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Physical Medicine and Rehabilitation Management in Pediatric Patient with Postural (Positional) Clubfoot: A Case Report

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Abstract*:* Clubfoot, *talipes equinovarus*, is a common term used to describe several kinds of ankle or foot deformities present at birth. This condition is one of the most treatable birth defects, often leading to normal or near-normal athletic activities later in life. We reported a patient with positional clubfoot treated with serial casting, passive manipulation, and stimulation. Male, 6 days old, lived in Sonder, with a chief complaint of right foot that bent inward since birth. Patient was consulted by pediatrician to physiatrist since the birth day. The bent inward foot was not accompanied by swelling and redness, and patient was seen calm when the foot being moved. Patient was treated by physiatrist with passive manipulation, four times weekly with serial casting, and everyday stimulation for feet. During treatment session, patient's deformity was getting improved. After treatment, the deformity was corrected and patient's foot was in normal position without any complication. The aim of medical rehabilitation of clubfoot was to reduce the deformity with the success criteria that foot could be functional, free of pain, good mobility, and did not require correction shoes, therefore, the patient could carry out normal activities after growing up. In conclusion, to produce the maximum correction results, good cooperation is required with the patient's parents. Even though correction is optimal and done as soon as possible, if bone growth has not stopped, the clubfoot problem can reappear. The first element of management is correction of the cavus deformity by positioning the forefoot in proper alignment with the hindfoot.
Keywords: postural clubfoot; physical medicine and rehabilitation; children; passive manipulation; serial casting; everyday stimulation for feet

INTRODUCTION

Clubfoot, *talipes equinovarus*, is a common term used to describe several kinds of ankle or foot deformities present at birth. The foot is generally in equinus, with forefoot and hindfoot varus and severe adduction. As the most common birth defect, it carries an incidence ranging from 1:250 to 1:1,000 live births, depending on the population. This condition is one of the most treatable birth defects, often leading to normal or near-normal athletic activities later in life. Multifactorial genetic inheritance, along with poorly understood environmental factors, may explain the bulk of etiology. Some clubfoot disorders are transient or apparent in nature and result simply from intrauterine crowding. Other conditions may occur in association with myelodysplasia, arthrogryposis, and particularly hip dislocation. Prenatal ultrasound can be effective in diagnosing intrauterine clubfoot, with no false-negative prediction and a true-positive predictor rate of 83%. Recent treatment has focused primarily on the *Ponseti technique*. The range of motion (ROM) should be maintained by passive exercise and therapeutic play, particularly into dorsiflexion and eversion. Persistent deformity into adulthood can result in unstable ankles, lateral sprains, and difficulty with weight-bearing and other gross mobility tasks.[1]

The classification of a clubfoot may change with time depending on management. Typical clubfoot is the classic clubfoot found in otherwise normal infants. It generally corrects in five cast, and with Ponseti management the long-term outcome is usually good or excellent.[2] The need for clubfoot scoring is controversial. Proponents find serial scoring useful in classifying the clubfoot, assessing progress, showing signs of recurrence, and establishing the prognosis. There are two commonly used methods of scoring. Pirani score, this score documents the severity of the deformity and sequential scores are an excellent way to monitor progress. Dimeglio score, this score provides an additional method of assessing each component of the clubfoot deformity.[2] Laboratory tests are usually not necessary for assessment. Radiographic examination is rarely done or is not necessary for assessment. Because active handling is usually done since the beginning of the infantile period.[3]

Congenital talipes equinovarus (CTEV) abnormalities are easily diagnosed, but full correction is difficult often due to the ignorance of the patient's family, so that the abnormality becomes dormant. Deformity of CTEV requires early treatment so that possible disabilities do not continue into adulthood. If done as early as possible, the results achieved will be quite satisfactory.[4,5] Management of clubfoot consists of operative and nonoperative managements.[5,6] Without treatment, clubfoot deformity causes lifelong disability due to pain and difficulty in walking. The aim of medical rehabilitation of clubfoot is to reduce the deformity with the success criteria that foot can be functional, free of pain, good mobility and do not require correction shoes so that the patient can carry out normal activities at childhood and after growing up. Program therapy in clubfoot is a long-term therapy. To produce the maximum correction results, good cooperation is required with the patient's parents. Even though correction is optimal and done as soon as possible, if bone growth has not stopped, the clubfoot problem can reappear.[7]

