

Current concepts

Common errors in the treatment of congenital clubfoot

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Summary. *The conservative treatment of clubfeet in newborn babies is detailed, and the pitfalls in the treatment are commented.*

Résumé. *Le traitement conservateur des pieds bots à la naissance est expliqué en détail et les erreurs de traitement sont commentés.*

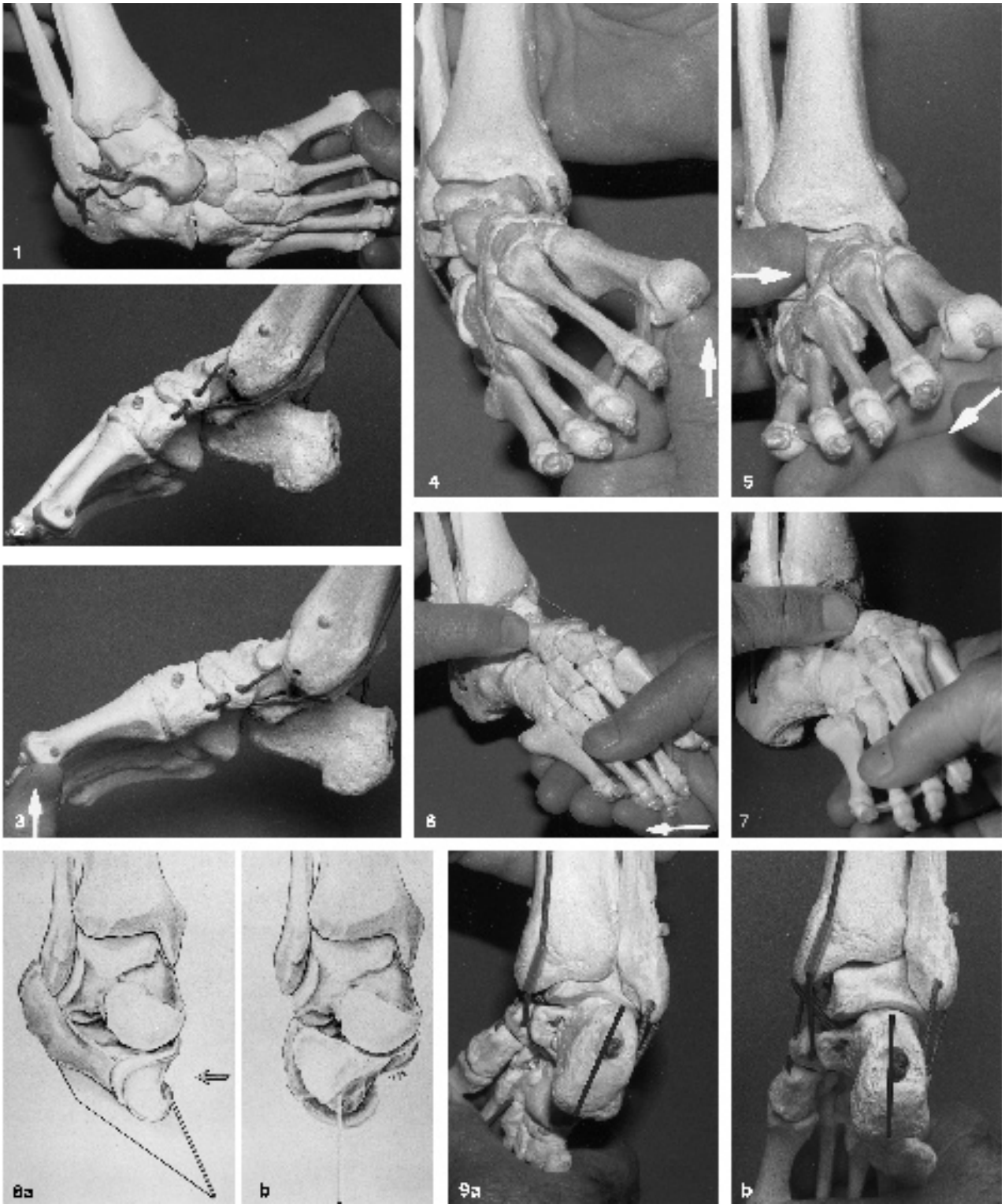
Most orthopaedic surgeons agree that the initial treatment of congenital club foot should be non-operative, beginning in the first days of life so as to take advantage of the favourable fibroelastic properties of the connective tissue which forms the ligaments, joint capsules and tendons. Early operation induces fibrosis, scarring and stiffness [4, 5]. It must be delayed until the child is at least three months old. These first three months offer the skilled and knowledgeable surgeon a golden opportunity to correct the deformity by manipulation and casting. Proper manipulative techniques followed by applications of well moulded plaster casts offer the best and safest correction of most clubfeet in infants [11].

