



<https://africanjournalofbiomedicalresearch.com/index.php/AJBR>

Afr. J. Biomed. Res. Vol. 28(2s) (February 2025); 11-20

Research Article

Evaluating Treatment Outcomes: A Review Of Ponseti, French, And Kite Approaches For Clubfoot

Sucheta Singh^{1*}, Chanchal Jain², Dr. Jyoti Kataria³

¹ *BPT Student, Banarsidas Chandiwala Institute of Physiotherapy, Delhi-110019.

² Assistant Professor, Banarsidas Chandiwala Institute of Physiotherapy, Delhi-110019.

³ Associate Professor, Banarsidas Chandiwala Institute of Physiotherapy, Delhi-110019

***Corresponding Author:** - Ms. Sucheta Singh

*BPT Student, Dept. of Physiotherapy, Banarsidas Chandiwala Institute of Physiotherapy, Delhi-110019

Email: suchetas60@gmail.com

Abstract:

Introduction: Congenital talipes equinovarus (CTEV), also known as clubfoot, is a common congenital orthopedic condition characterized by an excessive arch of the foot (equinovarus) and a high medial longitudinal arch (cavus). The cause of congenital talipes equinovarus (CTEV) is unknown. Clubfoot affects one in 1,000 babies born worldwide, and the prevalence varies by geographic region.

Objective: The purpose of this review was to conduct a systematic review of the literature to learn about the conventional management techniques used in CTEV.

Methodology: Without any date restriction, we conducted a February 2024–April 2024 English search on PubMed and Google Scholar. We did not omit any data sources and gave systematic reviews, meta-analyses, and clinical trials priority.

Results and conclusion: Although all three methods discussed in this review showed effective results in the treatment of CTEV, the Ponseti method was comparatively better received and showed fewer relapses.

***Authors for correspondence:** suchetas60@gmail.com

Received - 22/12/2024 Acceptance- 22/01/2025

Doi: <https://doi.org/10.53555/AJBR.v28i2S.6343>

© 2024 The Author(s).

This article has been published under the terms of Creative Commons Attribution-Noncommercial 4.0 International License (CC BY-NC 4.0), which permits noncommercial unrestricted use, distribution, and reproduction in any medium, provided that the following statement is provided. "This article has been published in the African Journal of Biomedical Research"

1. Introduction :

Congenital talipes equinovarus (CTEV), also known as clubfoot, is a common congenital orthopedic condition characterized by an excessive arch of the foot (equinovarus) and a high medial longitudinal arch (cavus). It can affect either one or both legs^{1,2}. CTEV is one of the most common congenital issues of the musculoskeletal system³.

The calcaneus, navicular, and cuboid bones are rotated medially relative to the talus and are held in adduction and inversion by ligaments and tendons. Although the foot is supinated, the forefoot is tilted relative to the hindfoot, causing a cavus. In

addition, the first metatarsal is more plantarflexed⁴. The cause of congenital talipes equinovarus (CTEV) is unknown. Various theories have been proposed, including vascular, viral, genetic, anatomic, compartment syndrome factors, environmental factors, and the effects of uterine position⁵. Clubfoot develops in the first few weeks of pregnancy and might be due to systemic or neurological diseases, or it can be a feature of certain syndromes.

However, most cases occur in isolation and are called "idiopathic"⁶. Congenital talipes equinovarus can occur alone as isolated congenital anomalies of "idiopathic" causes or as a component of other features in genetic

diseases and is called as "syndromic"⁴.

CTEV is a common component of several neurological diseases, including distal arthrogryposis, myotonic dystrophy, and myelomeningocele. Chromosomal abnormalities, including chromosome 2q deletion and trisomy 18 have been associated with CTEV^{7,8}.

Clubfoot affects one in 1,000 babies born worldwide, and the prevalence varies by geographic region⁹. It has an incidence of around 1 in 1,000 live births in the UK, and up to 50% of cases are bilateral^{10,11,12}. Approximately 80% of children born with clubfoot each year live in low- and middle-income countries (LMICs)^{13,14}. A study suggests that 24.4% of cases have a family history, although the exact mode of inheritance has not been determined¹⁵. The incidence of clubfoot is 0.5-2 per 1,000 births.¹⁶ Untreated, it can cause long-term disability, deformity and pain¹. Although various surgical methods are used to correct clubfoot, such as soft tissue releases or bony procedures in older children, conservative treatment is currently the preferred option¹⁷.

The purpose of this review was to conduct a systematic review of the literature to learn about the conventional management techniques used in CTEV and their efficacy when used for treatment.

