ILLUSTRATED CLINICAL MONOGRAPH

Philosophy of Progressive Collapsing Foot Deformity in Adults

Sub-talar & Extended Medial Column Fusion



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FIRST EDITION | 21 OCTOBER 2026

Cover revised 22 October 2026

About this edition

Philosophy of Progressive Collapsing Foot Deformity in Adults

Mr Peyman Bakhshayesh, MD, PhD, MBA. First edition, 21 October 2026.

This professional educational monograph examines a proposed reconstructive strategy alongside published literature and a retrospective analysis of the available clinical records. It includes a new analysis of a 12-entry pain and wound summary, a separate account of an earlier ten-case manuscript and an illustrated postoperative atlas.

The clinical observations do not establish a uniform technique-specific cohort, a fixed follow-up efficacy result, whole-construct union, comparative superiority or the safety of a routine early-loading policy. Those boundaries are part of the scientific interpretation, not grounds for omitting the observed benefits or harms.

The views and operative proposals are the author's. Institutional affiliations identify professional roles and do not imply institutional endorsement. This book is a separate publication from any journal manuscript and is intended for specialist education and informed discussion.

Original identifiable questionnaires and clinical lists are not reproduced. The radiographic photographs supplied for illustration are not assigned to named patients or used for unverified outcome measurements.

Published references are numbered 1 to 22. Internal clinical records are identified as D1 to D5 in the source notes. The statistical appendix enables reproduction of the new pain calculations from grouped, de-identified observations.

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1 The author and the purpose of this book

I am Mr Peyman Bakhshayesh, MD, PhD, MBA, a Consultant Trauma and Orthopaedic Surgeon working in major trauma and complex foot and ankle reconstruction in Leeds. I am an Honorary Senior Lecturer at the University of Leeds. My clinical training in orthopaedics was undertaken in Sweden, and my doctoral work at Karolinska Institutet examined clinical and radiological aspects of traumatic pelvic ring injuries. My subsequent work in Sweden, Germany and the United Kingdom has brought together complex fracture surgery, limb reconstruction and elective foot and ankle practice. These experiences shape the questions explored in this book. [21,22]

In trauma surgery, a satisfactory reconstruction must tolerate the loads of daily life while respecting the patient's ability to heal. I apply the same reasoning to a collapsing adult foot. A radiograph may show the arch, but the patient experiences pain, difficulty with shoes, fatigue, instability and a loss of confidence when walking. The aim of surgery is a tolerable, stable, plantigrade foot that serves the person's needs. An attractive radiograph is one part of that assessment.

Progressive collapsing foot deformity presents a particular problem when several levels of the arch have become painful, unstable or arthritic. In selected patients, restoring a tendon and changing the position of the heel may not adequately address the whole deformity. My proposed approach combines subtalar arthrodesis with longitudinal stabilisation and fusion of the affected medial and, where indicated, central column. Two subtalar screws and a longitudinal medial plate provide the principal fixation described in my records. The extent of fusion must follow the anatomy and the individual indication.

This book develops that clinical proposition, describes the relevant alternatives and critically examines our available clinical records. It uses the name Bakhshayesh proposed technique for the author's particular reconstructive strategy. It does not imply that combining hindfoot and medial column fusions is a new operation: related procedures have been described by other surgeons. The question is whether a particular extent of reconstruction is justified for a particular pattern of collapse. [6,7]

Clinical philosophy and clinical evidence

My central argument is that PCFD should be understood through the interaction of bone shape, ligament support, muscle and tendon function, joint degeneration, loading and the patient's general condition. Posterior tibial tendon dysfunction remains clinically relevant, but a tendon diagnosis alone does not describe every collapsing foot. Contemporary nomenclature has already recognised this wider problem. [1]

Our clinical table records substantial pain reductions and several wound problems. An earlier manuscript reports smaller changes at an early review. These accounts are analysed separately. The book presents a surgical philosophy, an operative framework and a transparent retrospective analysis; comparative superiority remains unproven.

