luxated os calcaneum (Case 1). Theoretically ligamentum calcaneo-cuboideum might counteract reduction of the abnormal abduction in Choparts joint (Figure 1 A), but in my cases no tenotomy of this ligament has been necessary.

After tenotomy of the named ligaments, reduction could be accomplished by digital pressure upon the dorsal facet of os naviculare and simultaneous plantar flexion and adduction of the forefoot, which is also at the same time pronated. A dorsal traction upon caput and collum tali with a bonebook will help the reduction manoeuvre, but must de done very cafully, because—as happened in one case (Case 3, page 85)—the epiphysis of caput tali may be damaged and even torn loose. When os naviculare has been brought into a correct position to caput tali correction of the vertical position of talus will spontaneously follow, especially in the presence of a slight overcorrection which makes the navicular exerts a press upon the head of talus in a slightly dorsal direction Figure 8 D, page 84. The reduction manoeuvre may result in excavation of the planta pedis and adduction of the forefoot, as well as a slight varus of os calcaneum—*i.e.* the picture of a pes excavatus aaductovarus (Figure 5, page 81).

On attempt at omitting this overcorrection a tendency to re-dislocation usually will occur. The difficulty of maintaining normal reduction without introducing overcorrection is caused by the dorsal flattening of the caput tali, thus giving poor support to the reduced os naviculare. Some means of fixation of os naviculare to caput tali may be necessary in a number of cases in order to maintain reduction. This fixation may be done by a Kirschner wire (Case 4), or better with expediently placed silk sutures.

In one case (Case 1) a silk suture was placed between caput tali and the upper part of the lateral malleolus in order to keep the talus in a horizontal position, and herethough prevent a gliding of naviculare dorsally. After the operation immobilization in plastercast is used for

12–14 weeks. Then supports are accurately molded. However, better than supports are the high heeled shoes or boots. (Chapter I, Figure 57). Operative lengthening of the achilles tendon has not proved necessary—not even in the cases when such lengthening upon preoperative examination was deemed unavoidable (Case 1, Chapter II, page 80, Chapter I, page 47). In one bilateral case lengthening of the achilles tendon was done primarily, because the tendon appeared to be considerably contracted. However, the procedure had no definite influence upon the vertical position of talus nor did it facilitate closed reduction (Figure 13) which primary was attempted (Case 3, Chapter II, page 85).

Case Report

Case 1, John A. Male. Born November 2, 1951.

The patient was first seen on January 28. 1953, at the age of 15 months. He had started to walk at the age of 12 months.

Status January 28. 1953: Bilateral, irreducible rockerbottomfoot, severe degree. Passive dorsiflexion took place in Choparts joint without attending movement of the heel.

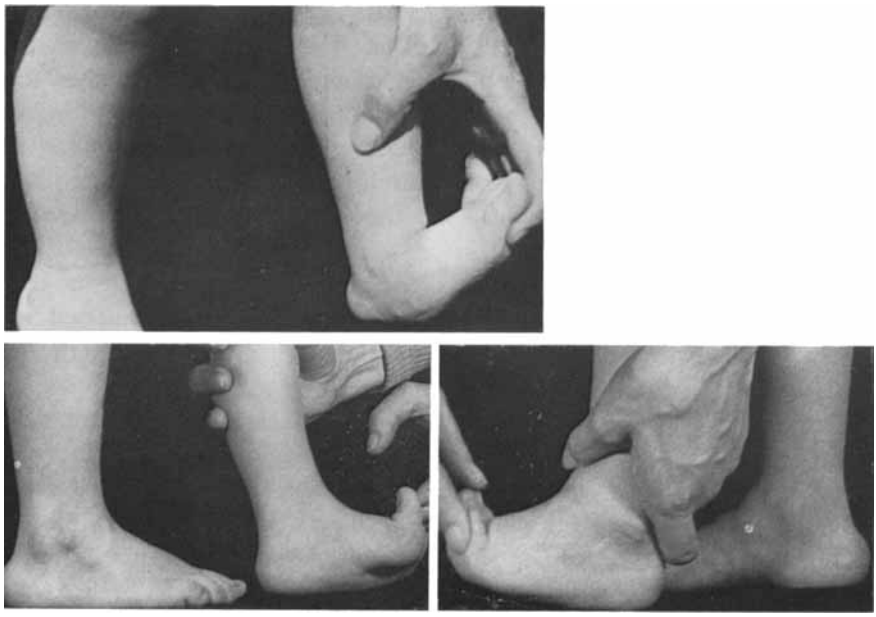


Figure 2 A, Case I. Left foot in passive dorsiflexion before the operation and one year after. See text.

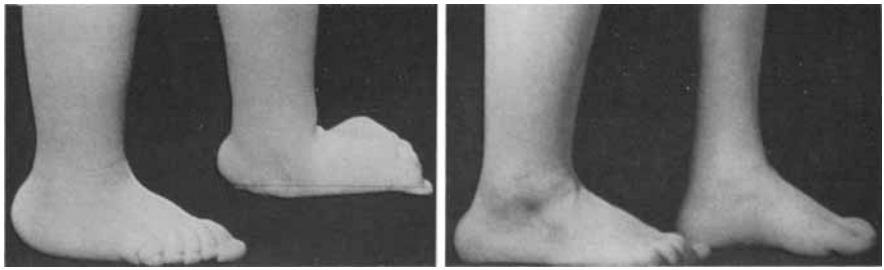


Figure 2 B. Left foot in weightbearing before the operation and one year after. See text.

Figure 2 A demonstrates the *abnormal* dorsiflexion in Choparts joint before operation and the *normal* conditions one year after. Figure 2 B demonstrates full weightbearing before the operation and after. The right foot, not illustrated, shows the same condition.

Radiographs of both feet (lateral views) before operation. The dorsal dislocation in Choparts joint of the forefoot and the vertical position of talus are demonstrated. Tibio-talus angle 175 degrees. Due to the equinus position of calcaneus, most marked on the right foot, the tibio-calcaneus angle is wide—105 degrees, while the talo-calcaneus angle is relatively small—40 degrees, in spite of the pronounced vertical position of talus. (See Chapter I, page 14 and 47).

The dorso-plantar talo-calcaneus angles are large—L. 55 degrees and R. 45 degrees, Figure 3 B.

May 11. 1953: Under general anesthesia and bloodless field, operative reduction was performed on the *left* foot (the child was now 17 months old). Lateral longitudinal incision. Reduction was achieved after cutting of the named ligaments (Figure 1 A and B).

A tight ligament of silk was applied between the lateral malleolus and collum tali to keep talus in dorsiflexion. (At the time of operation a later operative

Figure 3 A.

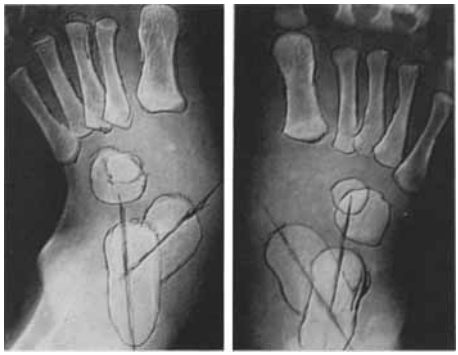


Figure 3 B.

lengthening of the achilles tendon was planned, which later proved unnecessary, look page 47, Chapter I). The plastercast which was applied at the end of the operation was removed after 12 weeks. X-ray then in lateral view demonstrated normal position of the bones of the forefoot. In the dorso-plantar view the talo-calcaneus angle had been reduced from 55 degrees to 10 degrees.

