

Review Article

Ponseti Method for Idiopathic Clubfoot: Long-Term Relapse Rates and Functional Assessment

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Received: 1 March 2025; Accepted: 16 May 2025; Published: 22 August 2025; DOI: [10.5281/zenodo.22327737](https://doi.org/10.5281/zenodo.22327737)

Citation of this article: Zupancic S, Leitner V, Fabbri L (2025) Ponseti Method for Idiopathic Clubfoot: Long-Term Relapse Rates and Functional Assessment. Int J Orthop, 6(1): 01-06.

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Abstract

Background: The Ponseti method has replaced primary surgical release as the standard treatment for idiopathic clubfoot worldwide, but relapse and brace non-adherence remain persistent challenges.

Objective: To synthesise evidence on Ponseti technique, brace compliance, long-term relapse, functional outcomes, comparison with surgical release, and performance in resource-limited settings.

Methods: Narrative review of classic series, comparative cohorts, randomised and systematic-review literature.

Findings: Correction rates exceed 90%, but relapse recurs in roughly a third of feet and rises with follow-up duration; brace non-adherence is the strongest modifiable predictor, with non-compliant children up to 183 times more likely to relapse. Long-term functional and gait outcomes are generally favourable and superior to historical extensive surgical release, though degenerative radiographic change persists into adulthood. Resource-limited programmes achieve comparable correction but face substantial adherence barriers.

Conclusions: Sustained bracing support and standardised follow-up are essential to preserving the method's long-term benefit.

Keywords: Ponseti method; Clubfoot; Talipes equinovarus; Brace compliance; Relapse

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Introduction

Idiopathic clubfoot (congenital talipes equinovarus) affects approximately 1 to 2 per 1,000 live births worldwide and, left untreated, produces a rigid, weight-bearing deformity of the lateral foot border that causes lifelong pain and disability. For much of the twentieth century, extensive posteromedial soft-tissue release was the default treatment for feet that did not respond to simple manipulation, but long-term follow-up of released feet revealed stiffness, pain, and degenerative change, prompting a search for less invasive alternatives [1]. Ignacio Ponseti's method of gentle sequential

manipulation, serial casting, and, when required, percutaneous Achilles tenotomy, followed by prolonged bracing in a foot abduction orthosis, was described in its modern form in 1963 and validated by decades of follow-up at the originating centre [2]. Adoption elsewhere was initially slow, in part because the method's gentle, incremental correction contrasted with the more immediately visible results of surgery, but multicentre reports in the early 2000s demonstrating dramatically reduced surgical rates catalysed the method's global spread, and it is now endorsed by international paediatric orthopaedic and global-health bodies as first-line treatment [3]. Despite this near-universal endorsement, relapse remains the method's principal limitation, and the literature on why some corrected feet recur, and how durable functional benefit truly is once children reach adolescence and adulthood, has grown substantially over the past two decades. This review synthesises the literature on Ponseti technique, the relationship between brace compliance and relapse, long-term relapse and functional outcomes, comparison with surgical release, and performance in resource-limited settings, drawing on classic series, comparative cohorts, and systematic reviews rather than a single institutional experience.

Technique and Initial Correction

The Ponseti method corrects deformity in a fixed sequence: cavus, adductus, and varus are addressed simultaneously by supinating and abducting the foot around the head of the talus, with weekly cast changes over roughly five to six weeks; residual equinus is then corrected, usually via percutaneous tenotomy, in most feet [4]. The Pirani scoring system, assessing hindfoot and midfoot contracture components, correlates with the number of casts required and the likelihood of tenotomy, and offers a reproducible tool for tracking correction and communicating severity between clinicians [4]. Initial correction is achieved in over 90% of idiopathic feet

regardless of the exact casting cadence, and an accelerated protocol using twice-weekly rather than weekly cast changes has produced equivalent correction with a shorter treatment course, suggesting the biological remodelling window tolerates a modestly compressed schedule without compromising the crucial subsequent bracing phase [5]. Deviation from the described technique in manipulation, casting, tenotomy indication, or brace protocol has been implicated as a major source of variability across published series, reinforcing that fidelity to the original method, not merely its general philosophy, underlies reported success [6]. A large consecutive case series demonstrated that only 2.5% of feet ultimately required extensive corrective surgery when the method was applied faithfully from birth, a striking contrast with historical surgical-era practice and the finding most responsible for the method's rapid international uptake [3].