2. Methods :

We conducted a comprehensive search of Google Scholar and PubMed using the following keywords: CTEV, Congenital talipes equinovarus, CTEV treatment, Ponseti method, French method ctev, clubfoot French method, ctev Kite method, clubfoot Kite method. The search was conducted in English from February 2024 until April 2024, with no date restriction. We prioritized systematic reviews, meta-analyses, and clinical trials and did not exclude any data sources.

3. Results :

3.1 : Ponseti Technique

3.1.1 : Description

Ponseti method of manipulation and casting, which requires great compliance by caregivers for casting as well as bracing¹⁸. Ponseti developed his method for the conservative treatment of clubfoot at the University of Iowa in the 1950s, but up until about 1997, it was mostly limited to Iowa. It has since spread widely around the world¹⁹. Achilles tenotomy is needed in most patients to completely correct the equinus component of the deformity. After correction is achieved, a postcorrective brace known as a foot abduction orthosis (FAO) is used to prevent a recurrence of the deformity. The FAO is worn full time for 3 months, followed by night and naptime use²⁰.

3.1.2 Efficacy

Several authors have published several case studies and randomized control trials on the effect of the Ponseti method in children with CTEV.

Barik et al., (2018)¹⁸ published a study comparing the

results between standard Ponseti (7-day interval) and accelerated Ponseti (3-day interval) results with at least 5 years of follow-up. Children under one year of age participated in the study. In this study, 30 patients were analyzed, of whom 22 were men (73.3%). Finally, there was no significant difference in standing heel position, final dorsiflexion, varus valgus motion of the heel, eversion inversion of the foot, or final functional score.

Abdelgawad et al., (2006)²¹ conducted a study to evaluate the effectiveness of the Ponseti technique in the treatment of idiopathic clubfoot after at least 2 years of follow-up. The mean age of the 89 patients (137 feet) at the first visit was 8.6 weeks (range, 0.5 to 78 weeks). An average of 5.5 (range 3-10) castings were done on each leg. Nine feet (7%) did not improve with the initial casting and required early surgery. When the Ponseti method was fully followed, including initial casting, bracing, and treatment of relapses with recasting, Achilles tenotomy, and/or anterior tibial tendon transfer, their success rate was 93%.

Shack et al., (2006)²² studied 24 children (40 feet). All legs had an idiopathic congenital talipes equinovarus deformity.

The mean age at first consultation and start of treatment was 3 weeks (mean 4.3; 1-12). Children who did not require a tenotomy (n = 15) required an average of 3 casts (range 1-5) for complete repair, while those who had a tenotomy (n = 25) required an average of 6 casts (range 3-10) and a post-tenotomy cast. Improvement was achieved in all feet.

Complete correction was not achieved in four feet of three children due to non-compliance with the abduction orthosis. One of those feet required surgery. The success rate was 97.5% (39/40 feet).

A study by Chand et al. (2018)²³ evaluated the efficacy of repeating the Ponseti procedure for treating clubfoot that had relapsed after undergoing the Ponseti approach. For the final assessment, 115 cases of idiopathic clubfoot (79 children) with at least a 12-month follow-up were available. All 115 feet (100%) were corrected by the Ponseti treatment protocol. No osseous operations or capsular release were necessary for any of the feet. Later, 19 feet (16.5%) relapsed again. These re-relapse cases were managed again in a similar way with the Ponseti method and are currently under follow-up. The study concluded that the Ponseti method should be the preferred initial treatment modality even for relapsed idiopathic clubfeet.

3.2 French Method

3.2.1 : Description

The French method is also called the functional physiotherapy method. It consists of daily manipulation of the newborn clubfoot by an experienced physical therapist, stimulation of the muscles surrounding the foot (especially the peroneal muscles), and temporary immobilization of the foot with elastic and inelastic taping so that the reduction achieved by the passive manipulations is preserved²⁴.

3.2.2 : Efficacy

Richards et. al., (2005) ²⁵ performed a retrospective review of clinical outcomes in 98 patients with 142 congenital idiopathic clubfoot treated between February 1998 and February 2001 using the French physiotherapy method. All patients were 3 months or younger at the start of treatment. The mean score for all 142 feet at 35 months of follow-up (range, 20-62 months) was 42.3% excellent, 8.4% good, 28.9% fair, and 20.4% poor.

Excellent and good results were achieved in 76% of feet rated as moderate before treatment, 55% of severe feet and 0% of very severe feet. Fair results were achieved in 18% of legs rated as moderate before therapy, 28% rated as severe, and 48% as very severe. Poor outcomes occurred in 6% of feet that were rated as moderate before therapy, 17% as severe, and 52% as very severe.

It was concluded that when the French method of physiotherapy was applied to infants with idiopathic congenital clubfoot, more than half of the patients affected feet have excellent or good results (no surgery or simple heel tenotomy).