2 Terminology definition and classification

Progressive collapsing foot deformity is a three-dimensional deformity with variable hindfoot valgus, forefoot abduction and collapse or instability through the medial arch. Peritalar subluxation and, in some patients, ankle valgus are part of the presentation. The deformity can remain flexible or become rigid. A low arch without pain, instability or demonstrated progression is not automatically the same clinical problem. [1]

Adult acquired flatfoot deformity remains useful when reading older literature. It describes an acquired clinical pattern but can imply a previously normal arch and encourages attention to the flat appearance of the foot. PCFD allows a broader description of progressive deformity, including progression in a foot that was already relatively flat. Posterior tibial tendon dysfunction describes tendon pathology; it is neither a complete anatomical description nor a sufficient explanation for every case.

Two staging systems must be kept separate

The contemporary PCFD system describes flexibility as stage 1 and rigidity as stage 2, together with classes A to E. The legacy Johnson-Strom and Myerson framework uses stages I to IV for a different progression of tendon and deformity findings. A reference to stage II in an older reconstruction paper therefore does not mean rigid stage 2 in the newer PCFD system. Historical records should retain their original terminology, with any contemporary classification assigned only when the examination and imaging support it. [1]

Table 1 Contemporary PCFD classification [1]

Element	Description	Use in the clinical record
Stage 1	Flexible component	Record examination evidence for correctability
Stage 2	Rigid component	Record fixed deformity and relevant joint disease
Class A	Hindfoot valgus	Heel position and hindfoot alignment
Class B	Abduction	Talonavicular and forefoot relationship
Class C	Forefoot varus or medial instability	Residual position after hindfoot correction
Class D	Peritalar subluxation	Talocalcaneal relationship and impingement
Class E	Ankle valgus	Ankle and deltoid assessment

What medial column means in this book

The conventional medial column follows the talus, navicular, medial cuneiform and first metatarsal. The intermediate and lateral cuneiforms and the second and third metatarsals belong to the central column. My proposed reconstruction extends across this medial and central region when the pathology requires it. The anatomically precise description is subtalar fusion with extended longitudinal medial and central column arthrodesis.

There is no single straight chain passing through all three cuneiforms and then all three metatarsals. The navicular articulates with the cuneiforms through separate facets, and the cuneiforms connect to their corresponding metatarsal bases. A study must therefore identify each intended fusion level. Talonavicular, naviculocuneiform facets, intercuneiform and tarsometatarsal joints must not be merged into a single undocumented label.

Table 2 Map the intended fusion levels

Region	Anatomical relationship	Required operative description
Hindfoot	Talus to calcaneus	Subtalar arthrodesis
Proximal medial column	Talus to navicular	Talonavicular arthrodesis if performed
Naviculocuneiform level	Navicular to medial, intermediate and lateral cuneiform facets	Specify which facets are prepared and fused
Intercuneiform region	Adjacent cuneiforms	Specify intended fusion or fixation
Distal medial column	Medial cuneiform to metatarsal 1	First tarsometatarsal arthrodesis if performed
Distal central column	Intermediate and lateral cuneiforms to metatarsals 2 and 3	Specify second and third tarsometatarsal fusion separately

A plate can bridge a joint without demonstrating that the joint was prepared for arthrodesis or subsequently united. For the clinical study, intended fusion comes from the operative record; union comes from an appropriate longitudinal assessment. Neither can be inferred from the outline of the implant alone. The distinction is especially important when a long medial plate has screws directed towards several columns.

3 Why the adult arch collapses

The arch depends on several structures sharing load. Articular geometry provides a framework. Plantar ligaments and fascia resist separation and deformation, while muscles and tendons modify alignment and stiffness during activity. Failure in one part changes the demands on the rest. The clinically useful question is which components are failing in this patient and whether the remaining structures can sustain a correction.

Ligaments fascia and the posterior tibial tendon

The spring ligament complex supports the talar head and participates in talonavicular stability. The deltoid and other peritalar ligaments influence hindfoot and ankle relationships. The plantar fascia and plantar ligaments support the longitudinal arch. The posterior tibial tendon contributes to inversion and dynamic support, but its condition must be interpreted alongside these passive structures.