Brace Compliance and Relapse

Correction achieved through casting is inherently unstable until the foot has remodelled, and the foot abduction orthosis is the treatment component most responsible for consolidating correction. In the foundational multicentre analysis of predictors of outcome, brace non-compliance was overwhelmingly the strongest predictor of relapse, with non-compliant children approximately 183 times more likely to relapse than those who wore the brace as prescribed (Figure 1) [7]. A New Zealand cohort similarly found recurrence in 41% of feet at a minimum two-year follow-up, again identifying bracing non-adherence as the dominant modifiable risk factor [8]. Randomised comparison of two distinct orthosis designs found no difference in compliance or outcome between brace types, indicating that the relevant variable is consistent wear itself rather than any specific device [9]. Early removal of the orthosis, whether from parental difficulty, discomfort, or family and

logistical circumstances, recurs as the central theme across compliance studies, and clinical guidance has consistently emphasised structured family counselling and close early follow-up as the practical lever available to reduce relapse [10]. Discontinuing the orthosis prematurely, even after apparently satisfactory casting correction, has itself been associated with a materially higher rate of relapse requiring repeat casting or surgery, underscoring that the brace is an active component of treatment rather than a passive precaution [11]. Consensus guidance recommends near-continuous wear for approximately three months followed by a gradually tapered nightly and nap-time schedule to about age four, with the duration and rigor of tapering individualised to relapse risk rather than fixed rigidly for every child [12].

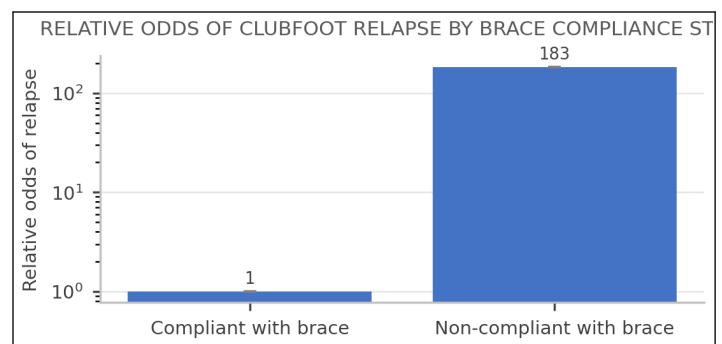


Figure 1: Relative odds of clubfoot relapse in children non-compliant with the foot abduction orthosis compared with compliant children (reference = 1), from a multicentre analysis of predictors of outcome after Ponseti treatment [7].

Long-Term Relapse and Functional Outcomes

Relapse risk does not plateau at two years. A systematic review of 46 studies found reported relapse rates ranging from 3.7% to 67.3%, with a significant positive correlation between length of follow-up and relapse frequency, indicating that recurrence continues to accrue into later childhood and that short-term series understate the true burden [13]. Minimum five-year follow-up of Ponseti-treated feet, including feet referred after failed treatment elsewhere, found good functional dorsiflexion in the large majority, with brace adherence again

predicting freedom from further surgery [14]. A multicentre series of 162 feet followed two to five years reported good clinical results overall, supporting reproducibility of outcome beyond the originating centre (Table 1) [15]. At the extreme of follow-up, thirty-year assessment of clubfeet managed with older, more surgical protocols found good or excellent outcomes in 78% of adult patients, but outcome was unrelated to residual radiographic appearance and was instead governed by pain, motion, and function, an observation subsequently echoed in Ponseti-era intermediate-term series and systematic reviews reporting good plantigrade function alongside persistent, generally mild, radiographic degenerative change in a substantial minority of adults [1,16,17]. Comparative long-term data directly pit the Ponseti method against extensive soft-tissue release: feet treated surgically show progressive stiffness and degenerative change over decades, whereas Ponseti-treated feet more often remain supple and near-normal on gait analysis [18,19].

Study	Population/design	Follow-up	Key relapse/functional finding
Cooper 1995	45 patients, 71 feet (surgical era)	30 years (adult)	78% good/excellent; outcome unrelated to radiographic appearance

Comparison with Surgical Release

Direct comparison confirms the Ponseti method's superiority over primary extensive release for most idiopathic feet. A prospective cohort comparison found Ponseti-treated feet had better range of motion and fewer subsequent procedures than surgically released feet, supporting a shift away from primary release as first-line treatment (Table 2) [20]. Comprehensive gait and pedobarographic comparison referenced against normative paediatric data likewise favoured the Ponseti group [21], while long-term follow-up of extensively released feet documented progressive functional decline that was not mirrored in Ponseti cohorts [18]. The French functional (physiotherapy-based) method offers a second non-surgical alternative: a comparative series found similar rates of surgery avoidance at mid-term follow-up (84% with either approach), though relapse rate and residual gait parameters differed modestly between methods (Figure 2), indicating that multiple non-operative protocols can achieve comparable joint-preserving outcomes when properly resourced and monitored [22]. A Cochrane systematic review of interventions for clubfoot concluded that evidence quality for many head-to-head comparisons remains limited despite the volume of published series, underscoring a continued need for standardised, adequately powered trials with agreed functional and radiographic outcome measures reported to a common minimum follow-up [23]. Taken together, the comparative literature supports reserving extensive primary release for the small minority of feet, often atypical or syndromic, that fail an adequately delivered course of manipulation, casting, and bracing,