About 30% require subsequent posterior releases but not midfoot surgery. Only 20% of clubfeet require extensive posteromedial release.

In 52 patients (74 feet) under the age of one year who received congenital clubfoot treatment using the French approach, Vasilescu et al. (2014)²⁶ monitored the outcomes of the early conservative orthopedic treatment. The study's patients were under 9 months old when treatment started, and they lacked any additional congenital foot abnormalities. 13 foot out of 74 (17.56%) required posteromedial release at the conclusion of the treatment period due to their poor response to the conservative treatment. It was determined that more than half of the affected feet will have excellent or good outcomes (no surgery or straightforward Achilles tenotomy) when the French approach is applied to newborns with idiopathic clubfoot. About thirty percent of patients need posterior releases; midfoot surgery is not necessary. Merely 20% of clubfeet will need comprehensive posteromedial releases.

Steinman et al., (2009) ²⁷ compared the results of Ponseti and the French method in one institution. The inclusion criteria were met by 267 feet out of 176 patients treated with the Ponseti method and 119 feet out of 80 patients treated with the French functional method. The average duration of patient follow-up was 4.3 years.

At the last follow-up, 72% of legs treated with the Ponseti method had good results, fair 12%. and poor 16%. The results of the feet treated with the French operative method were good in 67%, fair in 17% and poor in 16%. Although better results were obtained using the Ponseti method, the difference was not significant.

Chotel et. Al., (2011) ²⁸ conducted a retrospective study comparing French physiotherapy and Ponseti method used to treat idiopathic clubfoot in 2

Institutions. Two hundred nineteen clubfeet (146 patients) were included in this study (116 feet in FM group and 103 feet in PM group). Similar rates of surgery were conducted in both groups after a mean follow-up of 5.5 years (range, 2.5 to 7.4 y) (21% in group FM and 16% in group PM). Results were noted excellent, good, fair, and poor in respectively 55%, 20%, 6%, and 19% of patients in group FM and 79%, 15%, 4%, and 2% of patients in group PM. The rate of excellent results was higher in group PM and the rate of poor results was lower in this group. It concluded that Ponseti method enables reduction of extensive surgery compared with French physiotherapy mainly for severe deformities.

3.3 Kite Method

3.3.1 Description

The Kite Method involves gradual correction of the forefoot adduction, heel varus and ankle equinus in sequence through repeated manipulation and cast application. With Kite treatment and casting, equinus is repaired after full correction of forefoot adduction and heel varus.

The foot is never extended beyond the neutral position. Pressure on the calcaneocuboid joint acts as a block for the corrective force ²⁹.

3.3.2 Efficacy

Sanghvi et. Al., (2009) ²⁹ conducted a randomized control trial comparing the Kite method with the Ponseti method. 14 males and 7 females (34 club feet) were treated with the kite method. In the Kite group, three patients (1 bilateral, 2 unilateral) had recurrence of the condition and underwent complete posteromedial soft tissue release. 3 patients had pain: one occasionally, one usually during vigorous activity, and one while walking.

The Ponseti method had significantly fewer no. of casts (7 vs. 10); the duration of casting necessary to achieve a complete repair was significantly shorter (10 versus 13 weeks); the maximum ankle dorsiflexion achieved was significantly higher (12 versus 6 degrees); and the incidence of residual deformities and relapses was slightly lower.

Rijal et. Al., (2010) ³⁰ conducted a randomized controlled trial in which the foot was manipulated using the Ponseti and Kite method. Sixty feet of 38 patients, 22 with bilateral and 16 with unilateral clubfoot in children less than 2 years of age and without previous medical or surgical treatment, were randomly assigned to the Ponseti (30 feet) and Kite (30 feet) procedures. In twelve bilateral clubfoot patients with one leg receiving the kite method and the other Ponseti manipulation, the Ponseti-treated legs improved faster than the kite-treated legs, so the mean difference between baseline and follow-up scores was significantly greater ($P < 0.05$) difference from zero from

fourth week onwards to up to 10 weeks. In the unpaired analysis, the mean Pirani scores in Ponseti feet improved much faster than Kite feet, for both unilateral and bilateral club feet, regardless of side.

Selmani et al. Al., (2012) ³¹ conducted a study to compare the results of two different treatment protocols for idiopathic clubfoot (Ponseti and Kite). The study was conducted on 100 patients with a total of 150 feet (76 in the Ponseti group and 74 in the Kite group). In the Kite group, the mean follow-up time was 35.1 months \pm SD 2.5 (33-38 months). In the first year, ten feet presented recurrent deformities. All four deformities recurred in five feet; Cavus and varus in one leg; adduct and varus in 2 feet; varus only in two feet; and an equinus alone in one leg. The relapse in the second year consisted only of heel varus. Relapses were not related to age or severity in either group. At the last follow-up, the average movement of the ankle joint in the Ponseti group was 8.21° (dorsiflexion) - 13.32° (plantar flexion). In the Kite group, the corresponding values were 7.32° (dorsiflexion) - 11.26° (plantarflexion). In both groups, the functional outcome was good in patients with a repaired foot who started walking without support.