Computational work by Malakoutikhah and colleagues illustrates how combinations of ligament failure can produce deformity and redistribute forces. These models support a system-level explanation; they do not establish the sequence of tissue failure in every patient. A separate force model found that isolated tendon failure and ligament failure had different effects on alignment and on the load carried by the remaining structures. Model assumptions, simulated loading and the absence of normal biological adaptation limit direct translation into a surgical prescription. [12,13]

Loading and tissue capacity

Higher body mass increases the load that the foot must accommodate. The effect depends on activity, limb alignment, lever arms, footwear and the quality of the supporting tissues. BMI is an imperfect clinical description of that exposure. It helps frame the discussion but does not determine whether a person needs fusion. The comparative literature includes obese patients with flexible deformity who improved after joint-preserving reconstruction. [10]

Diabetes requires a more detailed description than a yes or no diagnosis. Neuropathy, vascular disease, glycaemic control, skin condition and ulcer history influence both the presenting foot and the risk of reconstruction. Poor proprioception may affect control and protective behaviour, but it must be assessed rather than assumed. An insensate, warm, swollen or rapidly changing foot raises a different diagnostic question, including Charcot neuroarthropathy.

Osteopenia can reduce fixation purchase and may accompany frailty, disuse or other disease. It should be treated as a potential modifier of fixation and healing rather than a proven universal cause of PCFD. The local material does not establish that reduced bone density initiated collapse. Bone-health assessment should follow the patient's clinical risk and the relevant care pathway.

Arthritis and progressive instability

Painful arthritis can make a previously compensating foot less adaptable. Instability can increase deformation under load, while altered contact relationships may contribute to further degeneration. In a contact-mechanics model, ligament failures changed pressure differently at different joints. This is a reason to avoid saying simply that all midfoot and forefoot pressure increases in every collapsing foot. Pressure redistribution is regional and depends on the deformity. [14]

My clinical hypothesis is that patients with a combination of multilevel instability, degeneration and limited tissue reserve may benefit from a construct that supports a longer section of the arch. The individual contributions of diabetes, bone quality, proprioception and BMI to the outcome of this particular technique remain research questions. Our present records cannot isolate those causal effects.

4 Altered biomechanics and the aims of correction

PCFD changes the relationship of the talus, calcaneus, navicular and forefoot in more than one plane. Hindfoot valgus, talonavicular uncoverage and sagittal sag can coexist in different proportions. The forefoot may appear supinated relative to a corrected hindfoot even when the whole foot previously looked everted. A correction performed in one plane must therefore be reassessed in the others.

The lever arm of a deformity

A simple mechanical relationship helps explain the concern about loading: bending moment equals force multiplied by the perpendicular lever arm. A change in alignment can increase the demand on a supporting structure even without a change in body weight. This is a conceptual model, not a measurement of forces in our patients. A long plate can resist bending during healing, but biological union remains necessary for durable load sharing.

Subtalar reduction aims to improve the relationship between the talus and calcaneus. Correcting the valgus heel involves movement towards inversion relative to its starting position. That direction of correction must be distinguished from a final rigid varus deformity. The endpoint is a balanced foot with appropriate plantar contact, assessed clinically and with suitable imaging.

The evidence on heel position is more nuanced than a universal numerical target. Conti and colleagues associated 0 to 5 mm of radiographic varus on a hindfoot alignment view, corresponding clinically to a straight heel, with better outcomes after selected stage II reconstructions. That observation concerns a particular population and measurement method; it does not validate deliberate excessive varus in an extensive fusion construct. [16]

Restoring the arch through reduction

In the author's approach, the navicular and forefoot are brought into a more supportive relationship beneath and in front of the talus, while the hindfoot is reduced. Raising the sagging medial arch is one component. Correction must also address abduction, rotation, foot length and contact of the first metatarsal head. Elevation of the navicular alone does not guarantee these relationships.