On July 3. 1953, the child now being 18 months old, operative reduction was done on the *right* foot: Longitudinal incision. In addition to the dorsal dislocation in Choparts joint, the calcaneus here was found to be sub-luxated laterally to a higher degree than usual. The operation was done as described above. The position was here maintained by plastercast, alone with the forefoot in pronounced plantar flexion and adduction. The plastercast was removed after 12 weeks.

Figure 4. X-ray in lateral view shows the left foot 6 months after the operation and the right foot 5 months after operation. The tarsals bones show normal position. However, in the dorso-plantar view the talo-calcaneus angle was 0 degree on the left foot, and 10 degrees on the right. The clinical result is shown in Figure 2 A, B. Inspection of the planta pedis revealed a slight pes adductus of the left foot. This became more pronounced by the time, and two years after the operation conservative reduction was attempted with following immobilization in plastervast for 8 weeks but with no success.

February 19. 1958, 5 years after operation the leftsided pes adductovarus was still present. The right foot had remained normal (Figure 5).

L *Figure 4* R

Figure 5, Case I. Five years after the operation: Left sided pes adduktovarus.

July 3. 1958 operative reduction was done of the leftsided pes adductovarus, through a medial longitudinal incision. At the operation os naviculare was found in a supinated position, its articular surface prominating 1,5 millimeter *medially* to the articular surface of caput tali. Full reduction was not achieved and therefore the incised medial ligaments between os naviculare and caput tali were not re-sutured. The operation now was followed by 9 weeks in plastercast, the last five with a walking-cast. Later a night splint was used. October 13. 1961, three years after the last operation the feet both appeared normal except for the tendency of the first toes towards hammertoe position as in a case of ordinary pes excavatus.

June 20. 1963, ten years after the first operation (Figure 6). The boy, now 11,5 years old, took part in different sport activities without being hampered by his feet.

Status: He walks normally. The foot arches are excavated. No valgus or varus. The hammertoe position of the first toes have increased—mainly on the left foot.

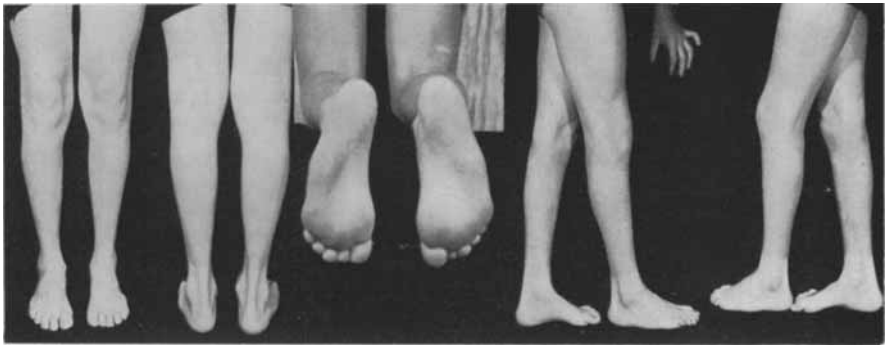


Figure 6. Clinical appearances 10 years after the operation. The arch of the foot is excavated, but without causing any complaint. Keen on sport.

Figure 7, Case I. 10½ years after the operative reduction X-ray both feet in maximal dorsiflexion. See text.

X-rays lateral view of the right foot shows no steeping of talus (tibio-talus angle = 95 degrees). Os naviculare is subluxated slightly dorsally to the articular surface of caput tali (the axis through talus touches just navicular plantarly). The navicular is wedge-shaped towards planta pedis. The corners of caput tali are pointed. The medial arch of the foot is excavated. X-ray of the left foot shows no dorsal subluxation of the navicular. The talusaxis passes through the lower edge of the navicular. No vertical position of talus (tibio-talus angle 90 degrees). The navicular shows a slight wedging. The pointed angles of caput tali are pronounced. The excavation of the arch is less than on the right side.

Case 2. Vivian St. J. Female. Born August 10. 1955.

The patient was first seen at the age of three years. She had a leftsided rocker-bottomfoot with marked pes valgus and vertical talus. The right foot was normal. At the time of the first examination (June 11. 1958) she was under treatment for hypothyroidism.

Roentgenogram of the left foot in 5 degrees dorsiflexion, lateral view: The navicular ossification center is not visible in spite of her age. (Hypothyroidism) Tibio-talus angle 125 degrees. Tibio-calcaneus angle 90 degrees. The talusaxis goes

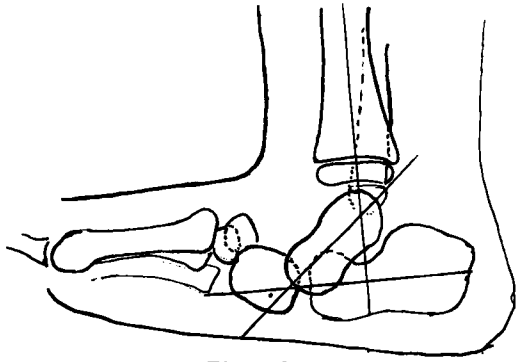


Figure 8 A.

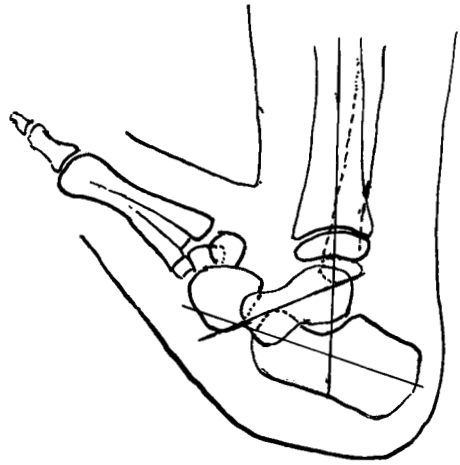
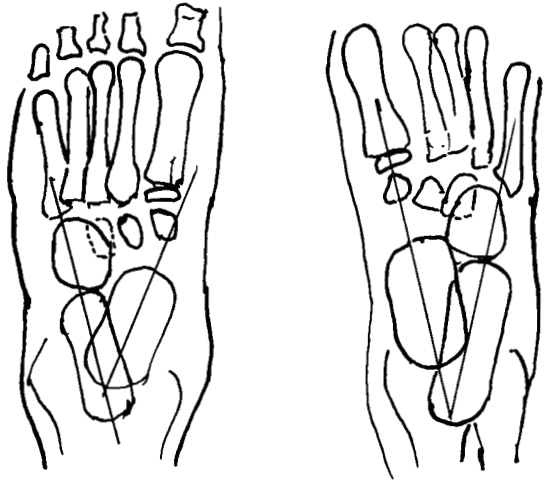


Figure 8 B.

through the lower ¼ of cuboid, the calcaneus-axis through the lower 1/3. The pronounced rockerbottomfoot which is present in spite of a relatively small deviation from the normal course of both these axes is due to the considerable dorsal dislocation seen in Choparts joint.