CASE REPORT

Initial presentation reveals a male baby, 6 days old, live in Sonder, has a major complaint of right foot is bent inward. From alloanamnesis with his parents, found that patient's foot was bent inward since birth. Patient was consulted by pediatrician to physiatrist since the birth day at Bethesda Hospital Tomohon. Parents were educated by physiatrist that the patient has to be treated with passive manipulation. Patient underwent therapy for passive manipulation and stimulation for both feet, the left foot can back to normal position, but the right foot is remaining bent inward. Then patient was reffered to medical rehabilitation at Kandou Hospital Manado to undergo the further treatment. The parents brought their son to medical rehabilitation policlinic at 6 days of age. The bent inward foot was not accompanied by swelling and redness, and patient was seen calm when the foot being moved. The right foot could be positioned to neutral position passively meanwhile the left foot was normal. There was no complain about feeding in patient (Fig. 1).

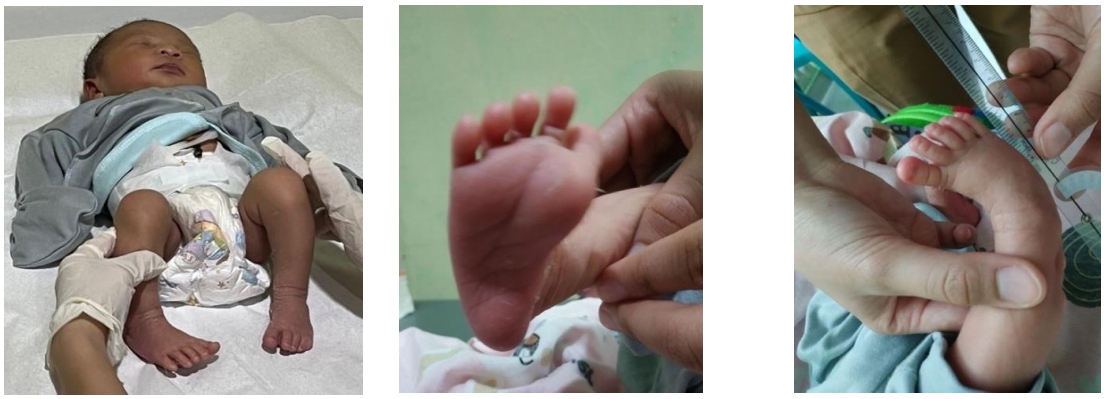


Figure 1. Patient's appearance at the first visit

For history of natal, patient was born through caesarian section due to fetal distress in August 31, 2022 with birth weight 3200 g, body length at birth 50 cm, Apgar score was unknown, but he immediately cried. History of icteric, cyanotic or other diseases were denied except the foot abnormality. He got immunization according to age (Hep B, polio).

On the physical examination, in localic status of the right lower limbs there was a convex at lateral side, concave at medial side (bean shaped deformity), the forefoot in adduction, midfoot in supination and there was cavus, hindfoot in equinus and varus/inverted at right extremity. Right foot could be moved to neutral position, forefoot could not be positioned in the abduction position and hindfoot could not be everted, partially palpated the heel, minimal tightness of Achilles tendon and deltoid ligaments, right and left calf circumferences (measuring 5 cm from patella) were 8 cm. Range of motion of right ankle in dorsoflexion -5^{0}, abduction -5^{0}, eversion was difficult to evaluate, meanwhile the other ROMs were in normal range. Measuring the Pirani score of right foot showed: mid foot: curved lateral border 0.5, medial crease 0.5, talar head 0; hind-foot: posterior crease 0.5, equinus rigidity 0.5, empty heal 0.5; and the total Pirani score was 2.5.