Subtalar fusion may leave residual abduction or forefoot varus. The subtalar and naviculocuneiform consensus describes this limitation and warns that overcorrection can create lateral overload. Residual deformity must be identified after hindfoot correction and addressed at its appropriate level. [3]

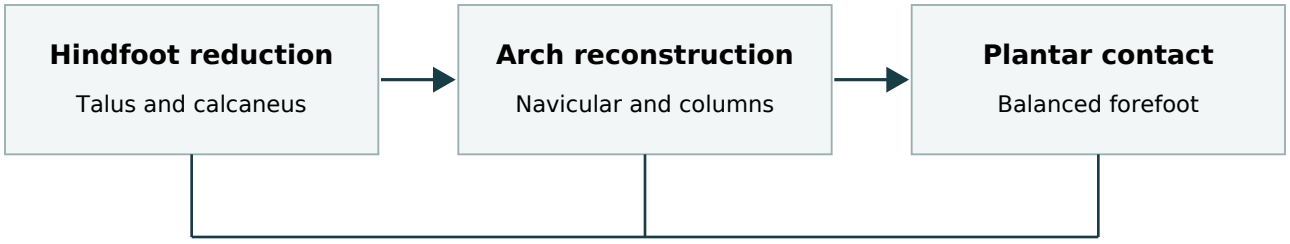


Figure 1 The intended relationship between hindfoot reduction, arch reconstruction and plantar contact. The plate and screws support a correction; they do not establish biological union.

Stability has a functional cost

Fusion sacrifices motion at the selected joints. A longer construct may increase the area of intended stability, but it also increases the number of fusion surfaces and can transfer demand to the remaining joints and plantar soft tissues. The central clinical trade-off is between a correction that can be maintained and the motion that the individual would otherwise retain. The 2020 operative consensus favours preserving motion when feasible while giving priority to a stable, well-aligned foot. [2]

5 Clinical assessment and imaging

Assessment begins with the patient's pain, walking demands, footwear, occupation, previous treatment and expectations. The examination should distinguish a flexible deformity from a fixed one and identify where correction is possible. Record standing alignment, forefoot abduction, heel position, skin and callus pattern, tendon function and the response of the forefoot when the hindfoot is brought towards correction.

The patient factors that influence the operation

Assess perfusion, protective sensation and skin integrity, especially in diabetes. Record smoking or nicotine exposure, relevant medication, inflammatory disease, bone-health concerns and mobility. Consider how the patient will manage a boot, walking aids, stairs and any period of restricted loading. A stronger implant does not resolve an unsafe home environment or the absence of protective sensation.

Examine gastrocnemius and Achilles-related contracture. A Strayer procedure is a gastrocnemius recession; it is not synonymous with Achilles tendon lengthening. The operation note should record the actual procedure performed and its indication. This distinction is relevant because one historical local manuscript uses the terms together.

Images must answer a defined question

Weight-bearing dorsoplantar and lateral foot radiographs show different components of deformity. A hindfoot alignment view and ankle radiographs can add information when the heel or ankle is involved. Weight-bearing CT can clarify three-dimensional relationships where available and clinically appropriate. MRI may help evaluate a specific tendon or ligament question but should not replace assessment of alignment under load. [4]

On a lateral view, Meary's angle uses the longitudinal axis of the talus and the first metatarsal. A study must specify its sign convention. Calcaneal pitch, talonavicular coverage and hindfoot offset describe other relationships; they should not be substituted for one another. Positioning, projection and loading status must be comparable when change over time is assessed.

The green lines on the supplied clinical photographs follow a posterior calcaneal or screw-related direction and an anterior direction. Their displayed values of approximately 130 degrees and 50 degrees are supplementary geometric angles. They are not accepted here as a validated Meary measurement, and no normal target is assigned to them. A proposed new angle requires a named landmark protocol, repeatability testing and correlation with meaningful outcomes.