Figure 8 B: The same foot in *maximum* dorsiflexion: Tibio-talus angle has been *reduced* to 105 degrees, the tibio-calcaneus angle to 75 degrees. It may be concluded that a dorsally dislocated forefoot not always will force the talus into a vertical position. The vertical position of talus is produced by the pull exerted upon the



L *Figure 8 C.* R

Figure 8 D, Case 2. X-ray during operative reduction. The reduced forefoot pushes talus up to a horizontale position. The undesired excavatus position is seen to occur.

dorsally dislocated forefoot by the plantar foot-muscles. However, marked hypotonicity of the muscles was seen in this case (due to her hypothyroidism) and may possibly be the cause why talus here not was forced down in a more vertical position in spite of the marked dorsal dislocation of the forefoot.

Dorsoplantar talo-calcaneus angle left side wide 40 degrees. Right 30 degrees. The general condition of the patient did not at this time permit operative intervention.

Two years later on May 2. 1960, she was then 5 years old, operative reduction of the dislocated left Choparts joint was done, as described above. It was noted at the operation, that the head of talus showed a considerable dorso-lateral flattening, caused by the pressure exerted by the dislocated os naviculare. In this case too a tendency to overcorrection with resulting pes excavatus was seen during reduction.

Figure 8 D demonstrates this situation. The overcorrection was reduced, but no internal fixation of the achieved position was instituted, only a plaster cast. X-ray taken after 7 weeks, when the cast was removed, showed a moderate relapse with subluxation and slight vertical position of the talus. However, the dorsoplantar talo-calcaneus angle, which before operation was 40 degrees, was now 20 degrees.

October 20. 1960, three months later, re-operation was done. This time the skin was incised anteriorly to the *medial* malleolus and forward along the medial side of the foot. *The tibio-naviculare ligament appeared intact, as did the medial part of the dorsal talo-navicular ligament. When these ligaments were incised reduction could easily be accomplished with no tendency to overcorrection or pes excavatus.* This time, to prevent re-dislocation in Choparts joint, two silk-sutures were placed medially between os naviculare and os calcaneum. The operation was followed by immobilization in plastercast for 8 weeks, and then supports were used. X-ray control December 14. 1960 still showed some subluxation.

L *Figure 9.* R

June 21. 1963, two years and nine months after the last operation, the girl was now 8 years old. Roentgenogram now shows only a very slight degree of subluxation (Figure 9 L). The talusaxis touches the lower border of os naviculare (on the right foot which is an ordinary flatfoot, the axis goes through the lower 1/3, Figure 9 R. *The flattening of the dorsal aspect of the articular facet of caput tali, which was seen at operation is clearly demonstrated on the roentgenogram.*

(Compare Chapter I). No vertical position was seen of the talus (tibio-talus angle 95 degrees). Clinically a slight pes plano-valgus was seen, but less than on the "normal" right foot (Figure 10).

Figure 10, Case 2. Age 8 years, clinical appearance in full weightbearing. Three years after operative reduction a small degree of ordinary flatfoot but less on the operated original congenital convex valgus with vertical talus.

Case 3. Tormod H. Male, born January 20, 1960.

The patient came to examination two days after birth. Marked, bilateral rocker-bottomfoot was found (Figure 11), with pes valgus and abduction contracture, most marked on the left side. Apparently the malformation of the feet had been successfully corrected at first attempt, without anaesthesia, and no roentgenogram was made.

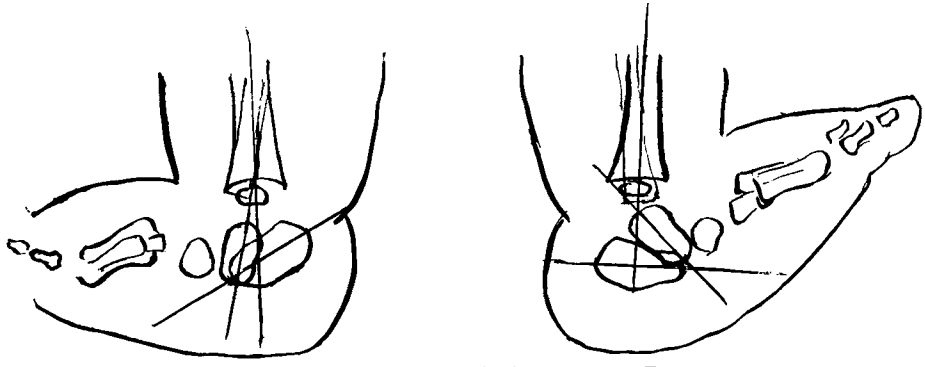
Figure 11.

On clinical examination 14 days later (also without a roentgenogram), the rockerbottomfoot still seemed to have been successfully corrected, although some abduction of the forefoot persisted. After another 4 weeks in correcting plastercast the feet looked normal and the casts were omitted. 14 days later control examination revealed a complete relapse. Two periods now followed with reductions and plastercasts but relapses occured whenever these were removed.

September 7, 1960—the child was now 8 months old—*the first roentgenogram was made* and the diagnosis of bilateral vertical talus was established. At this time the feet appeared clinically rather nice except for a significant contracture of the achilles tendons with a marked wrinkle across both heels.

Figure 12 A: Roentgenogram in lateral view of both feet in maximal obtainable dorsiflexion (dorsiflexion of right foot 20 degrees, left 5 degrees).

Tibio-talus angle R. 160 degrees. L. 175 degrees—note the wider tibio-talus angle on the left side in spite of the clinically less passive dorsiflexion. The reason for this is as seen of the X-ray—that the dorsal movement takes place in the Choparts joint not in the anklejoint, and that the dorsally, on this side completely, dislocated forefoot obviously pushes the talus in an increased steeping.



L *Figure 12 A.* R

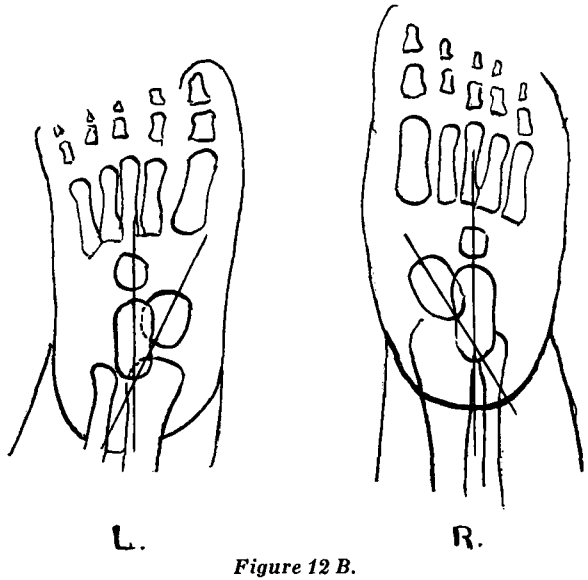


Figure 12 B.

Tibio-calcaneus angle R. 90 degrees L. 115 degrees.
Talo-calcaneus angle R. 45 degrees L. 40 degrees.
There was marked equinus position of the left calcaneus.

Figure 12 B: Roentgenogram of both feet in dorsoplantar view. The talo-calcaneus angle is seen to be narrow (compare Chapter I, Case 15, Figure 28, page 40).

Because of the contracted achilles tendons a primary lengthening was performed on both feet on March 7. 1962.

Roentgenograms had been made four months before the lengthening of the achilles tendons, after attempted reduction under anaesthesia, as well as shortly after the operation. The pictures were equivocal.

Obviously no improvement had achieved on the left foot, while on the right some slight improvement towards reduction had occured. However, the pictures may have been made in unequal manual pressure in dorsiflexion and therefore permit no conclusion. The pictures for this reason are omitted here.

