



# Conservative treatment of clubfoot: the Functional Method and its long-term follow-up

## Çarpık ayağın konservatif tedavisi: Fonksiyonel Yöntem ve uzun dönemli izlem

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Despite the presence of a considerable number of papers published in the international literature, talipes equinovarus keeps its secrets. Conservative methods of treatment are currently accepted as advantageous over surgery. Prediction of the future of a clubfoot after treatment is not possible, for this reason, a long-term follow-up is needful. A true Functional Method based solely on gentle manipulations has been used for more than thirty years. Its aim is to correct the deformity and to allow the child to walk without delay. The principle of this method is to distract joint contractures prior to progressive correction of the deformity. No selection is made regarding the severity of the deformity and its etiology. Family plays an important role in performing routine manipulations at home. Concerning this Functional Method, three main series have been published by our team, with excellent-good results accounting for up to 77%. We believe that our Functional Method of conservative treatment of clubfoot is an appropriate way for correction of the deformity and its stabilization.

**Key words:** Child; clubfoot/therapy/radiography; infant; manipulation, orthopedic.

Uluslararası literatürde çarpık ayakla ilgili önemli sayıda yayının varlığına rağmen, hastalığın halen çözülememiş yanları vardır. Günümüzde, konservatif tedavi yöntemleri cerrahiye göre daha avantajlı görünmektedir. Tedaviden sonra çarpık ayakla ilgili öngöründe bulunmak zordur; bu nedenle, uzun dönemli takibe gerek vardır. Biz, 30 yıldan fazla bir süredir, yalnızca nazik manipülasyonlara dayalı gerçek bir fonksiyonel yöntem uygulamaktayız. Bu tedavinin amacı deformiteyi düzeltmek ve çocuğun gecikmeksizin yürümesini sağlamaktır. Tedavinin prensibi ise, deformitenin sürekli düzeltilmesi girişimlerinden önce eklem kontraktürlerini gidermektir. Deformitenin ciddiyeti ve etyolojisi ile ilgili olarak herhangi bir ayırım yapılmamaktadır. Aile de rutin manipülasyonların evde yürütülmesi konusunda etkin bir rol oynamaktadır. Bu fonksiyonel yöntem üzerine, ekibimiz tarafından bugüne dek üç büyük çalışma yayımlanmıştır; bunlarda mükemmel-iyi sonuçların ağırlığı %77'yi bulmaktadır. Çarpık ayağın konservatif tedavisinde uyguladığımız Fonksiyonel Yöntem'in, deformitenin düzeltilmesi ve stabilizasyonunda uygun bir yol olduğuna inanıyoruz.

**Anahtar sözcükler:** Çocuk; çarpık ayak/tedavi/radyografi; bebek; manipülasyon, ortopedik.

## Introduction

Talipes equinovarus, also named clubfoot is a multiplanar, complex deformity of the foot. The true clubfeet are those, of which deformities cannot be fully reduced at the first visit. Such is the current definition of the clubfoot approved by the International ClubFoot Study Group (ICFSG). This definition is

important so that the postural feet (reducible deformities) should not be included in the results of our series.

Clubfoot is made up of four deformities which are to be corrected: the hindfoot is the site of varus and equinus; the midfoot -medial subluxation leads to the forefoot supination, and the calcaneo-forefoot unit (CFFU) is rotated inwards.

Two issues are fundamental to be recalled in treatment of clubfoot: at the first visit, the future evolution of the foot cannot usually be foreseen. Thus, a long-term follow-up is needful during the course of the growth of the foot to prevent late relapse.

After the checkup, the treatment of clubfoot should not be delayed. It should start as soon as the neonatal period. This issue is part of a global rule which entails initiating the treatment of some deformity as soon as its diagnosis is set up. On the other hand, in this neonatal stage, the muscles of the foot are in an intermediate situation between its activity in the fetal liquid atmosphere and its function in the air linked to its gravitational component. For the same reason, capsulo-ligamentous soft tissues are not yet at the fibrous stage, which will stabilize muscular imbalance. In the same way, connective and fatty soft tissues, especially the posterior ones, have not yet assumed fibrous metaplasia which will stabilize the deformities.