They were able to squat with their heels touching the ground.

No patient or parent reported pain, stiffness, or difficulty playing age-appropriate indoor/outdoor games. The study concluded that the success rate of the Ponseti method was significantly higher.

Sud et. Al., (2007) ³² did a research on Ponseti vs Kite method. It consisted of 45 patients with 67 feet (36 in the Ponseti group and 31 in the Kite group). There were 31 males (14 in the Ponseti and 17 in the Kite group). Twenty-two infants had bilateral pathology while 23 patients had unilateral presentation. Following a follow-up duration of 26.04 months on average. Ponseti's method was shown to have a noticeably greater rate of correction. Ponseti's method also corrected a significantly higher number of very severe clubfeet (16 out of 18, 88.8%) than Kite's method (14 out of 24, 58.3%), in a smaller period of time. The study found Ponseti's method to be far superior in correcting all deformities in a shorter period of time, thereby reducing the requirement of surgical intervention.

Evaluating Treatment Outcomes: A Review Of Ponseti, French, And Kite Approaches For Clubfoot

S. NO.	AUTHOR	TITLE	OBJECTIVE	METHODOLOGY	CONCLUSION
1.	Sitanshu Barik, Muhammed Nazeer, Babloo Thomas Mani	Accelerated Ponseti technique: efficacy in the management of CTEV	The objective of this study was to compare the effectiveness of standard and accelerated Ponseti technique.	At a tertiary care hospital in South India, this prospective non-randomized trial was carried out over a 2-year period with a minimum follow-up of 5 years. Two sets of patients were created, one with a seven-day cast change interval and the other with a three-day gap. The study included children with CTEV who were younger than a year old and had not had any prior treatments. At the last follow-up, the functional score developed by Ponseti was established.	It concluded that the feet treated by standard Ponseti and accelerated Ponseti have same functional outcome at the end of a 5-year follow-up.
2.	Amr Atef Abdelgawad, Wallace B. Lehman, Harold J.P. van Bosse, David M. Scher, Debra A. Sala	Treatment of idiopathic clubfoot using the Ponseti method: minimum 2-year follow-up	The purpose of this study was to evaluate the Ponseti technique's efficacy in treating idiopathic clubfoot during a minimum of two years of follow-up.	Retrospective analysis was conducted on 89 individuals (137 feet) with idiopathic clubfoot who were treated with the Ponseti technique between March 1, 2000, and December 31, 2002.	It concluded that the Ponseti technique for treating idiopathic clubfoot is a successful method for managing this difficult and complicated condition.
3.	N. Shack, D. M. Eastwood	Early results of a physiotherapist-delivered Ponseti service for the management of idiopathic congenital talipes equinovarus foot deformity	The purpose of this prospective study was to determine whether results from a Ponseti service provided by a physiotherapist could be comparable to those reported by medically trained staff in a central London NHS teaching hospital.	It studied 24 children (40 feet). Both during the presentation and at every subsequent attendance, all feet were scored using the Pirani approach.	It concluded that the Ponseti technique is suitable for use by non-medical personnel, but a holistic approach and good continuity of care are essential to the success of the programme.
4.	S. Chand, A. Mehtani, A. Sud, J. Prakash, A. Sinha, A. Agnihotri	Relapse following use of Ponseti method in idiopathic clubfoot	They evaluated the age, the association between the number of casts needed for correction and the Pirani and Dimeglio scores at presentation, and the relapse pattern during the presentation. They hypothesized that clubfoot relapses might be successfully treated with the Ponseti approach.	They assessed 115 cases of idiopathic clubfoot in 79 kids who had undergone Ponseti method treatment and were now exhibiting relapses. With a mean follow-up of 24 months, the average age was 33.8 months. Every patient underwent an evaluation to identify any patterns of recurrent abnormalities. The Pirani and Dimeglio ratings were used to quantify the abnormalities. A Ponseti procedure was repeated for each relapsing foot.	It came to the conclusion that the Ponseti technique is the recommended first treatment option for relapsing club foot and is also successful. Surgery should only be used to correct residual deformity following a reasonable trial of Ponseti cast therapy.
5.	B. Stephens Richards, Charles E. Johnston, Holly	Nonoperative Clubfoot Treatment Using the French	The objective of this study was to see the results of non-operative clubfoot treatment using the French physical	A retrospective review of the clinical outcomes from 98 patients with 142 congenital idiopathic clubfoot who received	At the authors' institution, the French physical therapy approach