July, 4. 1962. The patient now aged 2½ years, was again seen. In the meantime he had been using supports. Pes calcaneus and a severe degree of pes plano-valgus with rockerbottomfoot was found bilateraly, but most pronounced on the left.

Figure 13: Roentgenogram of both feet, lateral view, in maximal dorsiflexion.
Tibio-talus angle R. 100 degrees L. 130 degrees.
Tibio-calcaneus angle R. 70 degrees L. 80 degrees.
Talo-calcaneus angle R. 35 degrees L. 55 degrees.

Similar to the findings in Case 2, a distinct rockerbottomfoot with dorsal dislocation in Choparts joint is present on the right side although talus does not take

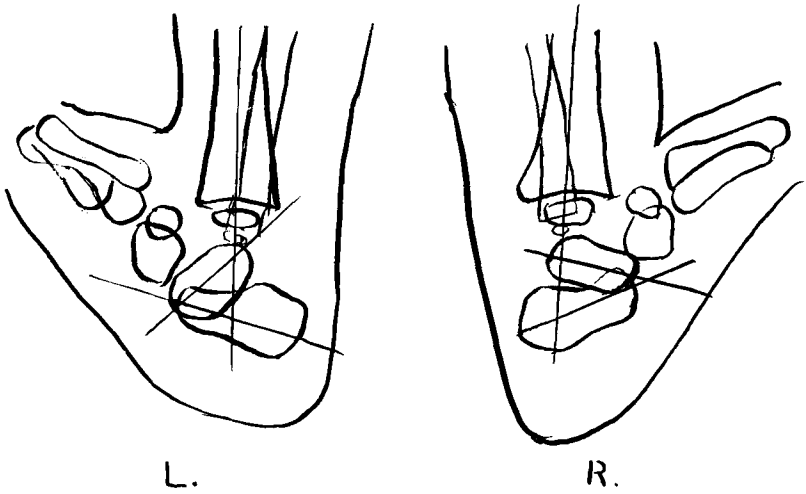


Figure 13, Case 3. 2½ year after achilleslengthening X-ray both feet in passive maximal dorsiflexion. The luxation of the forefoot is not tangible influenced and attempts to closed reduction did not succeed better than before lengthening.

a more vertical position than seen normally. The dorsal luxation of the forefoot, total on the left foot and sub-total on the right, is present, indicated by the talus-axis passing far behind and below cuboid, and further by the calcaneus axis also passing below cuboid in spite of normal dorsiflexion of calcaneus. (See Chapter I, page 17, Figure 4 L, compare Chapter II, Case 2, Figure 8 B, page 83).

September 7, 1962: Under general anaesthesia was done operative reduction of the right Choparts joint. Accidentally, during the operation, the upper part of the epiphysis of caput tali was torn loose and slightly dislocated.

October 20, 1962, the same operation was done on the left foot, without complications.

During the operations, the procedure on neither side seemed to have profitted by the earlier lengthening of the achilles tendons.

August 19. 1963, one year after the operation clinically a satisfactory footarch was seen on both sides, but some valgus of the heels (Figure 14).

Figure 15 A: Roentgenogram of left foot in maximal dorsiflexion, lateral view. Talus appears deformed. The not here illustrated x-ray in dorsoplantar view ascertains that the navicular is enlarged. There is no vertical position of talus. (Tibio-talus angle 95 degrees).

Figure 15 B: Roentgenogram of right foot: The disrupted piece of the talus epiphysis appears ossified dorsally to the navicular ossificationcentre and seems to prevent a dorsal slipping of the navicular.

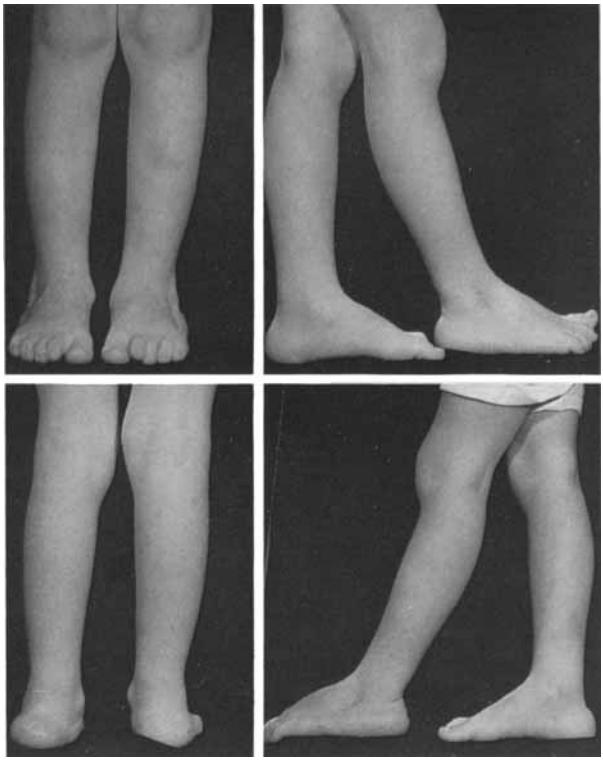


Figure 14. The clinical aspect one year after operative reduction: Quite good foot-archs. The best appearance on the side where the epiphysis of the head of talus was disconnected and dorsally dislocated during the operation. There is valgus-position of both heels.

Figure 15 C: Examination August 10. 1966. Age 6½ year, 4 years after the operations:

He apparently is not much hampered of his feet. His surroundings does not find anything extraordinary by his gait.

In weightbearing left foot shows a pronounced planovalgus, which can be corrected a great deal, but with a tendency to metatarsal supinationcontracture.

The right foot shows a moderate degree of pes valgus. He is using supports.

Figure 15 C. X-ray left foot in lateral view in maximal passive dorsiflexion: There is no steeping of talus, which is short and lumpy as before. The slight degree of dorsal subluxation of the forefoot is not increased. The medial footarch without weightbearing looks good. X-ray in dorsoplantar view (not represented here) shows abduction of the forefoot localized in the cuneiforme navicular-calcaneo-cuboidal joints (not in Choparts joint or sub-thalo).

Figure 15 C. X-ray in maximal dorsiflexion lateral view right foot, shows the dorsally dislocated epiphysis of the head of talus ossificied, completely unchanged.

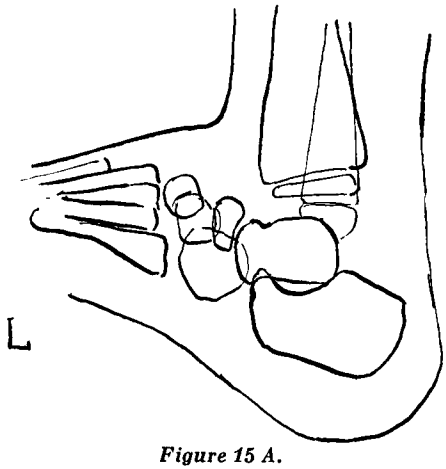


Figure 15 A.