DIAGNOSIS

In medical diagnosis, the clinical diagnosis is positional/postural clubfoot, topical diagnosis is bilateral foot, and etiological diagnosis is intrauterine crowding. Functional diagnosis consists of body function, body structure, activities, participation, enviromental factors, and personal factors. Body Function is functions of joints and bones b710 mobility of joint functions, limitation of ROM ankle, b715 stability of joint functions which is equinus, b720 mobility of bone functions tarsal bone deformity, b789 movement functions, other specified and unspecified. Body Structure is structures related to movement consisting of s750 structure of lower extremity ankle and foot, s799 additional musculoskeletal structures related to movement of tendon Achilles and deltoid ligament tightness, s789 structure related to movement, other specified ROM limitation of ankle, s799 structure related to movement, unspecified which in this case are ankle and foot. Activities and Participation are changing and maintaining body position, d410 changing basic body position movement of lower extremity. Enviromental Factor in support and relationships is e310 Immediate family which is parents and grandparents. The last one is Personal Factors which is parent's anxiety.

Rehabilitation Problems

The rehabilitation problems in this case are the foot shape abnormality due to clubfoot, Achilles tendon and deltoid ligament tightness, risk of gross motor developmental disturbance, parents' anxiety, and lack of information about clubfoot and its treatment.

Short term goals are to correct deformity and reduce the thickness and tightness of Achilles tendon and deltoid ligament. Long term goals are to restore normal ROM of ankle, prevent recurrences, achieve ability to wear normal shoes, and prevent delayed development.

This patient was given Ponseti technique manipulation technique with long leg serial casting

(replaced every week) at right foot, passive stretching at Achilles tendon and deltoid ligament, mental support for the parents to come regularly because the therapy took a long time and needed attention and cooperation of the parents for the success of therapy. Moreover, the financial condition was evaluated, too. The parents were educated about their child condition, its causes, and that the medical system could manage these problems. The parents were also reassured that the cause was not their fault and the treatment was highly effective but took time, and motivated to follow the advice and treatment. However, if the tip of the toe was pale or blue immediately removed the cast by soaking and unwrapping method and then took the child to the hospital, for correction of the serial casting. The toes had to be uncovered, diapers had to be changed frequently so the cast was not damaged. Before going to the hospital, the casting had to be opened at home by soaking in water and unwrapped the cast.

DISCUSSION

This case report is about a 6 days old boy who has deformity of his foot where it bent inward since birth and was consulted with the diagnosis of clubfoot. Clubfoot is a congenital disorder that is usually found in newborns. It can occur unilateral or bilateral with abnormal position of the foot. Clubfoot consists of *talipes* (talus = ankle, = foot), *equinus* (lower toes than heels) and *varus* (twisting inward).[1,8]

Clubfoot is a shift in the medial and plantar direction of the thoracalcaneonaviculare and calcaneocuboid joints that occur in utero. The clinical appearance at birth is very typical, which is both legs bent inward. The ankle is in a fixed equinus condition with the heel arranged upward and the calcaneus tethered to the fibula. Movement of ankle in plantarflexion and dorsiflexion is limited. Forefoot and midfoot are in a fixed equinus and inversion condition.[9]

The clubfoot is classified into categories. This classification is made to establish the prognosis and to plan the management. The classification of a clubfoot may change with time depending on management. Typical clubfoot is the classic clubfoot and is found in otherwise normal infants. It generally corrects in six casts, and with Ponseti management the long-term outcome is usually good or excellent. Typical clubfoot consists of positional clubfoot, delayed treated clubfoot, recurrent typical clubfoot, and alternatively treated typical clubfoot. Atypical clubfoot is usually associated with other problems. Start with the Ponseti management, the correction usually is more difficult. Atypical clubfoot consists of rigid or resistant atypical clubfoot, syndromic clubfoot, teratologic clubfoot, neurogenic clubfoot, and acquired clubfoot.[9]