Failures of manipulative treatment usually occur when the surgeon lacks a thorough knowledge of the kinematics and pathological anatomy of the deformity. The kinematics of clubfoot were clearly described by Farabeuf in 1892 [6] and Brockman in 1930 [2]. In 1963, when presenting

our results of fifteen years of treatment, we explained that to correct the deformity all of the foot distal to the talus must be made to rotate laterally, i.e. abduct, underneath the talus which is fixed in the ankle mortise [10]. In a recent review of our patients treated 25 to 42 years ago [3], it was found that although the treated clubfeet were less supple than the normal foot, there were no significant difference in function or performance compared to a population of a similar age born with normal feet.

Our treatment is easy to learn. An interested resident is proficient in the technique after correcting two or three clubfeet. The main stages of the correction are illustrated in Figs. 1 to 9 using a facsimile of a clubfoot made of plastic bones and elastic strings.

First, the resident learns to identify by palpation the position of the main bones of the foot in relation to the malleoli and to the head of the talus. In the clubfoot the calcaneus, the navicular and the cuboid are rotated medially in relation to the talus, and are firmly held in adduction and inversion by very tight ligaments and tendons (Fig. 1). Although the whole foot is in extreme supination, the forefoot is pronated in relation to the hindfoot and this causes the cavus, the first metatarsal being in more plantar flexion than the lateral metatarsals (Fig. 2). The resident feels the distance between the medial malleolus and the tuberosity of the navicular. The shorter this distance the worse is the clubfoot (Fig. 1). When abducting the foot he must estimate the degree of resistance of the navicular to be moved away from the medial malleolus. This resistance correlates with the severity of the deformity.



To correct the clubfoot, the cavus is corrected first by supinating the forefoot and dorsiflexing the first metatarsal (Figs. 3, 4). The forefoot must never be pronated.

To correct the varus and adduction, the foot in supination is abducted while counterpressure is applied with the thumb against the head of the talus (Figs. 5, 6). The calcaneus abducts by rotating and sliding under the talus (Fig. 8). As the calcaneus abducts it simultaneously extends and everts, and thus the heel varus is corrected (Figs. 8, 9). The calcaneus cannot evert unless it is abducted [7]. The improvement obtained by manipulation is maintained by immobilising the foot in a plaster cast for five to seven days. With immobilisation, the tight medial and posterior tarsal ligaments tend to yield. The deformity can be gradually corrected with further manipulations and five or six changes of cast. To fully stretch the medial tarsal ligaments in the later casts, the foot in front of the talus must be severely abducted to an angle of about 60° (Fig. 7). The heel must not be touched.

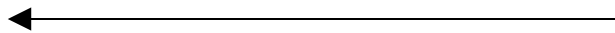


Fig. 1. Model of a clubfoot made with plastic bones and elastic strings simulating the ligaments. The talus and calcaneus are in severe flexion. The calcaneus, navicular and the cuboid are adducted and inverted. The navicular tuberosity is close to the medial malleolus. The metatarsals are adducted

Fig. 2. Medial view. The first metatarsal is in more flexion than the other metatarsals, thus causing the cavus

Fig. 3. The cavus is corrected by extending the first metatarsal and supinating the forefoot

Fig. 4. Front view. To initiate the correction of the clubfoot the first metatarsal is extended and the forefoot is held in supination in proper alignment with the midfoot and the calcaneus. In this position the foot can be abducted under the talus

Fig. 5. Gradual correction is obtained by abducting the supinated foot with counterpressure applied on the lateral aspect of the head of the talus. The heel is not touched