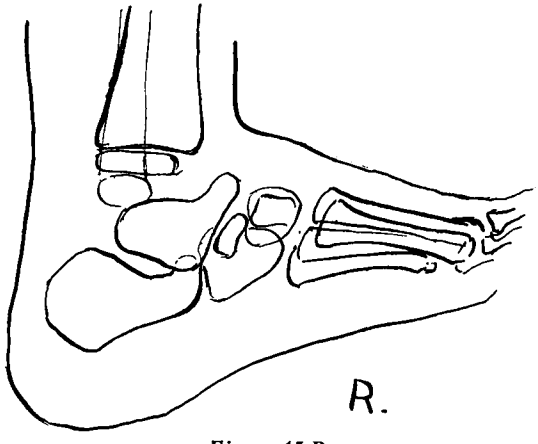


Figure 15 B.

L R

Figure 15 C. X-ray lateral view both feet, August 10. 1966, age 6½ year. See text.

The prominence does not hinder the dorsiflexion of the foot. The position of the navicular is unchanged. The prominence prevents a gliding upwards. The long footarch is high without weightbearing.

X-ray in dorsoplantar view (not represented) no abduction of the forefoot.

For the planovalgus of his left foot is physiotherapeutic treatment and supports, —later stabilizing operation indicated.

Summary and Discussion of Case 3

The child was treated from the second day after birth. Seemingly the rockerbottomfoot was successfully reduced without resistance and without the use of anaesthesia, which led to the error of not making a roentgenogram at this time. Roentgenogram were not taken until the child was 8 months old, when the diagnosis of bilateral vertical talus was made. The treatment to this therefore had been inconsistent and unsatisfactory.

Most probably full reduction had no been achieved. As the treatment in this case did not be guided by the correct diagnosis at an early moment, it is not included as a unsuccessfully conservatively treated case. Operative lengthening of the Achilles has proved unnecessary even in cases with considerable contracture where lengthening has been deemed mandatory before the operative reduction (Chapter II, Case 1, page 80).

In Case 3 it was evident that a primary lengthening offered no advantage. The tendency towards pes calcaneus following the lengthening represents an unfortunate weakening of the coordinated musclefunction of the calf and foot.

The right foot by this patient showed in spite of the traumaticized and dislocated epiphysis of the head of talus a relatively good clinical aspect. The left foot which showed a pronounced flatfoot had no rockerbottomfoot. On X-ray there was no increased dorsal gliding of the forefoot in Choparts oint and no steeping of talus. In this case too, like the other ones,—the congenital convex valgus with vertical talus is changed to an ordinary flatfoot although here of a grievous degree. The deformation of the corpus tali may be a post-operative consequence on this side too, but we are noticing the before mentioned congenital anomalies.

None of the feet shows roentgenological changes Figure 15 C since last X-ray three years ago (Figure 15 A, B).

This patient is the only where primary lengthening of the achilles tendon has been made. Though as maintained this, of course, is not the

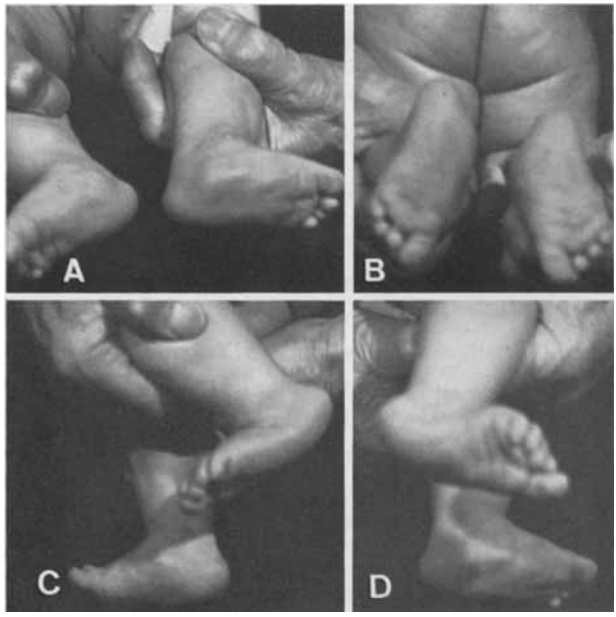


Figure 16. Clinical aspect of the pronounced bilateral rockerbottomfeet of Case 4 aged 3 months. Notice the medial prominence of the head of talus.

principal reason of the unsuccess in this case, but the reported maintained general course following the primary lengthening shows that this should rather have been omitted.

Case 4. Gunn H. Female. Born February 23. 1962 (compare Case 16, Chapter I).

She was first seen at the age of 3 months, with bilateral rockerbottomfoot, and vertical talus. Figure 16 shows the clinical appearance.

Figure 17 shows roentgenograms lateral view, age 3 months.

After several attempts, closed reduction of the right foot was successfully done when the child was 9½ months old (see Chapter I, Case 16). On the left foot all attempts at closed reduction failed (x-ray Figure 42 A, Chapter I).

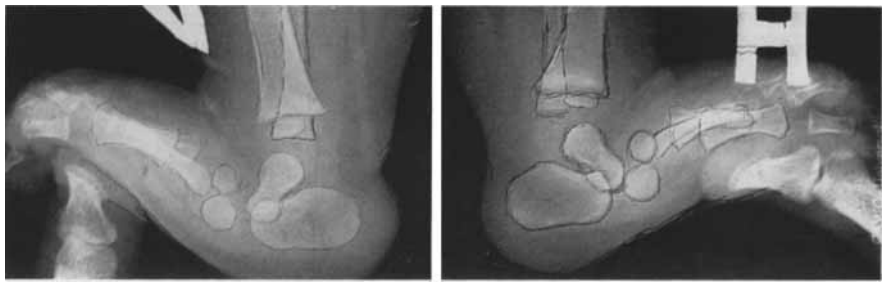
July 30, 1963 operative reduction was done on left foot. (Overlege Hadland).

A Kirshner wire was used for internal fixation after reduction. The wire was introduced through corpus and caput tali, through os naviculare, os cuneiforme and the proximal part of the first metatarsus and out through the skin. The wire was included in the plastercast and removed after 6 weeks. At this time operative lengthening of the achilles tendon was done.

After 8 months she commenced weightbearing using supports.

April 21. 1964. Control examination 9 months after operation.

Clinical examination revealed a satisfactory foot arch.



L *Figure 17.* R

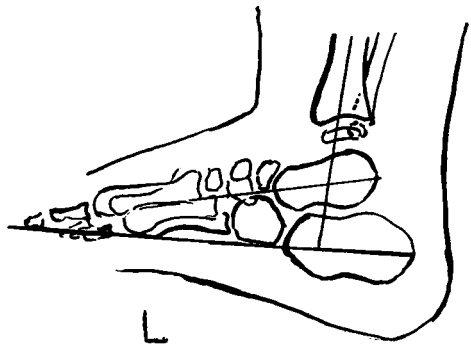


Figure 18.

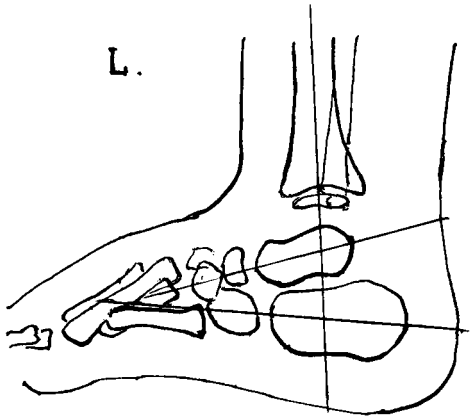


Figure 19.