### The method

The principle of early treatment of clubfoot corresponds to the demands of its characteristics. Indeed, what are we expecting from the treatment? Is our aim only to realign the foot in order to enable the patient to wear shoes while walking? For this purpose, no matter what the technique or when the onset of treatment will be. On the contrary, should we consider the goal of a functional recovery and also flexibility of the joints that correlates well with the alignment of the foot? In this case, it is indispensable to start treatment as soon as possible, and to use a nonaggressive procedure.

The consensus is currently global about the following dogma: the at-birth treatment of clubfoot should be conservative whatever its technique is.

In our practice, each clubfoot is checked objectively at birth.

The score in the neonatal period allows us to distribute clubfeet to one of the four groups, according to the Dimeglio-Bensahel classification:<sup>[1]</sup>

- A (1-5) – Mild;
- B (6-10) – Moderate;
- C (11-15) – Severe;
- D (16-20) – Rigid

Mild deformities account for less than 1% in our practice, the average score at birth being 11.5 (range 4 to 20).

All the feet are treated by our functional method. This procedure is used in all kinds of clubfoot, from mild to rigid cases, from idiopathic to neurologic cases. In short, our functional method is not a selective treatment at all. It consists of consecutive gentle manipulations during the time the baby is relaxed or asleep after having been fed. The baby must not be crying during these manipulations. These manipulations start by gentle joint distractions, then progressive reduction of each deformity so that no counter pressure is caused on the bone or cartilaginous frames. This functional treatment is made up of the following stages:

- In our concept of the pathophysiology of clubfoot, the onset of deformities is in the midtarsal foot as it is the most flexible and provides the widest range of movements. Thus, gentle distraction is applied on the talonavicular joint followed by progressive reduction of this subluxation.

- Correction of the varus of the hindfoot and partial correction of the equinus of the os calcis.

- Progressive reduction of the talus in the tibiotalar joint as the posterior soft tissues become more flexible. This talar reduction aims to keep the hindfoot with some plantar flexion.

- Lateral derotation of the CFFU. Combined with the reduction of the navicular subluxation, this derotation will allow the correction of the mid- and forefoot supination.

- Finally, achievement of correction of the hindfoot equinus.

Each session of manipulations uses the same ritual and progresses depending on the rate of improvement of the deformities.

Active rehabilitation is the last step of each session in order to decrease the imbalance of the muscles. Indeed, our major aim is to restore the function of the foot and ankle.

A flexible splint is applied between the sessions of manipulations. It is light, flexible (made of elastic tape) and it is a below-the-knee splint. It allows self movements of the baby and physiologic gesticulations in the motor schemes. This splint does not

maintain the foot in the full corrected position: it is an undercorrecting splint. It is merely used to keep the achieved level of correction of the deformities without disturbing the baby.

At birth, the manipulations (around 30 minutes per foot) are performed daily. After a fortnight, they will be five times per week. Then, it can be decreased progressively to two sessions per week. The manipulations are taught to the family to be performed in the meantime of the sessions at the therapist's office. Of course, the more often the manipulations, the greater is the efficiency. Its influence on the parents is much helpful in enhancing their psychological participation and their willingness to perform routine manipulations at home.

The length of time for reduction of the deformities ranges from four to six weeks for hindfoot varus correction, talonavicular reduction, and derotation of the CFFU. Approximately 50% of the hindfoot equinus can be reduced in six weeks, the residual equinus is more demanding, from four more weeks to a few months. In fact, the residual equinus may be due to the contracture of the triceps surae. But, in other cases, it is due to the stiffness of the posterior soft tissues. The former may undergo spontaneous correction at the weight-bearing stage.

The use of ultrasonography allows us to confirm that these manipulations, with distraction effect and progressive correction, are harmless to the development of the bones and cartilage.