The differential diagnosis matters

Charcot neuroarthropathy, primary navicular collapse including possible Müller-Weiss disease, inflammatory arthropathy, post-traumatic deformity and neuromuscular disease can resemble parts of PCFD. They may need different diagnostic and reconstructive pathways. The primary PCFD cohort should not mix these diagnoses without explicit strata. A photograph of a postoperative foot cannot by itself settle the original diagnosis.

For the retrospective study, use authorised de-identified PACS exports for measurements. The photographs in this book illustrate the constructs. They are not a substitute for paired study images, a hindfoot alignment assessment or serial evidence of union.

6 Choosing between reconstruction and fusion

Treatment should match the location and flexibility of the deformity, the condition of the joints, the supporting tissues and the patient's priorities. Orthoses, suitable footwear, bracing and rehabilitation can remain appropriate treatment. The decision to operate follows persistent symptoms and a coherent explanation of what a procedure is intended to improve.

The joint-preserving reconstruction framework

The reconstruction principles associated with Myerson and other foot and ankle surgeons use combinations of procedures rather than a single operation for every flat foot. A medialising calcaneal osteotomy addresses heel valgus. Lateral column lengthening can address substantial abduction. FDL transfer augments or substitutes for deficient posterior tibial tendon function. Ligament reconstruction may address relevant soft tissue failure. Gastrocnemius recession or Achilles lengthening addresses a demonstrated contracture, according to its level.

A Cotton osteotomy is a plantarflexion opening-wedge osteotomy of the medial cuneiform, used to address residual forefoot varus in an appropriate flexible medial column. It is different from first tarsometatarsal fusion. The latter can address instability or arthritis at that joint. The presence of sag at the naviculocuneiform level may require a different correction. These distinctions prevent the phrase first-ray correction from concealing the anatomical problem. [5]

Table 3 The procedure should follow the deformity

Finding	Potential procedure	Key distinction
Flexible heel valgus	Medialising calcaneal osteotomy	Changes heel position while preserving the subtalar joint
Flexible abduction	Lateral column lengthening or selected soft tissue reconstruction	Assess lateral loading and avoid overcorrection
Tendon insufficiency	FDL transfer as part of a balanced reconstruction	Does not alone correct every bony deformity
Residual forefoot varus with a flexible medial column	Cotton medial cuneiform osteotomy	Different from fusion of an unstable joint
TMT or NC instability or arthritis	Selected joint arthrodesis	Locate the symptomatic or unstable level
Rigid arthritic hindfoot with multilevel arch failure	Subtalar and appropriately extended column fusion	Justify every additional fusion level

When a fusion strategy becomes reasonable

Painful arthritis, rigid deformity, substantial peritalar instability, symptomatic multilevel arch instability or a failed previous reconstruction may favour fusion. An extended operation requires a reason for including each level. Fusing a non-arthritic joint to maintain correction can be a considered proposal, but its rationale and the alternatives should be documented. An uncontrolled case series cannot establish that preventive extension was necessary.

High BMI, older age and diabetes influence the decision but are not automatic exclusions from joint-preserving surgery. Soukup and colleagues reported similar postoperative outcomes across BMI groups after selected flexible deformity reconstructions. Conti and colleagues found that older patients could improve without an increased rate of subsequent surgery compared with younger groups. These findings challenge an age- or BMI-only indication for extensive fusion. [10,11]

Diabetes with neuropathy and impaired healing can also make a larger fusion more hazardous. Wukich and colleagues linked neuropathy and poor glycaemic control to infection after foot and ankle surgery. The relevant question is whether the expected functional benefit exceeds the combined mechanical, biological and wound risks for that person. [15]

An insensate foot still needs postoperative protection despite a mechanically strong construct.

7 The Bakhshayesh proposed reconstructive strategy

The strategy described in this book combines subtalar reduction and arthrodesis with longitudinal support of the collapsing medial arch. A medial plate spans the intended medial column reconstruction. Extension towards the intermediate and lateral cuneiforms and the bases of metatarsals two and three is considered when central-column arthritis, instability or the correction requires it. The intended result is a supported arch within a balanced foot.