Figure 18 (compare x-ray of a normal foot, Chapter I, Case 6, page 18, Figure 6). Roentgenogram left foot lateral view. The navicular takes a somewhat high position, as indicated by the talusaxis touching its lower border. But it is no steeping of talus and the talusaxis passes dorsally to cuboid. In spite of the lengthened achilles tendon the calcaneus axis points too much towards the planta pedis: The axis

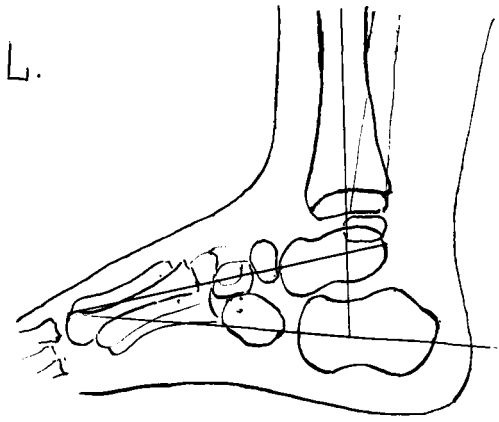


Figure 20 A.

touches the lower border of os cuboid and the tibio-calcaneus angle is 90 degrees.

Tibio-talus angle 95 degrees.

Talo-calcaneus angle 10 degrees.

In shortness judging the roentgenogram we are finding a slight degree of rocker-bottomfoot of the type with a narrow talo-calcaneus angle as seen as a complication in treatment of clubfoot (cfr. Chapter I, Figure 53, page 65). She is continiously using her supports. No other treatment.

July 29. 1964. 11 months after operative reduction.

Figure 19 X-ray shows now a normal foot. The talusaxis cuts the lower ¼ of the navicular and the calcanear axis passes the cuboid through the middle. This x-ray is made in a less dorsiflexion than the previous but the tibio-talus angle is still the same.

November 12, 1964. 21 months after operation. Clinically was found well defined foot arch on both feet. X-ray Figure 20 A was made in 5 degrees dorsiflexion as on the previous examination:

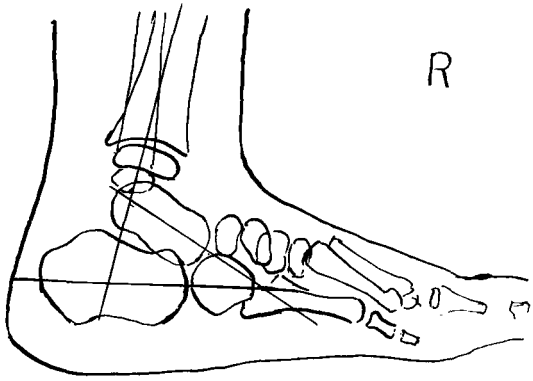


Figure 20 B.

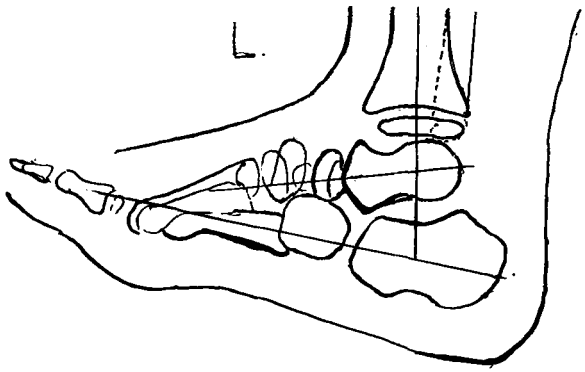


Figure 21 A. Left foot 2 years after operative reduction. X-ray in maximal dorsiflexion shows full restitution. See text.

(Figure 20 B the conservative treated right foot for comparison).
Tibio-talus angle L. 95 degrees R. 100 degrees.
Tibio-calcaneus angle L. 80 degrees. R. 80 degrees.
Talo-calcaneus angle (lateral view) L. 20 degrees R. 35 degrees.
Talusaxis: Left—passes through lower 1/3 of the navicular.
(Right—passes just below the navicular).
Calcaneus axis: Left—passes below the middle of os cuboid.
(Right–as on the left). See Chapter I.
As a whole the position in the left foot is now good.
(The conservatively treated *right* foot of this patient, Figure 20 B has dealt with in Chapter I, Case 16. Controll examination shows here a slight subluxation in Choparts joint).
June 6. 1965. Case 4, two years after operative reduction of the left foot.

Figure 21 A. (Compare with photographs Figure 48, page 59, Chapter I) X-ray left foot: It is spontaneous improvement in the x-ray appearence compared with the

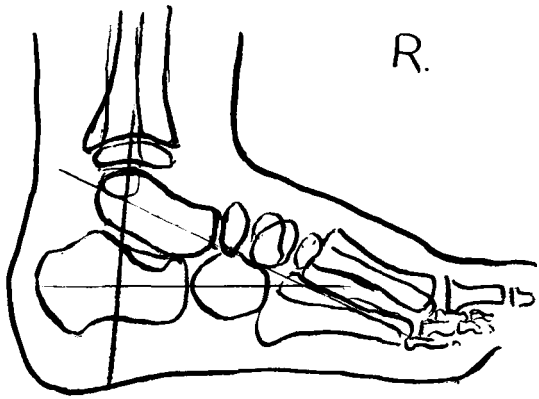


Figure 21 B.

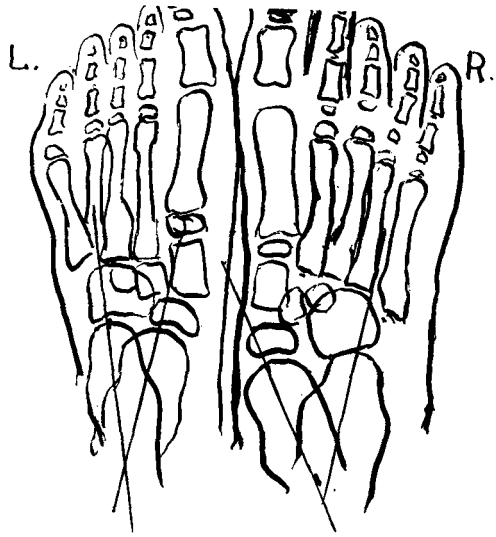


Figure 21 C.

situation 12 months ago. (See Figure 18, Chapter II, page 93). The angles show a normal wideness the axes show a normal cours and the mutual positions of the tarsal bones are now normal. The only changes are the pointed prominenses on the edges of the articular facet of the head of talus and the slight flattening of the upper part of the articular facet (compare Case 2, Figure 9 L).

Figure 21 B. (Compare x-rrays Figure 48, page 59, Chapter I). To comparison the Right foot 2½ years after closed reduction—shows a considerable spontaneous

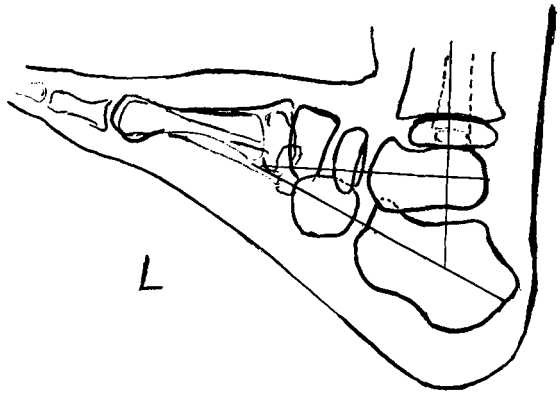


Figure 22 A. Case 4, March 4. 1966, age 4 years.
Left foot in maximal dorsiflexion 3¼ years after operative reduction. Normal axes and angles. See text.

