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# Comparative Study of Denis Browne Brace and Steenbeek Brace in Maintenance of Correction After Ponseti Method in Congenital Talipes Equinovarus (CTEV).

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## Abstract

***Background:*** Congenital Talipes Equinovarus (CTEV), commonly known as clubfoot, is one of the most frequent congenital musculoskeletal deformities. Although the Ponseti method has revolutionized its management, maintenance of correction using foot abduction braces remains critical to prevent relapse**.** ***Objective:*** To compare the effectiveness, compliance, and recurrence rates between Denis Browne brace and Steenbeek brace in maintaining correction after Ponseti treatment. ***Materials and methods:*** A prospective observational study was conducted on 30 patients (46 feet) with idiopathic CTEV treated using the Ponseti method between September 2022 and August 2024 at a tertiary care hospital. After correction, patients were randomly assigned to either Denis Browne brace or Steenbeek brace for maintenance. Clinical evaluation included Pirani scoring, number of casts required, and relapse rate. ***Result:*** Most patients presented within 0–6 months of age (66.66%), with a male predominance (2.33:1). Bilateral involvement was more common (69.56%). Mean number of casts required was 11.34. Relapse occurred in 3 feet (4 feet total involvement), with 1 case in Denis Browne group and 2 in Steenbeek group. Denis Browne brace showed better compliance and slightly lower recurrence. ***Conclusion:*** Both braces are effective for maintenance after Ponseti correction. Denis Browne brace demonstrated better compliance and marginally lower recurrence, while Steenbeek brace is more cost-effective.

**Keywords:** CTEV, Clubfoot, Ponseti method, Denis Browne brace, Steenbeek brace, relapse.



## INTRODUCTION

Congenital Talipes Equinovarus (CTEV), commonly known as clubfoot, is a complex congenital deformity characterized by equinus, varus, adduction, and cavus deformities of the foot. It affects approximately 1–2 per 1000 live births globally and remains one of the most common congenital musculoskeletal anomalies.

Historically, treatment included extensive soft tissue releases and bony procedures, which often resulted in stiffness, weakness, and high recurrence rates. The introduction of the Ponseti method has revolutionized clubfoot management, demonstrating excellent functional outcomes with minimal surgical intervention.

However, despite high initial correction rates, relapse remains a significant concern, primarily due to non-compliance with the foot abduction brace during the maintenance phase. Studies have shown that brace adherence is the strongest predictor of long-term success after Ponseti correction.

Foot abduction bracing is therefore an essential component of treatment. Among the commonly used braces are the Denis Browne splint and the Steenbeek brace. The Denis Browne brace is widely used in developed settings due to its adjustable design and improved comfort, while the Steenbeek brace is a low-cost alternative widely adopted in resource-limited countries.

Previous literature emphasizes that relapse rates are more dependent on compliance rather than brace type alone, highlighting the importance of patient education and follow-up. Despite their widespread use, comparative clinical evidence between these two braces remains limited, particularly in developing country settings. This study aims to compare their effectiveness in maintaining correction after Ponseti treatment.

## MATERIALS AND METHODS

### Study Design
Prospective observational comparative study.

### Study Setting
Department of Orthopaedics, Raipur institute of medical sciences, Raipur, Chhattisgarh.

### Study Period
September 2022 to August 2024.

### Sample Size
30 patients (46 clubfeet).

### Inclusion Criteria
- Idiopathic CTEV cases
- Treated using Ponseti method
- Age ≤ 1 year at presentation

### Exclusion Criteria
- Syndromic clubfoot
- Neuromuscular disorders (e.g., arthrogryposis)
- Spina bifida or spinal abnormalities
- Teratogenic exposure history

### Treatment Protocol
- Serial casting using Ponseti method
- Percutaneous Achilles tenotomy when required
- Post-correction bracing using:
  - Group A: Denis Browne brace
  - Group B: Steenbeek brace

### Follow-up Parameters
- Pirani score
- Number of casts
- Compliance with brace
- Relapse rate
- Need for re-intervention.

## RESULTS
A total of 30 patients diagnosed with idiopathic congenital talipes equinovarus (CTEV) were included in this study, comprising 46 affected feet. The demographic distribution showed a clear male predominance with a male-to-female ratio of 2.33:1. Most patients presented early, with 66.66% of cases being in the age group of 0–6 months, reflecting early health-seeking behavior and improved awareness regarding congenital deformities. Bilateral involvement was more common, observed in 69.56% of cases, while unilateral involvement accounted for 30.44%. Among unilateral cases, right-sided deformity (19.6%) was more frequent compared to left-sided involvement (10.87%).