Fig. 6. The flexed foot, lightly supinated, is slowly abducted while counterpressure on the head of the talus stabilizes the bone against rotation in the ankle mortice. The medial tarsal ligaments are stretched allowing the calcaneus to abduct with the foot and the anterior tuberosity of the calcaneus is disengaged from its position under the head of the talus

Fig. 7. Complete correction of the clubfoot requires severe abduction of the midfoot and forefoot to stretch the tight medial tarsal ligaments

Fig. 8 A In the clubfoot the calcaneus is severely adducted, flexed and inverted under the talus. **B** When the calcaneus abducts it simultaneously extends and everts to its normal and neutral position under the talus. (Fig. 8 originally appeared in [10])

Fig. 9 A Posterior view. The heel is in varus when the foot and calcaneus are adducted. **B** The heel is in the normal position when the adduction of the foot and of the calcaneus are corrected

The equinus is corrected by dorsiflexing the fully abducted foot. A tenotomy of the Achilles tendon is often necessary to completely correct the equinus [11].

Many degrees of severity and rigidity of clubfoot are found at birth. Failures in treatment are related more often to faulty techniques of manipulation and application of the cast than to the severity of the deformity. Our experience of 50 years indicates that most clubfeet, when treated shortly after birth, can be easily corrected by manipulation and five or six applications of plaster casts. A small number of infants with very severe, short, fat feet with stiff ligaments unyielding to stretching will need surgical correction. Long term function and the results of our patients treated in infancy indicate that the well treated clubfoot is not a handicap and is compatible with a normal active life [3].

The common errors in the treatment of the clubfoot and how to avoid them are:

1. *Pronation or eversion of the foot (Fig. 10).* The wrong assumption is made that the severe supination in the clubfoot will correct by pronating or everting the foot. Pronation of the foot will make the deformity worse by increasing the cavus and locking the adducted calcaneus under the talus, while the midfoot and forefoot are twisted into eversion [12]. Supination of the foot and heel varus are corrected by abducting the supinated foot under the talus.

2. *External rotation of the foot to correct abduction while the calcaneus is in varus.* This causes a posterior displacement of the lateral malleolus by externally rotating the talus in the ankle mortice. The posteriorly displaced lateral malleolus, seen in poorly treated clubfoot, is an iatrogenic deformity [12]. It does not occur when the foot is abducted in flexion and slight supination to stretch the medial tarsal ligaments, thus allowing the calcaneus to abduct under the talus with correction of the heel varus.

3. *Abducting the foot at the midtarsal joints with the thumb pressing on the lateral side of the foot near the calcaneocuboid joint, arching the foot as if straightening a bent wire.* This was taught by Kite and is a major error [8]. By abducting the foot against pressure at the calcaneocuboid joint the abduction of the calcaneus is blocked, thereby interfering with correction of the heel varus (Fig. 11). Kite wrongly believed that the heel varus would correct simply by everting the calcaneus. He did not realise that the calcaneus can evert only when it is abducted, i. e. laterally rotated, under the talus. This error in the Kite technique had a major neg-