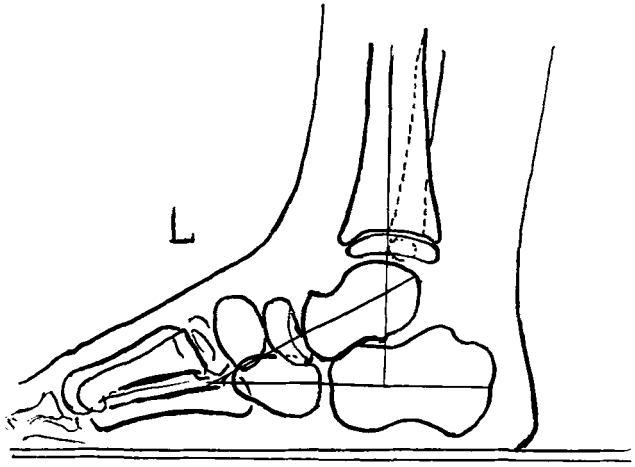


Figure 22 B. X-ray of the same foot on weightbearing. See text.

roentgenological improvement too. But there is still on this side a small degree of dorsal dislocation of the navicular.

Figure 21 C. X-ray in dorsoplantar view shows the talo-calcaneus angle on the left operated foot normal on the closed reducted foot enlarged.

September 29. 1965.—31 months after operative reduction of the left foot. The girl is now 3 years and 8 months old. Clinical examination with weightbearing shows a in some degree of flattened arch. Right foot shows with weightbearing a quite flattened arch and some medial convexity (see Chapter I). Without weightbearing both feet look near to normal.

Figure 22 A. Marz 4. 1966. Left foot in maximal dorsiflexion.

Compared with the axes on the previous x-ray made 9 months ago we now find

Figure 23.

Figure 24.

that the navicular and cuboid have a little higher position in Choparts joint. This is due to a stronger upward-press on the forefoot and is a normal appearance.

Figure 22 B. X-ray left foot in weightbearing at the same time: The angles have a normal wideness, the axes course and the mutual relations between the tarsal bones are normal.

Case 4. May 10, 1966. Age 4½ years, 38 months after operative reduction (see Chapter I, page 60–61).

She has contineously used her supports, no other treatment.

Figure 23. (Chapter I, Figure 49) left foot shows clinically in full weightbearing a rather high footarch of normal appearance.

Figure 24 (Chapter I, Figure 50). X-ray in lateral view, shows no steeping of talus, no subluxation.

The mutual proportions between the tarsal bones are normal, all axes have a normal course and the angles a normal wideness.

The same conditions occurs in full weightbearing. *Figure 25* (Chapter I, Figure 51 A). The pointing of the dorsal corner of the articular facet of the head of talus is present on the left side but not on he right conservatively treated. In dorsoplantar view the talocalcanear angle on left foot is zero. On right 20 degrees (see page 62, Figure 51 B).

Figure 25.

Summary and Discussion of Chapter II. Open Reduction.

Operative reduction has been done in four patients with vertical talus, two of which were bilateral. One with bilateral vertical talus had open reduction on one side and closed on the other. The total of 6 feet were operated. The age of the patients varied from 15 months to 5 years at the time of operation (in comparison the age of the conservatively treated patients varied from one day to 9½ months).

The observation time has been:

11 years two feet.
6 years three feet.
3 years one foot.

X-ray control after a longer observation time revealed changes in the shape of the tarsal bones. Although these changes cannot be realized roentgenologically until the bones become ossified, they may well have been present also at earlier stages of growth. The most peculiar changes were recession or flattening of the dorsal articular facet of talus. A more ordinary change is pointing of the corners of caput tali, and a plantar wedging of the navicular, which also as a whole was flatter than normal. In one case os naviculare was slightly dislocated in dorsal direction. More pronounced changes of caput and collum tali were found in one case. In the one foot of this patient as a result of the epiphysis being traumatized at operation. In the other foot by this patient deformation of corpus tali was also seen. But it is here to be noted, that the boy had congenital deformations of the fingers and in a slight degree of the elbows, and he was mentally retarded, so a congenital anomaly of the growth cannot be quit excluded. In no case was vertical position of talus seen on follow up.

The findings on clinical follow up examination were:

None of the patients were hampered by their feet. Two feet showed moderate pes excavatus, with hammertoe of the first toe. One foot was quite normal. One had slight pes valgus but no more than the "normal" foot. One foot showed a pronounced pes planovalgus. This refers to the boy with the deformation of talus. Primary lengthening of the achilles tendon is not advocated.

Arguments for this are given.

Lengthening of the achilles on the whole appear unnecessary more often than would be anticipated upon pre-operative clinical evaluation.

Observations made at operation support those made during closed reduction (Chapter 1): The vertical position of talus is secondary to the subluxation seen in Choparts joint, which is in a great deal believed to be the primary event. The cause of exceptions is discussed. Maintenance of the position after operative reduction appears to be more stable than after non-operative reduction (Case 16, Chapter I right foot). This may be due to discision of the ligaments which in the non-operated cases are allowed to the structures in the dislocation.

This especially applies to ligamentum tibio-naviculare, which directly tends to pull os naviculare dorsally when the foot is bent in plantar flexion in the ankle joint.

Zusammenfassung

Kapitel I und Kapitel II[1]

Als Einleitung wird eine kurze Übersicht über die verschiedenen Auffassungen, die sich hinsichtlich des angeborenen Knickplattfusses und seiner Behandlung seit der eingehenderen anatomischen und röntgenologischen Beschreibung durch *Hohmann* in 1934 und *Günz* in 1939, geltend gemacht haben.

Spätere Verfasser – *Osmond Clarke, Hendorn, Heymann* und mehrere – haben die Aufmerksamkeit besonders auf die Vertikalstellung des des Talus hingelenkt. Der Veerfasser zeight in dieser Arbeit röntgenologisch wie die Vertikalstellung des Talus sekundär durch Druck des dorsal luxierten Forfusses von oben entsteht. Er weist auch nach wie der Talus sich aufrichtet, wenn die Luxation reponiert wird und dadurch der Druck des Vorfusses in die richtige Richtung gelenkt wird.

In Übereinstimmung damit haben sich besonders Verfahren um den Talus aufgerichtet zu erhalten als unnötig erwiesen.

Ein gutes Behandlungsergebnis hängt in jedem einzelnen Falle davon ab, dass mit der Behandlung frühzeitig begonnen und dass sie zielbewusst durchgeführt wird. Dies ist wiederum von einer frühzeitigen Diagnose abhängig, welche nur röntgenologisch festgestellt werden kann.

Jeder Fall von angeborenem Wiegenfuss soll daher Röntgen-fotographiert werden. Man kann nämlich einen angeborenen hochgradigen Wiegenfuss haben ohne dass eine Subluxation des Vorfusses und ein vertikaler Talus vorliegt. Beispiele dafür werden vorbewiesen.