Evaluating Treatment Outcomes: A Review Of Ponseti, French, And Kite Approaches For Clubfoot

		Wilson	Physical Therapy Method	therapy method.	treatment using the French physical therapy approach between February 1998 and February 2001 was conducted retrospectively. When treatment started, all of the patients were no older than three months. Even if any of the 98 patients eventually stopped adhering to the program, the results are still recorded for them. There was a 20-month minimum follow-up.	substantially reduced the requirement for surgical intervention.
6.		Dana VASILESCU, Mădălina VĂLEANU, Dan COSMA	Results of the Conservative Treatment in Clubfoot using the French Method	The objective of this study was to follow the results of the early conservative orthopedic Treatment (French method) in the congenital clubfoot in 52 patients	The study's patients were under 9 months old when treatment started, and they lacked any additional congenital foot abnormalities. In this retrospective analysis, 52 children (74 feet) received treatment in accordance with the French approach. The neurological and artrogripotic kinds of clubfoot were not taken into account in the study. A 20-month minimum follow-up was required.	For newborns with idiopathic clubfoot, over half of the affected feet will respond well to the French technique (no surgery or a straightforward Achilles tenotomy). About thirty percent of patients need posterior releases; midfoot surgery is not necessary. Just twenty percent of clubfoot will require extensive posteromedial releases.
7.		Suzanne Steinman, B. Stephens Richards, Shawne Faulks, RN, CNS, Kim Kaipus	A Comparison of Two Nonoperative Methods of Idiopathic Clubfoot Correction: The Ponseti Method and the French Functional (Physiotherapy) Method	The purpose of this prospective study was to compare the results of The Ponseti method and French method at one institution.	Patients under three months of age with previously untreated idiopathic clubfeet were enrolled. The inclusion criteria were met by 237 feet in 176 patients treated with the Ponseti method and 119 feet in 80 patients treated with the French functional method.	Most individuals can sustain nonoperative correction of an idiopathic clubfoot deformity over an extended period of time. The Ponseti approach did appear to yield better results, but the trend was not statistically significant. Based on the observations made, parents choose the Ponseti approach twice as frequently as the French functional approach.
8.		Franck Chotel, Roger Parot, Raphaël Seringe, Jérôme Berard, Philippe Wicar	Comparative Study: Ponseti Method Versus French Physiotherapy for Initial Treatment of Idiopathic Clubfoot Deformity	This study aimed to retrospectively compare the Ponseti approach and French physiotherapy utilized in two institutions to treat idiopathic clubfoot.	This study included 219 idiopathic clubfoot patients (146 patients) treated over a 3-year period (2000–2003): 116 clubfoot patients in group FM received treatment based on modified French physiotherapy (with percutaneous heel-cord tenotomy in 17% of cases), and 103 clubfoot patients in group PM received treatment based on the Ponseti method. Additional surgery was viewed as a failure of nonoperative management: nonrelease surgery or unoperated feet were graded using the modified Ghanem score,	In comparison to French physiotherapy, the Ponseti approach allows for a reduction in major surgery, primarily for severe abnormalities.

Evaluating Treatment Outcomes: A Review Of Ponseti, French, And Kite Approaches For Clubfoot