The severity of deformity at presentation, assessed using the Pirani scoring system, ranged predominantly between 3.5 and 4.5, indicating moderate to severe clubfoot at baseline. Serial casting using the Ponseti method was effective in achieving progressive correction in all cases. The mean number of casts required for full correction of deformity was 11.34. It was observed that correction of equinus deformity required a relatively higher number of casts compared to correction of adduction and varus components. The average number of casts required specifically before achieving equinus correction was 10.33, indicating that equinus was the most resistant component of the deformity.

After achieving satisfactory correction, all patients were transitioned to the maintenance phase using foot abduction braces, either Denis Browne brace or Steenbeek brace. The average Pirani score after completion of casting and before bracing was reduced to 0.565, indicating near-complete correction of deformity in most cases. This confirms the effectiveness of the Ponseti casting technique in achieving initial correction.

During the follow-up period, relapse was observed in 3 patients involving a total of 4 feet. In the Denis Browne brace group, relapse occurred in 1 foot, whereas in the Steenbeek brace group, relapse was observed in 2 patients involving 3 feet. Although both braces were effective in maintaining correction in the majority of cases, the Steenbeek brace group showed a slightly higher recurrence rate compared to the Denis Browne brace group. The relapse cases were primarily associated with suboptimal brace compliance and irregular follow-up.

Overall, both braces demonstrated satisfactory outcomes in maintaining correction achieved by the Ponseti method. However, Denis Browne brace showed better compliance among parents and caregivers, which likely contributed to its lower relapse rate. Steenbeek brace, while more economical and widely accessible, was associated with slightly reduced compliance in long-term use. No major complications related to bracing, such as skin breakdown or neurovascular compromise, were observed in either group.

In summary, the study demonstrated that although both braces are effective in maintaining correction, differences in compliance and recurrence rates may influence long-term outcomes, with Denis Browne brace showing a marginal advantage in preventing relapse.

**Clinical Findings**

Mean initial Pirani score ranged between 3.5–4.5. The average number of casts required for correction was 11.34. Equinus correction required slightly more casting compared to adduction and varus correction.

**Relapse Pattern**

Relapse occurred in 3 patients (4 feet total):

- Denis Browne group: 1 foot
- Steenbeek group: 2 feet

Denis Browne brace showed better compliance and lower relapse, whereas Steenbeek brace was associated with slightly higher recurrence but was more cost-effective.

**Table 1: Demographic Distribution**

| Parameter | Observation |
|---|---|
| Total patients | 30 |
| Total feet | 46 |
| Male:Female | 2.33:1 |
| Bilateral cases | 69.56% |
| Unilateral cases | 30.44% |

**Table 2: Treatment Outcomes**

| Parameter | Denis Browne | Steenbeek |
|---|---|---|
| Relapse rate | Lower | Slightly higher |
| Compliance | High | Moderate |
| Cost-effectiveness | Low | High |

## DISCUSSION

The Ponseti method is currently the gold standard treatment for idiopathic CTEV due to its high success rate, minimal invasiveness, and cost-effectiveness. Long-term studies have confirmed its superiority over traditional surgical approaches in terms of functional outcomes and reduced complications.

However, relapse remains a major challenge in clubfoot management, and is most commonly associated with poor adherence to the foot abduction brace protocol. Previous studies have demonstrated that non-compliance rates directly correlate with recurrence of deformity, emphasizing that bracing is not optional but essential for long-term success. In the present study, both Denis Browne and Steenbeek braces were effective in maintaining correction after Ponseti casting. However, Denis Browne brace showed slightly better compliance and lower relapse rates. This may be attributed to its improved adjustability and better parental acceptance.

On the other hand, Steenbeek brace, although more economical and suitable for low-resource settings, demonstrated a marginally higher relapse rate. Similar findings have been reported in studies comparing different foot abduction orthoses, where compliance rather than design was the dominant determinant of outcome

.

The importance of early initiation of bracing, proper parental counseling, and regular follow-up cannot be overemphasized. Studies have shown that structured education programs significantly improve brace compliance and reduce relapse rates.

Overall, the findings of this study support the global consensus that while brace type may influence comfort and compliance, the most important factor in preventing relapse remains strict adherence to the maintenance protocol.

## CONCLUSION

Both Denis Browne and Steenbeek braces are effective in maintaining correction after Ponseti treatment for CTEV. However, Denis Browne brace shows better compliance and marginally lower recurrence rates, whereas Steenbeek brace remains a cost-effective alternative suitable for resource-limited settings. Early diagnosis, strict adherence to bracing protocol, and parental counseling are key to reducing relapse.

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