Once the four deformities of the foot are corrected, it is needful to continue these manipulations to stabilize the achieved correction, which is a must in this functional method. It will increase its efficiency, as well.

In case the functional method do not result in complete correction of the deformities of clubfoot, a limited, *a la carte* surgery will be proposed in order to achieve the realignment of the foot. Thereafter, the functional method is used again to stabilize the reduction of the foot and to strengthen and balance the muscles.

At the time the infant starts standing upright, we often use a wooden splint to allow the hindfoot to be stabilized in a neutral position and the CFFU to be straightened with respect to the tip of the patella

(alignment to the thigh-foot angle). Until this alignment is achieved, the risk for further relapse is high.

Finally, once the treatment is over, we follow the child until the end of growth, allowing him to have a normal life, including sports activities, and wearing normal shoes. Long-term follow-up is needful in clubfoot as some relapse may occur late during the growth.

An outcome evaluation<sup>[2]</sup> is made according to the one proposed by the ICFSG. It includes objective parameters. It is rated from 0 (the best result) to 60 points (the worst result). The global score is calculated from the following: up to 12 points for the end morphology of each part of the foot; up to 36 points for the function of the foot (including passive motion, muscular strength, gait, and pain), and up to 12 points for X-rays.

This evaluation is employed at the age of six years, and then, at the end of the growth of the foot.

### Results of the functional method

The expertise of a procedure is the result of the experience each one of us may develop. This is why our publications of the results of such treatment have been limited in number. Three wide series have been published as a sample of the protocol of our Functional Method. The first series was published in 1980 in the French literature,<sup>[3]</sup> followed by the other two in the English literature in 1990<sup>[4]</sup> and 2004, respectively.<sup>[5]</sup> From the first (600 clubfeet) to the third series (338 cases in the second, and 350 cases in the third), the rate of excellent-good functional results has improved from 48% to 77% of the cases. This evolution of improvement shows how much useful the experience of a practitioner is to get the best results.

However, we place great emphasis on the fact that the technique has to be used and followed according to the guidelines of the Functional Method and to the successive stages of the correction of the deformities. In addition, the length of time for realignment of the foot will be determined by the severity of the deformities and no acceleration of treatment can be made as a routine.

In our practice, all the cases of clubfoot have been included whatever its severity is, with the more severe and rigid cases accounting for 70% of our practice. No clubfoot has been rejected on the

grounds of severity, and no selection has been made among the cases. Besides, this method has also been used in non-idiopathic cases (neurogenic, arthrogryposis, etc.). In this case, the treatment can be incomplete, but it will allow the foot to become more flexible so that surgery can be more limited.

In our practice, children with clubfoot are followed after the end of treatment until the end of growth, which is the best means to detect early relapse and to confirm the early good results. Moreover, this is the only way to prove the efficiency of our Functional Method.

### A review of published series

Surgery may reduce all the deformities of clubfoot. However, data incorporating the final morphological aspect and the passive and active function of the foot and ankle are limited.

The inconveniences of surgery emphasize the conservative treatment which is invaluable. Currently, two methods are widely used: either the serial plaster cast or single manipulations. The plaster cast technique is used according to the Kite or, much more, Ponseti's techniques.<sup>[6]</sup> It may not reduce all the clubfeet as well as that achieved by the Functional Method.

The Kite<sup>[7]</sup> technique is achieved by open surgery. As for the Ponseti's technique, it includes a percutaneous Achilles tenotomy. Thus, it is, in fact, a combined technique using a conservative technique (serial casts) in conjunction with surgery. Besides, after correction of the foot, a Dennys Browne splint is worn, with both feet (even if the clubfoot is unilateral) being in an outgoing position, initially twenty-four hours a day, then for the rest, at nights as the child walks, up to four years of age. Moreover, in more than one-third of the cases, a lateral transfer of the tibialis anterior is required.