This patient was classified as typical clubfoot, specifically postural or positional clubfoot. At birth, it is important to differentiate between postural and rigid CTEV in which the deformity is stiff and the ROM is limited. The postural clubfoot shows inversion of the hind foot, adduction and inversion of the forefoot, and the entire foot is plantar flexed at the level of the ankle. Usually there are neither abnormal skin creases nor calf atrophy. The deformity is supple and on passive manipulations it is fully correctible. According to the physical finding there was good outcomes with Ponseti management at 3rd serial casting and there was also great improvement based on Pirani score from 2.5 to 0. Physical findings showed that the foot was flexible on palpation and in passive movement the foot can be positioned into neutral.[9]

In most cases, clubfoot in newborns results from misplaced fetal foot while still developing in utero. Therefore, the history needs to be explored the situation of maternal pregnancy to look for causes during in utero, weight and length of body, labor history (normal or not, crying right away or not), family history of illness (both from the father and mother), the mother's environment during pregnancy, and the lifestyle of the mother during pregnancy.[9] In this patient, based on anamnesis the diagnosis is the right leg bent at birth meanwhile the history of the mother is still unclear since there is no abnormalities during antenatal care.

In physical examination, there were no significant physical abnormalities and no other congenital abnormalities. In neurological examination the result was in normal limit. At local status examination of the right lower extremity, inspection revealed bean shaped deformity,

forefoot: adduction, midfoot: cavus, hindfoot: equinus and varus, upward heel and inversion. On palpation, both feet could be moved to a neutral position. Forefoot could be positioned passively in the abduction position, hindfoot could be everted as well. Achilles tendon and deltoid ligaments were supple and flexible. Right and left calf circumferences (measuring 5 cm from patella) were 8 cm each, right and left foot lengths were 8.5 cm each. According to the literature on clubfoot the physical examination must be done in head-to-toe examination, because this abnormality is often accompanied by other abnormalities, including joint weakness, developmental dysplasia of the hip (DDH), tibia torsion, oligodactyly, and absence of some tarsal bones. All these abnormalities must be examined carefully in order to obtain the etiology.[10,11]

Different from rigid CTEV, the characteristics features showed a three-dimensional deformity (inversion, adduction, and equinus) with four evident components (C.A.V.E) in the right foot: Cavus (increased longitudinal arch of the foot), Adduction (tarsal bones directed towards the median plane), Varus (inversion and adduction of the calcaneal bones), and Equinus (increased plantar flexion of the ankles).[12] The hindfoot is held in a firm position of equinus, with a tight heel cord. There is a retraction and atrophy of the gastrosoleus muscles; the calcaneus is inverted in varus position; and the forefoot is held in adduction and supination, but still less supinated than the hindfoot, producing a cavus deformity with a medial and a posterior skin crease, more pronounced in severe cases. On palpation, the change in kinematics is apparent. Decreased subtalar motion reflects the severe shortening of the medial and posterior tarsal ligaments and the tightness of the tibialis posterior and gastrosoleus muscles. On the dorsal part of the foot, the head of the talus is palpated uncovered by the navicular, which is medially positioned, close to the medial malleolus.[12] These clinical manifestations of deformity were present in this patient, but with passive manipulation the ROM can correctible, no different in length and width of the feet, and this patient does not have atrophy at calf muscle.