Um eine frühzeitige – d.h. unmittelbar nach der Geburt – Röntgendiagnose zu stellen, muss man das gegenseitige Verhältnis der Knochenkerne und seine Variationen bereits zu diesem Zeitpunkte kennen. Der Verfasser legt einen Teil der Untersuchungen, die er bei normalen Säuglingen, an gutartigem pes calcaneus bei Neugeborenen, bei Säuglingen mit angeborenem pes calcaneo-valgus und am hypermobilen Kinderplattfuss ausgeführt hat, vor. Diese verschiedenen Zustände

---

[1] English Summary to be found after each of the two Chapters.

werden mit dem wirklichen angeborenen, konvexem Valgus mit vertikalem Talus und dorsaler Luxation oder Subluxation im Chopart-Gelenk verglichen.

Die leichten Grenzfälle werden beschrieben. Die Kriterien der röntgenologischen Diagnose in diesem frühzeitigen Stadium werden durchgegangen.

Eine Eigentümlichkeit des Röntgenbildes beim „kongenitalen, konvexen Valgusfuss mith vertikalen Talus" ist, dass der dorsoplantare Talocalcaneuswinkel, im Gegensatz zum gewöhnlichen Plattfuss, in einem grossen Teil der Fälle vermindert ist, obwohl die Talusachse stark nach medial weist. Der Grund dafür ist eine Adduktionsstellung des Calcaneus. Diesem Umstand wird bei der Reposition Rechnung getrageen und er wird bei der gedeckten Reposition näher besprochen.

Es wird ein röntgenologischer Vergleich mit dem Wiegenfuss, den man während der Behandlung des Klumpfusses auftreten sieht und den man beim angeborenen, konvexen Valgusfuss mit vertikalem Talus vor sich hat, vorgenommen. Wie zu erwarten, ist der Unterschied ein wesentlicher.

Veränderungen in den Fusswurzelknochen bei im übrigen mit gutem Erfolg behandelten Fällen werden röntgenologisch sichtbar während diese verknöchern und nach der Meinung des Verfassers ist es weniger wahrscheinlich, dass es sich um sekundäre Formveränderungen handelt, die während des Wachstums bei der Belastung entstanden sind.

Die Behandlung und ihre Ergebnisse werden in zwei Kapiteln durchgegangen.

Kapitel I: Die konservative Behandlung. "Gedeckte Reposition".

Kapitel II: Die operative Behandlung „Offene Reposition".

Die erstere kann zum Ziele führen wenn die Behandlung in den ersten Lebenswochen beginnt. In einem Falle glückte die Reposition jedoch im Alter von 9½ Monaten nach mehrfachen, vorausgehenden, vergeblichen Repositionsversuchen.

Im übrigen wendete man in so vorgeschrittenem Alter nur die operative Behandlung an.

Unter den konservativ Behandelten waren 3 Fälle, bei denen die Behandlung als höchst unvollständig angesehen wurde, wo aber das Ergebnis doch gut war. Der eine war ein Grenzfall – aber die beiden anderen wiesen das Bild auf, das man bei schwereren Graden des Leidens vor sich hat.

Es ist selbstverständlich, dass man nur eine einwandfreie röntgenologischen Heilung anerkennt. Doch bezeichnet man als gutes Resultat

auch die Fälle, in denen die ursprüngliche Subluxation im Chopart-Gelenk, eventuell mit Vertikalstellung des Talus, in einen gewöhnlichen weichen Kinderplattfuss umgewandelt wurde, der mittels Verwendung von Einlagen spontan ausheilt.

Die operativ behandelten Fälle weisen eine frühzeitige grössere Stabilitet (d.h. geringere Rezidivtendenz) auf als die konservativ behandelten. Der Verfasser meint, dass der Grund dafür darin zu suchen ist, dass die Ligamente, die die Reposition hindern, bei der konservativen Behandlung immer noch einen Zug ausüben, während dieser Zug bei der operativen Behandlung wegen der radikalen Durchschneidung ganz ausgeschaltet wird.

Das Verfahren bei der geschlossenen und offenen Reposition wird beschrieben und die anatomischen Grundlagen für die Operation werden illustriert.

Abgesehen von den Ergebniissen werden auch begangene Fehler besprochen.

Eine Verlängerung der Achillessehne war in den Fällen, die der Verfasser operierte nicht notwendig, obwohl eine scheinbare Strammung derselben mit Spitzfussstellung des Calcaneus von vornherein bestand. Achillessehnenverlängerung soll daher niemals primär vorgenommen werden.

Im Zusammenhang mit der Achillessehnenverlängerung weist der Verfasser darauf hin, dass die eine „falsche" Elevation der Längswölbung des Fusses hervorrufen kann, wegen der pes calcaneus Tendenz, die man durch die Schwächung der M. gastrocnemius erhält, in Übereinstimmung mit den Veränderungen, die man bei Paresen dieses Muskels findet.

References

Grice, D. S."The Role of Subtalare Fusion in the Treatment of Valgus Deformitties of the Feet". In Instrüctional Course Lectures. *The American Academy of Orthopedic Surgons Vol.* **16** B., 127–150.

Günz, Eduard (1939) "Die pathologische Anatomie der angeborenen Plattfusses". *Zeitschrift für Orthopädie und ihre Grenzgebiete, Band* **69**, 219–236.

Herndorn, Charles, Heyman Clarence "Problemes in the Recognition and Treatment of Congenital Convex pes Valgus". *The Journal of Bones and Joint Surgery Vol.* **45** A, no. 2, 413–429.

Hohman, Georg (1934) "Der angeborene Knickplattfuss". In "Fuss und Bein", 26–33. Verlag I. F. Bergmann, München.

Köhler, A (1953) "Grenzen des Normalen und Anfänge des Patologischen im Röntgenbilde Des Skelettes Auflage 9. Algemeiner Teil S. 10. Georg Thieme Verlag, Stuttgart.

Lütken, Poul (1959) "Medfödte deformiteter. Pes planovalgus cong. "Gængefot". Nordisk lærebok i ortopedi, 22, Svenska Bokförlag, Stockholm.

Mau, C. (1939) "Beitrag zur Frage der Ätiologie der angeborenen Hackenknickfuss". *Zeitschrift für Orthopädie und ihre Grenzgebiete Band* **69**, 191–218.

Nordentoft, Erik L. "Acurracy of Orthoroentgenographic Measurements". *Acta Orthopaedica Scandinavica Vol. XXXIV Fasc.* **3**, 283–288.

Osmond, Clarke H. "Congenital Vertikal Talus". *Journal of Bone and Joint Surgery Vol.* **38** B, 334–341.

Sage, T. P. (1963) "Congenital Rockerbottom-foot". *Campbell Orthopaedic surgery Vol.* **2**, Chapter 25, p. 1677.

Shands, Raney, Brashear (1963) "Congenital Vertical Talus". Handbook of Orthopaedic Surgery, Chapter II. Edition 6. The Mosby and Company. Saint Louis, p. 47.

Snyder, William H. (1962) "Congen. plantar-flexed talus. Pediatric Surgery Vol. 2. Yearbook Medical Publishers, p. 1175.

Stören, H. (1965) On the Closed and Open Correction of Congenital Convex Pes Valgus With a Vertical Astragalus". *Acta Orthopedica Scandinavica Vol.* **36**, Fasc. 3, 352–358.

Thomasen, Eivind "Der angeborene Klumpfuss. Über die Mechanic und ihre primäre Behandlung". *Acta Orthopaedica Scandinavica Vol. XII*, 33–100.

Wainwright, Devis (1963) "The Recognition and Cure of Congenital Flatfoot". *Acta Orthopaedica Scandinavica Vol. XXXIII.* Procedings. 389–390.