Table 1: Selected cohort and systematic-review studies reporting relapse rate by length of follow-up after Ponseti treatment of idiopathic clubfoot [8,14,15,13,16,1].			
Study	Population/design	Follow-up	Key relapse/functional finding
Haft 2007	51 patients, 73 feet, cohort	Minimum 2 years	41% recurrence; non-adherence dominant risk factor
Bor 2009	74 patients, 117 feet, cohort	Minimum 5 years	Good dorsiflexion in majority; adherence predicted no further surgery
Saetersdal 2012	162 feet, multicentre cohort	2-5 years	Good clinical results, reproducible outside originating centre
Thomas 2019	46 studies, systematic review	Variable, up to late childhood	Relapse 3.7-67.3%; rises significantly with follow-up duration
Rastogi 2021	14 studies/774 patients, systematic review	Long-term	Plantigrade feet in majority; ~47% relapse/surgery on pooled long-term analysis

rather than offering it as an equal first-line alternative.

Table 2: Comparative characteristics of the Ponseti method versus extensive posteromedial soft-tissue release and the French functional method for idiopathic clubfoot [20,21,18,19,22].			
Characteristic	Ponseti method	Extensive surgical release	French functional method
Primary modality	Manipulation, casting, +/- tenotomy	Open posteromedial soft-tissue release	Daily manipulation and taping/splinting
Joint invasiveness	Minimal (percutaneous tenotomy only)	Extensive intra-articular dissection	None
Long-term stiffness/degenerative change	Uncommon, generally mild	Common, progressive over decades	Uncommon
Relapse requiring further procedure	Common but usually joint-sparing (recasting/transfer)	Lower relapse, higher baseline morbidity	Comparable surgery-avoidance to Ponseti
Resource requirement	Low (casting materials, brace)	High (operating room, surgeon)	High (intensive daily physiotherapy)

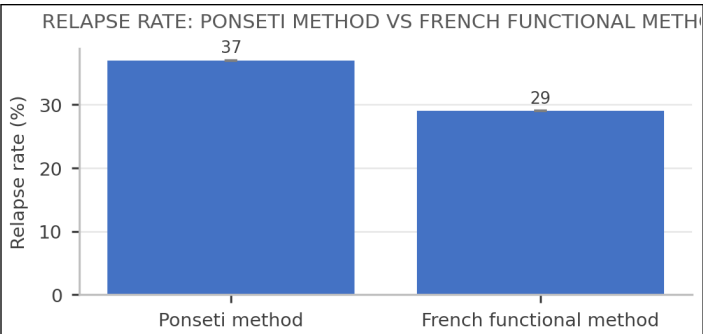


Figure 2: Relapse rate with the Ponseti method (37%) versus the French functional method (29%) at a mean follow-up of 4.3 years [22].

Outcomes in Resource-Limited Settings

The Ponseti method's low cost and minimal equipment requirements have made it the preferred approach in low- and middle-income countries, but adherence barriers are amplified by poverty and distance. Uganda's national clubfoot programme demonstrated that Ponseti clinics can be scaled across dozens of hospitals, while identifying travel cost, distance, and time as major barriers to sustained brace adherence and follow-up [24]. Studies

from rural North American populations similarly identified socioeconomic and logistical factors, rather than treatment technique, as key drivers of variable outcome, indicating that the compliance challenge is not confined to low-resource countries [25]. Physiotherapist-led Ponseti services have achieved outcomes at least equivalent to, and in some series better than, surgeon-led care, an important finding for health systems where orthopaedic surgeon availability is limited [26]. More recent registry analysis found that neighbourhood-level socioeconomic deprivation was not independently associated with relapse once brace compliance and follow-up duration were accounted for, suggesting that targeted adherence support, rather than broad socioeconomic status, is the more actionable lever for programmes serving disadvantaged populations [27]. Practical adaptations reported from high-volume low-resource programmes include community-based brace fitting, task-shifting to trained non-physician clinicians, mobile-phone follow-up reminders, and subsidised transport, each aimed squarely at the logistical barriers identified as the dominant cause of loss to follow-up and relapse in these settings.

Conclusion

Four decades of accumulated evidence confirm the Ponseti method as the preferred initial treatment for idiopathic clubfoot, achieving high rates of correction while sparing most children the joint stiffness associated with extensive surgical release. Its principal vulnerability is relapse, driven overwhelmingly by brace non-adherence and continuing to accrue well beyond early childhood, such that meaningful outcome assessment requires follow-up into adolescence. The method translates successfully to low-resource settings and non-surgeon-delivered care, provided structured family support and sustained follow-up address the logistical and behavioural barriers to bracing.

Standardised long-term functional and radiographic reporting into adulthood remains the most pressing gap in the literature.

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