A positional clubfoot, also known as habitual or postural, is a very mild foot deformity, resembling clubfoot in appearance, but with a full ROM. This means that the foot can move freely in any direction, and there is no structural limitation and structural abnormality. This deformity develops between 14 and 16 weeks of gestation when the fetus still has a lot of space inside the uterus and when there is a large amount of amniotic fluid that allows it to move freely and without any obstructions. It may be seen during a standard ultrasound scan, but only after the delivery will it be possible to determine exactly the defect type and whether the original diagnosis is correct.[13,14]

The positional clubfoot is of normal size and slender shape. There is no difference in the length and width of the feet as noted in children with congenital clubfoot with a structural basis (i.e. exhibiting existing changes in the structure of bones and soft tissues). The bones inside the foot are not shifted against one another. Their shape remains unaltered. The Achilles tendon in the positional clubfoot is of adequate length and width and is not fibrotic. Its functions are preserved. This is evidenced not only by the possibility of obtaining a good dorsiflexion of the foot, but also the skin folds above the heel are the same as in a healthy foot. Likewise, the calf muscles are not fibrotic and smaller (hence the circumference of the calf is practically the same as in a healthy leg), and the potential "error" in myosin does not reflect in the characteristic pathoanatomy of the clubfoot.[13,14]

The classification of clubfoot based on clinical severity was suggested by Pirani. The classification of Pirani is a commonly used, giving a numerical score on midfoot and hindfoot structures, as well as monitoring the progression of clubfoot treatment. Pirani Score is a simple system and reliably to determine the severity and monitor progress in the assessment and management of clubfoot. This score system visualize problems in soft tissue and bone anatomy. The abnormality on foot can be assessed in <1 minute and no technical equipment is required.[13,14] Developed by Shaque Pirani, Pirani Scores are easy instruments was used, developed to assess the severity of each individual component with clubfoot. The increasing score between the interval follow up can indicated relapsing on clubfoot. Scoring system on Pirani score based on 6 clinical sign that consist of medial crease, curved lateral border, lateral head of talus, posterior

crease, empty heel and rigid equinus, each sign is scored with: 0; no abnormality, 0.5; moderate abnormality, 1 severe abnormality.[15]

Pirani scoring for this patient in the initial examination was 2.5 at right foot and 0 at left foot, then after in 3rd serial casting, the Pirani score decreased to 0 which showed a good improvement. The purpose for this treatment is divided into short-term and long-term goals. Short-term goals that can be achieved after initial treatment in the form of serial casting are to correct the deformity. Because over the past decade Ponseti management has become accepted throughout the world as the most effective and least expensive treatment of clubfoot,[5] and as can be seen from the Pirani score that there are significant changes during serial casting and at the end of serial casting the deformity has been corrected.[15]

The goal at the short-term was identify and overcome the barriers from parents in participating rehabilitation program. When a child suffers from disorders like this there will be many barriers that come from parents. Types of barriers are, as follows: first, other forms of clubfoot management. Parents may seek non Ponseti management methods. Traditional medicine and other methods are ineffective, and delays will make Ponseti management more difficult. Manage this problem with education to the family, other healthcare providers, and the public. Second, beliefs in some cultures, communities believe that clubfoot is caused by evil spirits, witchcraft, a curse, or the mother's misdeeds. The beliefs may include misinformation suggesting that Ponseti management is ineffective. Third, stigma, if it is believed that the clubfoot or other disabilities are due to sins or misdeeds of the family, the child with a disability is a source of shame and is hidden by the family. Fourth, village birth, infants born in villages pose a special problem. They will not normally have the benefit of an examination of the newborn by a trained healthcare worker. The families may have no awareness of the diagnosis or the need for early treatment.[15]

The principle of non-operative therapy is correcting deformity through the presence of flexibility from tendons and ligaments in the legs involved. There are several non-operative techniques, namely the Kite and Lovell methods, the French method, and the Ponseti method. Most non-operative therapy using serial casts. During the cast, the tension is on tissue around the foot will decrease. When the tension decrease, correction will be achieved.[9,16] Of all the non-operative techniques, the Ponseti technique has the best results, especially for developing countries. Ponseti himself in long-term follow-up was rated as success 88.5% of the outcome functional. Subsequent reports show 80-100% success. The Ponseti method significantly reduces the need for surgery (especially posteromedial release) and revision. Non-compliance with shoes uses, unefectiveness on level of education and communication which is affect success of the Ponseti method.[9,15-17]