					whereas limited posterior release was rated as fair and total posteromedial release as poor.	
9.		AV Sanghvi, VK Mittal	Conservative management of idiopathic clubfoot: Kite versus Ponseti method	To compare the long-term results of the Kite and Ponseti methods of manipulation and casting for clubfoot.	In the first several weeks of life, 42 patients (with 64 cases of idiopathic clubfoot) were randomized evenly to receive Kite or Ponseti therapy. The Kite approach was applied to 14 males and 7 females (34 clubfeet), while the Ponseti method was applied to 13 males and 8 females (30 clubfeet). One skilled orthopaedic surgeon performed manipulation, casting, and follow-up on each clubfoot for an average of three years. The end outcomes were compared.	Without weakening the Achilles tendon, the Ponseti technique can provide more fast correction and ankle dorsiflexion with fewer casts.
10.		Raju Rijal, Bikram Prasad Shrestha, Girish Kumar Singh, Mahipal Singh, Pravin Nepal, Guru Prasad Khanal, Pramila Rai	Comparison of Ponseti and Kite's method of treatment for idiopathic clubfoot	To conduct a randomized controlled trial wherein the club foot was manipulated using the Ponseti and Kite approach, and the correction was assessed using the Pirani score to compare the treatment's effectiveness.	Sixty feet in 38 patients were randomly assigned to the Ponseti (30 feet) and Kite (30 feet) methods of manipulation. Of these patients, 22 had bilateral clubfeet and 16 had unilateral clubfeet in children under the age of two, without any prior manipulation or surgical therapy. Through this procedure, 12 bilateral cases' right and left foot of the same patient were compared to one another (paired analysis). Four patients in the remaining ten bilateral cases received treatment for both feet from Ponseti, while six patients received treatment from Kite (unpaired analysis).	Ponseti reduces hind foot, midfoot, and overall Pirani scores far more quickly than Kite's approach of clubfoot manipulation. The difference starts to show statistical significance in paired analysis at week four, and in unpaired analysis at week ten after the treatment.
11.		Edvin Selmani	Is Ponseti's method superior to Kite's for clubfoot treatment he?	Very little information about prospective randomized studies contrasting the Kite and Ponseti approaches for treating clubfoot can be found in the literature. The purpose of this research was to examine the outcomes of two distinct treatment methods (Kite and Ponseti) for idiopathic clubfoot.	A prospective randomized research with 100 infants (150 feet) younger than 3 months old compared the conservative management approaches of Ponseti and Kite for idiopathic congenital clubfoot. The infants treated with Ponseti's and Kite's procedures were 76 and 74 feet, respectively.	It concluded that Ponseti's approach outperforms Kite's approach in terms of getting idiopathic clubfoot corrected in a comparatively shorter amount of time.
12.		Alok Sud, Akshay Tiwari, Deep Sharma, Sudhir Kapoor	Ponseti's vs. Kite's method in the treatment of clubfoot-a prospective randomised study	To compare the percentage of feet cured, the time and number of casts needed to achieve correction, the percentage of cases exhibiting relapse, and the abnormalities that relapse in each procedure between the two treatment approaches in a prospective randomised research.	Patients with classical idiopathic clubfoot, aged between five to ninety days, who attended the hospital's pediatric wing's clubfoot clinic between March 2003 and February 2004 were the subjects of this study. Patients who were older or had non-idiopathic abnormalities were not allowed to participate in the study. None of the participants chosen for the research had ever received surgical or conservative treatment before.	They came to the conclusion that, when applied to early infants, Ponseti's method is more effective than Kite's method in attaining correction in idiopathic clubfoot in a comparatively shorter amount of time.

4. Discussion :

We narratively reviewed the conservative interventions applied for CTEV investigated and published in scientific literature. The most well-studied approach is the Ponseti Method which is a conservative approach developed in 1963 by Ignacio Ponseti. It provides correction with manipulation, casting, Achilles tenotomy and bracing, and it takes about four to five weeks to achieve the full correction of all four components of the clubfoot deformity³³.

The other methods included the French functional therapy method which consists of daily manipulations of the infant's clubfoot, stimulation of the muscles acting on the foot to maintain the reduction achieved through manipulation, and foot immobilization using nonelastic adhesive strapping, and the Kite method formed in 1939, a more gentle method of manipulation that primarily involved serial manipulations and casting³⁴.

Initial outcomes of treatment with the Ponseti regimen, which is utilized worldwide, are favorable, according to Siapkara et al.³⁵ (2007). It will be necessary to do longer-term follow-up to see whether the strategy meets expectations.

In terms of post-procedure Pirani score, tenotomy rate, relapse rate, complications rate, and the number of casts needed by the patients, Alsayed et al.,³⁶ (2023) supported that the accelerated Ponseti method can achieve efficacy comparable to the standard method, with the advantage of requiring shorter duration of treatment, which is expected to achieve more patient compliance.

Matos et al.,³⁷ (2010) carried out a meta-analysis by searching the MEDLINE, LILACS, and EMBASE databases for clinical studies that compared Kite's and Ponseti's approaches over the previous 20 years (1986 to 2006). The meta-analysis indicated that Ponseti's group in the clubfoot treatment was superior to Kite's group.

Faulks et. Al.,³⁸ (2009) did a study in which More of the children treated with the French method walked with knee hyperextension, a mild equinus gait, and mild footdrop. Conversely, a greater number of individuals in the Ponseti group exhibited just mildly increased stance-phase dorsiflexion and a calcaneus gait. They also deduced that Specialized training of the physical therapist and committed, educated parents are crucial factors for the success of the French functional method of nonoperative treatment of clubfoot.

Masrouha et..al.,³⁹ (2021) in their review of treatment of relapsed CTEV mentioned The Ponseti method for the treatment of clubfoot is highly successful, with initial correction rates of over 90%.

Although all three methods show significant improvement on patients with clubfoot, all the studies, non-comparative as well as comparative, proved that the Ponseti method is the superior method for the treatment of CTEV.

A 'Hybrid' Method can also be used by combining the

advantages of the Ponseti method and the French method and it can reduce the need for surgical procedures (excluding Achilles tendon lengthening) in children with CTEV.⁴⁰ Hybrid Method requires more extensive researches to be done for exploring its benefits and limitations.