The Ponseti's technique is deeply different from our method, and the length of time the child wears a splint is far prolonged than that in our method. On the other hand, it is difficult to try to compare the results due to the surgical step included in the Ponseti's technique.

Out of the so many articles written by I. Ponseti and his disciples, it is uneasy to define to which kind of clubfoot the results belong. Indeed, no classification related to the grade of severity of deformity

seems to have been set up before the onset of the initial treatment. In the same way, taking into consideration the long-term follow-up of the results, the single paper of Laaveg & Ponseti<sup>[8]</sup> reported that, from a series of 498 patients, 70 patients with 104 clubfeet could be reviewed in the long-term, with the mean age at follow-up being 18.8 years.

This item of the long-term follow-up is fundamental for asserting the final result, e.g. by the end of growth.

Being nonexhaustive, we reviewed some other articles which included a long-term follow-up. It is the case of the study of Cooper & Dietz<sup>[9]</sup> concerning 45 patients whose average follow-up was 34 years. This is a valuable study, although 29 of the studied patients had been evaluated and reported on previously.

Heilig et al.,<sup>[10]</sup> thanks to a multicentric study inside the USA (in POSNA), reviewed 8,595 clubfeet. They underlined that 26.7% of the feet treated achieved complete correction without surgery.

Cerulli & Della Torre<sup>[11]</sup> reviewed 78 clubfeet having been treated with a conservative technique. Their follow-up ranged from six to 28 years. Their results underlined a high percentage of poor and moderate results (32.7%), though it is lower than the average values reported by other authors (50% to 60%). The used data may not be updated.

Ippolito et al.<sup>[12]</sup> published a paper of long-term follow-up, comparing the results of two procedures, both of which combined serial plaster casts to surgery (posterior or posteromedial release). They mentioned about the distribution of the results according to the Laaveg-Ponseti rating system, with the addition of radiographic results which was lacking in this system. However, no mention was made of the distribution of the grade of severity of deformity prior to onset of conservative treatment.

Macnicol et al.<sup>[13]</sup> reported a series of 234 cases (grades 2 and 3) with a mean follow-up of 10 years. The results were compared with relation to the severity of the initial deformity. This is worthwhile data which we never saw to be mentioned up to the recent paper of one of us (H.B.). However, this paper was based on surgical treatment, which is not the purpose of our article.

Seringe & Atia<sup>[14]</sup> reported in the French literature a series of 269 clubfeet treated with the Bensahel's method. These authors were aware of the insufficient follow-up which was around six years.

More recently, Vitale et al.<sup>[15]</sup> published a series of 24 patients, based on patient-based outcomes with a 16-year follow-up. Again, this informative paper was concerned with surgical treatment.

As for Andriesse et al.,<sup>[16]</sup> their clubfoot assessment protocol "can be used during the first seven years of childhood".

At last, the recent book of Exner et al.<sup>[17]</sup> which appeared in the German literature emphasized the usefulness of the Bensahel's method as the true functional conservative treatment of clubfoot.

Up to recently, it has been difficult (even impossible) to compare the results of different studies as the data having been selected are too divergent. Cooper and Dietz drew attention to the fact that such a comparison was, at least, uneasy. This is why one of us (H.B.) attempted to set up, together with the ICFSG, the above-mentioned Outcome Evaluation. It assesses the morphological results (clinical and radiographic) and, much more, the functional results which are the first target of our treatment. The objectivity of the data makes this evaluation accessible to all of us, so that we will be able to compare, in the near future, our respective results. Celebi et al.<sup>[18]</sup> who conducted an inter- and intraobserver reliability study confirmed the scientific value of this method of evaluation.

This Outcome Evaluation does not include the traditional satisfaction of the patient. It appeared to us to be contingent with regard to the future of the result.

The utility of such Outcome Evaluation proposed by the ICFSG, together with the Pre-Treatment Classification (having similar objective data) will allow all of us to speak the same language about clubfoot. Then, the international language will be much more effective for the benefit of children with clubfoot.

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