This patient was programmed with a Ponseti correction cast. The setup for casting includes calming the child with a bottle of milk or let the patient to sleep and then do the casting. The treatment setup is important. The manipulation and casting start as soon as possible, make the infant and family comfortable, and allow the infant to feed during the manipulation and casting processes.[15] The manipulation consists of abduction of the foot beneath the stabilized talar head. Locate the head of the talus exactly. The 1st element of management is correction of the cavus deformity by positioning the forefoot in proper alignment with the hindfoot. The forefoot is supinated to the extent that visual inspection of the plantar surface of the foot reveals a normal appearing arch. Alignment of the forefoot with the hindfoot to produce a normal arch is necessary for effective abduction of the foot to correct the adductus and varus.[15]

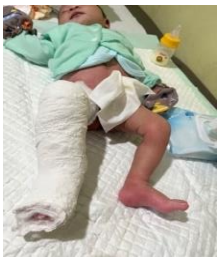
Steps in Cast Application

Plaster material was used and the heel is not touched to allow the calcaneus to abduct with the foot.[5] Then a thin layer of cast padding was applied to allow molding of the foot. The toes were held with counter pressure applied against the head of the talus while the cast was being applied with 3 to 4 turns around the toes, and then worked proximally up to the knee. The next step was molding the cast without force correction with the plaster. Light pressure was performed without constant

pressure with the thumb over the head of the talus; deformity rather, and was pressed and released repetitively to avoid pressure sores of the skin. The plaster was molded over the head of the talus while holding the foot in the corrected position. The arch was well molded to avoid flatfoot or rocker-bottom deformity. The heel was well molded by countering the plaster above the posterior tuberosity of the calcaneus. The malleoli were well molded, too. The calcaneus was never touched during the manipulation or casting, with continue molding while the plaster hardened.[15]

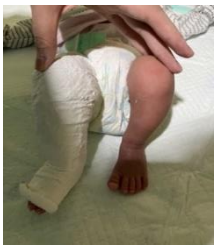
1st serial casting

1st follow up (after 1st serial casting)

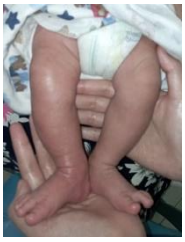


2nd serial casting

After 2nd serial casting

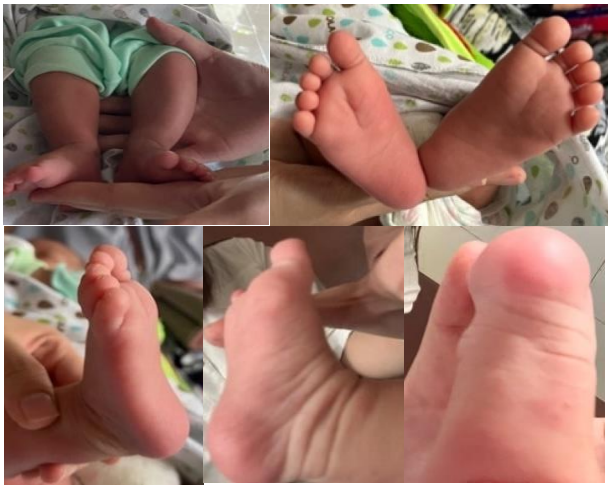


3rd serial casting



After 3rd serial casting

4th serial casting



After 4th serial casting (Final follow up)