In the researches used for the review, the group size, length of treatment, and therapeutic efficacy were among the several methodological variations that the researches and studies revealed. Upcoming research should use proven outcome metrics, more stringent methodologies that include suitable randomization processes, and larger patient groups.

5. Limitations :

We acknowledge that compared to systematic or meta-analysis reviews, this narrative review may be more biased. But we made an effort to carry out a thorough search and a critical evaluation of all English-language publications. The quality of the research included in this review was assessed and taken into consideration during their careful selection.

6. Conclusion

According to the available scientific literature, although all the three methods discussed are effective, Ponseti method can be a beneficial conservative management option for the treatment of clubfoot as compared to the other methods. This method is both cost-effective and comparatively has a low likelihood of relapse. Future studies should be conducted with a more rigorous methodology to determine these techniques' efficacy and better understand their underlying mechanisms.

REFERENCES:

1. Bina S, Pacey V, Barnes EH, Burns J, Gray K. Interventions for congenital talipes equinovarus (clubfoot). *Cochrane Database Syst Rev*. 2020;2020(5).
2. Mustari MN, Faruk M, Bausat A, Fikry A. Congenital talipes equinovarus: A literature review. *Ann Med Surg [Internet]*. 2022;81(August):104394. Available from: <https://doi.org/10.1016/j.amsu.2022.104394>
3. Pavone V, Chisari E, Vescio A, Lucenti L, Sessa G, Testa G. The etiology of idiopathic congenital talipes equinovarus: A systematic review. *J Orthop Surg Res*. 2018;13(1):1–11.
4. Miedzybrodzka Z. Congenital talipes equinovarus (clubfoot): A disorder of the foot but not the hand. *J Anat*. 2003;202(1):37–42.
5. Dietz FR. on the Pathogenesis of Clubfoot. *Lancet*. 1985;325(8425):388–90.
6. Werler MM, Yazdy MM, Mitchell AA, Meyer RE, Druschel CM, Anderka M, et al. Descriptive epidemiology of idiopathic clubfoot. *Am J Med Genet Part A*. 2013;161(7):1569–78.
7. GURNETT MBD and CA. Genetics of club foot. *J Pediatr Orthop B*. 2012;21(1):7–9.
8. Gurnett CA, Boehm S, Connolly A, Reimschisel T, Dobbs MB. Impact of congenital talipes equinovarus etiology on treatment outcomes. *Dev Med Child Neurol*. 2008;50(7):498–502.