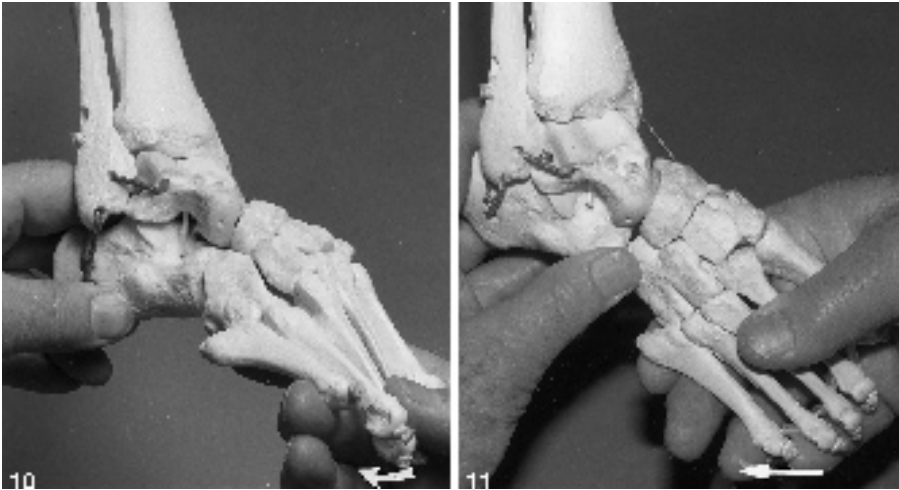


Fig. 10 Pronation of the forefoot will not correct the supination and adduction of the midfoot and of the calcaneus. The calcaneus will remain locked in adduction under the talus and the midfoot and forefoot will be twisted into eversion leading to increased cavus and to a “bean-shaped foot” deformity

Fig. 11. Arching the foot as if to straighten a bent wire with pressure applied on the lateral side of the foot near the calcaneocuboid joint is a major error because medial pressure at the calcaneocuboid joint prevents the calcaneus from abducting and therefore from evertting, since the calcaneus can evert only when it is abducted

ative impact on the manipulative treatment of clubfoot, Kite was able to correct the deformity after many manipulations and changes of cast. His less patient followers, with some notable exceptions, have resorted to surgery.

4. *Frequent manipulations not followed by immobilisation.* The foot should be immobilised with the contracted ligaments at the maximum stretch obtained after each manipulation. Plaster casts applied between manipulations serve to keep the ligaments stretched, and to loosen them sufficiently to facilitate further stretching in the manipulations following at intervals of five to seven days [11].

5. *Application of below knee instead of toe to groin casts.* The longer plasters are needed to prevent the ankle and talus from rotating. Since the foot must be held in abduction under the talus, the talus must not rotate, otherwise the correction obtained by manipulation is lost.

6. Attempts to correct the equinus before the heel varus and foot supination are corrected will result in a rocker bottom deformity.

7. *Failure to use shoes attached to a bar in external rotation for three months full-time and at night for two to four years.* These splints are necessary to counter the tendency of the ligaments to tighten, causing relapses [11].

8. *Attempts to obtain a perfect anatomical correction.* It is wrong to assume that early alignment of the displaced skeletal elements results in a normal anatomy and good long term function of the clubfoot. We found no correlation between the radiographic appearance of the foot and long-term function [3]. In severe clubfoot, complete reduc-

tion of the extreme medial displacement of the navicular may not be possible by manipulation. The medial tarsal ligaments cannot be stretched sufficiently to properly position the navicular in front of the head of the talus. Since the joint capsules and ligaments play a crucial role in the kinematics of the tarsal joints [7], they cannot be stripped away with impunity. In infants, the medial ligaments should be gradually stretched as much as they will yield rather than cut, regardless of whether a perfect anatomical reduction is obtained or not [11].

With a partially reduced navicular, the forefoot can be brought into proper alignment with the hindfoot because the ligaments in front of the navicular and the bifurcate ligaments will yield, allowing lateral displacement and lateral angulation of the cuneiforms and of the cuboid with proper positioning of the metatarsals. The calcaneus can be abducted sufficiently to bring the heel into a normal neutral position. This anatomically imperfect correction will provide good functional and cosmetic results for at least four decades, avoiding many of the complications of operative tarsal release. However, in children more than four or five months old, the ligaments become stiffer and they may need to be divided surgically to adequately position the foot.

Relapses are common in severe clubfeet and are probably caused by the same pathology that initiated the deformity, but they may easily be corrected by manipulation and two to three plaster casts. When a second relapse occurs and the tibialis anterior muscle has a strong supinatory action, the tendon must be transferred to the third cunei-

form. This transfer prevents further relapse and corrects the anteroposterior talcocalcaneal angle, thereby greatly reducing the need for tarsal release [9, 10].

Surgeons with limited experience in the treatment of clubfoot should not attempt to correct the deformity with manipulation and plaster casts. They may succeed in correcting mild clubfeet, but the severe cases require experienced hands. It is easy to compound the deformity, making further treatment difficult or impossible. No more than two or three changes of cast should be undertaken if correction is not being achieved. Referral to a centre with expertise in the management of clubfoot should then be made so that more skilled attempts at manipulation can be attempted before tarsal release operation is considered. The functional results are always better if this type of surgery can be avoided [1].

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