Figure 2. Follow up for the serial casting

Next step was extending cast to thigh, and much padding at the proximal thigh was used to avoid skin irritation. The plaster might be layered back and forth over the anterior knee for strength and for avoiding a large amount of plaster in the popliteal fossa area, making cast removal more difficult. The dorsum of all the toes were left free for full extension. The foot was in equinus, and the forefoot was supinated. This casting was replaced every week for with the previous manipulation technique.[15,18] Characteristic of adequate abduction was the foot was sufficiently abducted to into $0\text{-}5^0$ of dorsiflexion before performing tenotomy. The best sign of sufficient abduction was the ability to palpate the anterior process of the calcaneus as it abducted out from beneath the talus. Abduction of approximately 60^0 in relationship to the frontal plane of the tibia was possible. Neutral or slight valgus of os calcis was present determined by palpating the posterior os calcis. Since this was a three-dimensional deformity and that these deformities were corrected together. The correction was accomplished by abducting the foot under the head of the talus.[15] Each cast was removed in clinic just before a new cast was to be applied. Cast removal had to be avoid before clinic because considerable correction could be lost from the time the cast was removed until the new one was placed. Options for removal using soaking and unwrapping was an effective method.[15]

In this case, parents were educated to perform soaking and unwrapping method one day before the next serial casting or if parents noticed that patient's right toes became pale/blue color. In such condition, the patient had to be brought to the hospital to undergo re-casting. For the final outcome, at the completion of casting, the foot appeared to be over-corrected into abduction with respect to normal foot appearance during walking. This correction to complete, normal, and full abduction helps would prevent recurrence and did not create an overcorrected or pronated foot.[15]

After the 4th serial casting, there was a tremendous improvement of Pirani score from 2 at initial visit to 0 at last follow up which was to normal foot. The parents were educated that patient was not yet needed to use foot abduction brace, possibility of recurrences, and encouragement to often stimulate patient's right foot in eversion and dorsiflexion positions. Patient should be observed until he can stand and walk, and control to doctor once a month until 6 months of age. In addition, the probability in using foot abduction brace if the right foot is back to bend inward again.

Foot Abduction Brace

Clubfoot deformity tends to relapse after correction. To prevent relapses after removal of the last cast, a foot abduction brace must be worn, regardless of whether or not the heel-cord tendon was cut. There are several different types of available abduction braces. The most commonly used brace consists of straight-bordered, high-top, open-toe shoes that are attached to the ends of an adjustable aluminum bar. The distance between the heels of the shoes equals the width of the baby's shoulders. Modifications to the shoes are made to prevent them from slipping off. The shoe on the clubfoot is outwardly rotated 60 to 70 degrees and on the normal foot (if the child has only one clubfoot), 30 to 40 degrees. The brace is worn 23 hours a day for at least 3 months and, thereafter, at night and during naps for 3 to 4 years.[5]

During the first and second nights of wearing the brace, the baby may be uncomfortable as he/she adjusts to the legs being tethered together. It is very important that the brace not be removed, because recurrence of the clubfoot deformity will almost invariably occur if the brace is not worn as prescribed. After the second night, the baby will have adapted to the brace. When not required to wear the brace, ordinary shoes can be worn.[15]

The foot abduction brace is used only after the clubfoot has been completely corrected by manipulation, serial casting and, possibly, heel-cord tendon release. Even when well corrected, the clubfoot has a tendency to relapse until the child is approximately 4 years old. The foot abduction brace, which is the only successful method of preventing a relapse, is effective in 95% of the patients when used consistently as described. Use of the brace will not delay the child's development with regard to sitting, crawling, or walking.[15]

CONCLUSION

Good cooperation is required with the patient's parents to achieve the maximum correction results. Even though correction is optimal and done as soon as possible, if bone growth has not stopped, the clubfoot problem can reappear. The first element of management is correction of the cavus deformity by positioning the forefoot in proper alignment with the hindfoot.

Conflict of Interest

The authors affirm no conflict of interest in this study.