9. Novotny T, Eckhardt A, Doubkova M, Knitlova J, Vondrasek D, Vanaskova E, et al. The possible role of hypoxia in the affected tissue of relapsed clubfoot. *Sci Rep* [Internet]. 2022;12(1):1–10. Available from: <https://doi.org/10.1038/s41598-022-08519-z>
10. Wainwright AM, Auld T, Benson MK, Theologis TN. The classification of congenital talipes equinovarus. *J Bone Jt Surg - Ser B*. 2002;84(7):1020–4.
11. Porter RW. Clubfoot: Congenital talipes equinovarus. *J R Coll Surg Edinb*. 1995;40(1):66–71.
12. Hopwood S, Khan F, Kemp J, Rehm A, Ashby E. Clubfoot: An overview and the latest UK guidelines. *Br J Hosp Med*. 2023;84(1).
13. Jowett CR, Morcuende JA, Ramachandran M. Management of congenital talipes equinovarus using the Ponseti method: A systematic review. *J Bone Jt Surg - Ser B*. 2011;93 B(9):1160–4.
14. Smythe T, Rotenberg S, Lavy C. The global birth prevalence of clubfoot: a systematic review and meta-analysis. *eClinicalMedicine* [Internet]. 2023;63:102178. Available from: <https://doi.org/10.1016/j.eclinm.2023.102178>
15. Lochmiller C, Johnston D, Scott A, Risman M, Hecht JT. Genetic epidemiology study of idiopathic talipes equinovarus. *Am J Med Genet*. 1998;79(2):90–6.
16. Tracey Smythe¹, Hannah Kuper¹, David Macleod², Allen Foster¹ CL. Birth prevalence of Congenital Talipes Equinovarus in Low and Middle Income Countries: A Systematic Review and Meta-analysis. *Tr*. 2016;38(1):42–9.
17. Kadhum M, Lee MH, Czernuszka J, Lavy C. An analysis of the mechanical properties of the Ponseti method in clubfoot treatment. *Appl Bionics Biomech*. 2019;2019.
18. Barik S, Nazeer M, Mani BT. Accelerated Ponseti technique: efficacy in the management of CTEV. *Eur J Orthop Surg Traumatol* [Internet]. 2019;29(4):919–24. Available from: <https://doi.org/10.1007/s00590-018-2353-1>
19. Shabtai L, Specht SC, Herzenberg JE. Worldwide spread of the Ponseti method for clubfoot. *World J Orthop*. 2014;5(5):585–90.
20. Hosseinzadeh P, Kelly DM, Zions LE. Management of the relapsed clubfoot following treatment using the Ponseti method. *J Am Acad Orthop Surg*. 2017;25(3):195–203.
21. Abdelgawad AA, Lehman WB, Van Bosse HJP, Scher DM, Sala DA. Treatment of idiopathic clubfoot using the Ponseti method: Minimum 2-year follow-up. *J Pediatr Orthop Part B*. 2007;16(2):98–105.
22. Shack N, Eastwood DM. Early results of a physiotherapist-delivered Ponseti service for the management of idiopathic congenital talipes equinovarus foot deformity. *J Bone Jt Surg - Ser B*. 2006;88(8):1085–9.
23. Chand S, Mehtani A, Sud A, Prakash J, Sinha A, Agnihotri A. Relapse following use of ponseti method in idiopathic clubfoot. *J Child Orthop*. 2018;12(6):566–74.
24. Dimeglio A, Canavese F. The French functional physical therapy method for the treatment of congenital clubfoot. *J Pediatr Orthop Part B*. 2012;21(1):28–39.
25. Richards BS, Johnston CE, Wilson H. Nonoperative clubfoot treatment using the French physical therapy method. *J Pediatr Orthop*. 2005;25(1):98–102.
26. Vasilescu D, VĂLEANU M, Cosma D. Results of the conservative treatment in clubfoot using the French method. *Applied Medical Informatics*. 2014 Mar 31;34(1):57–62.
27. Steinman S, Richards BS, Faulks S, Kaipus K. A comparison of two nonoperative methods of idiopathic clubfoot correction: the Ponseti method and the French functional (physiotherapy) method. *Surgical technique. J Bone Joint Surg Am*. 2009;91 Suppl 2(Part 2):299–312.
28. Chotel F, Parot R, Seringe R, Berard J, Wicart P. Comparative study: Ponseti method versus French physiotherapy for initial treatment of idiopathic clubfoot deformity. *J Pediatr Orthop*. 2011;31(3):320–5.
29. Sanghvi A V., Mittal VK. Conservative management of idiopathic clubfoot: Kite versus Ponseti method. *J Orthop Surg (Hong Kong)*. 2009;17(1):67–71.
30. Rijal R, Shrestha BP, Singh GK, Singh M, Nepal P, Khanal GP, et al. Comparison of Ponseti and Kite's method of treatment for idiopathic clubfoot. *Indian J Orthop*. 2010;44(2):202–7.
31. Selmani E. Is Ponseti's method superior to Kite's for clubfoot treatment he? *Eur Orthop Traumatol*. 2012;3(3):183–7.
32. Sud A, Tiwari A, Sharma D, Kapoor S. Ponseti's vs. Kite's method in the treatment of clubfoot-a prospective randomised study. *Int Orthop*. 2008;32(3):409–13.
33. Ganesan B, Luximon A, Al-Jumaily A, Balasankar SK, Naik GR. Ponseti method in the management of clubfoot under 2 years of age: A systematic review. *PLoS One*. 2017;12(6):1–18.
34. Dobbs MB, Gurnett CA. Update on clubfoot: Etiology and treatment. *Clin Orthop Relat Res*. 2009;467(5):1146–53.
35. Siapkara A, Duncan R. Congenital talipes equinovarus: A review of current management. *J Bone Jt Surg - Ser B*. 2007;89(8):995–1000.
36. Alsayed MA, Hussein MA, Althaqafi RM, Alyami A. Conventional Versus Accelerated Ponseti in the Management of Cases of Idiopathic Clubfoot: A Systematic Review and Meta-Analysis. *Cureus*. 2023;15(9).
37. Matos MA, de Oliveira LAA. Comparison between ponseti's and kite's clubfoot treatment methods: A meta-analysis. *J Foot Ankle Surg*. 2010;49(4):395–7.
38. Faulks S, Richards BS. Clubfoot treatment: Ponseti and french functional methods are equally effective. *Clin Orthop Relat Res*. 2009;467(5):1278–82.
39. Masrouha K, Chu A, Lehman W. Narrative review of the management of a relapsed clubfoot. *Ann Transl Med*. 2021;9(13):1102–1102.

40. Canavese F, Mansour M, Souchon L, Samba A, Dimeglio A. The 'Hybrid method' for the treatment of congenital clubfoot. *Ann Transl Med.* 2021;9(13):1099–1099.