REFERENCES

1. Staheli LT. Foot (Chapter 9). In: Fundamentals of Pediatric Orthopedics (5th ed). Philadelphia: Wolters Kluwer; 2016.
2. Wahyuni LK, Soebadi RD, Wulan SM. Deformitas kaki dan pergelangan kaki. In: Wahyui LK, Tulaar ABM. Ilmu Kedokteran Fisik dan Rehabilitasi pada Anak (Cetakan 1). Jakarta: PERDOSRI; 2014. p. 562-96.
3. Brunner R, Freuler F, Hasler C, Jundt G. Pediatric Orthopedics in Practice. Heidelberg: Springer – Verlag; 2007. p. 374- 88.
4. Schoenecker P, Rich MM, Gordon JE. The lower extremity. In: Lovell and Winter's. Pediatric Orthopaedics Vol. 1 (7th ed) Vol 1. Philadelphia: Lippincott Wiliiams; 2014. p. 1261-341.
5. Murphy KP, Wuenderlich CA, Pico EL. Orthopedics and musculoskeletal conditions (Chapter 10). In: Alexander MA, Matthews DJ, editors. Pediatric Rehabilitation Principle and Practice (5th ed). New York: Demos Medical; 2015.
6. Visser JD. Foot. In: Visser JD, editor. Pediatric Orthopedics Symptoms, Differential Diagnosis, Supplementary Assessment and Treatment. Switzerland: Springer; 2017. p. 261-98.
7. Abdelgaward A, Naga O. Foot. In: Abdelgaward A, Naga O, editors. Pediatric Orthopedics A Handbook for Primary Care Physicians. Springer; El Paso; 2014: 157-198.
8. Brown DP, Freeman ED. In: Cuccurullo SJ, editor. Physical Medicine and Rehabilitation Board Review (3rd ed). New York: Demos Medical; 2015. p. 149- 340.
9. Herring JA. Congenital talipes equinovarus. In: Tachdjian's Pediatric Orthopaedics from The Texas Scottish Rite Hospital for Children (5th ed). Elsevier Saunders: 2013. p. 785-809.
10. Thomas J, Barry M. Congenital talipes equinovarus (Clubfoot). In: Paediatric Orthopaedics in Clinical Practice (3rd ed). Elsevier Saunders; 2016. p. 177-87.
11. Besselaar A, Sakkers R, Schuppers H, Witbreuk M, Zeegers E, Visser J, et al. Guideline on the diagnosis and treatment of primary idiopathic clubfoot. Acta Orthopaedica Journal. 2017;88(3):305-9.
12. Schoenecker P, Rich MM, Gordon JE. The lower extremity. In: Lovell and Winter's. Pediatric Orthopaedics Vol 1 (7th ed). Philadelphia: Lippincott Williams; 2014. p. 1261-341.
13. Rani M, Kumari P. Congenital clubfoot: a comprehensive review. Ortho & Rheum Open Access Journal. 2017;8(1):1-5.
14. Mejabi J, Esan O, Adegbehingbe O, Orimolade E, Asuquo J, Badmus HD, et al. The Pirani scoring system is effective in assessing severity and monitoring treatment of clubfoot in children. British Journal of Medicine & Medical Research. 2016;17(4):1-9. Doi: 10.9734/BJMMR/2016/27439
15. Staheli L, Ponseti I, Morcuende J.A, Pirani S. In: Kaki Pengkor: Penanganan dengan Metode Ponseti (3rd ed). Global Help. 2010. Available from: https://global-help.org/products/kaki-pengkor-penanganan- dengan-metode-ponseti/
16. Jeans KA, Karol LA, Erdman AL. Outcomes after nonoperative treatment of idiopathic clubfoot. The American Academy of Pediatrics Journal. 2019;41(4):40-5. Available from: https://doi.org/10.1542/gr.41-4-40.
17. Digge V, Desai J, Das S. Expanded age indication for Ponseti method for correction of congenital idiopathic talipes equinovarus: a systematic review. J Foot Ankle Surg. 2018;57(1):155-8. Doi: 10.1053/j.jfas.2017.08.015.
18. Rani M, Kumari P. Congenital clubfoot: a comprehensive review. Orthopedics and Rheumatology Open Acces Journal. 2017;8(1):001-005. Doi: 10.19080/OROAJ.2017.08.555728.