Define the construct before calling it extended

The core subtalar fixation in the author's records uses two cannulated screws across the prepared subtalar joint. One local manuscript identifies 6.5 mm screws. The medial fixation is described as a longitudinal medial column plate, with different implant systems appearing in earlier notes. Implant brand is an operative detail rather than evidence that one design is superior. [D1,D3]

Talonavicular fusion, naviculocuneiform fusion and first tarsometatarsal fusion each remove motion at a distinct level. Extension to additional naviculocuneiform facets, intercuneiform joints or second and third tarsometatarsal joints must be recorded individually. The study cannot assume that every patient received the full anatomical construct proposed in the current description.

This approach differs from a subtalar and naviculocuneiform fusion that deliberately preserves the talonavicular joint. It also differs from a medial double arthrodesis, which generally means subtalar plus talonavicular fusion, and from triple arthrodesis, which additionally includes the calcaneocuboid joint. Keeping these definitions explicit allows the reader to compare operations rather than labels.

The proposed indication

I consider the longer construct for an adult whose collapse is sufficiently extensive, arthritic or unstable that a shorter reconstruction may leave a clinically important unsupported segment. High loading demands, poor tissue quality and comorbidity contribute to that discussion. They do not replace the requirement to identify the actual deformity and justify the fusion levels.

The proposed advantage is simultaneous support of the hindfoot and the longitudinal arch during healing, followed by biological stability at the intended levels. Whether this reduces recurrent collapse or later surgery compared with limited fusion remains unproven. The plate is temporary mechanical support in the biological sense, even when it remains permanently implanted.

What is distinctive and what is established

Barg and colleagues described subtalar and naviculocuneiform fusion for extended medial arch breakdown in 2011. Steiner and colleagues subsequently reported a combined subtalar and naviculocuneiform series preserving the Chopart level. Our work must acknowledge this foundation. The contribution proposed here is the selection, extent and evaluation of a longer medial and central reconstruction in a defined clinical population, not ownership of the general idea of combining fusions. [6,7]

The technique should be tested against meaningful alternatives. A stable foot at the first review does not establish long-term benefit, and a favourable individual experience cannot determine the best fusion extent for the next patient.

8 Operative principles and technical decisions

The operative description is an educational account for specialist readers. The exact sequence and exposure depend on the deformity, skin, previous surgery and fusion levels. The objective is to obtain reduction without unnecessary shortening, excessive tension on the soft tissues or a residual forefoot position that produces abnormal plantar contact.

Prepare reduction and fixation together

The historical local technique describes a sinus tarsi approach to the subtalar joint, preparation of the opposing surfaces and compression with two cannulated screws. The medial exposure is described between tibialis anterior and tibialis posterior, extending along the required column. These details describe the author's recorded practice; they are not evidence of a tested advantage over another approach. [D1]

Joint preparation should remove the barrier to intended fusion while preserving useful contour and viable bone. Avoiding unnecessary resection may help retain length and the shape required for correction. However, limited preparation must not be confused with leaving cartilage at an intended arthrodesis surface. If a joint is bridged without preparation, it should be reported as bridged fixation rather than assumed arthrodesis.

Reduction is assessed in the coronal, sagittal and transverse planes. Reassess the forefoot after the hindfoot is corrected. Confirm the first metatarsal head can share plantar contact appropriately and that there is no excessive supination, abduction or shortening. Imaging should assess the bones and joints rather than simply showing that screws and plate appear well positioned.

Match the plate to the corrected foot

The plate supports the reduction achieved through joint positioning and preparation. It should not be used to force a poorly understood deformity into an implant contour. Screw trajectory, purchase, compression, plate prominence and the soft tissue envelope matter. A long construct can fail at a weak screw-bone interface or at a joint that has not united, even when the plate itself remains intact.

Osteopenia may influence fixation and the period of protection. Graft use should follow the clinical need for biology, contact and defects; neither routine omission nor routine use is established by the current local analysis. Record the graft, each prepared joint and any additional corrective procedure so that later outcomes can be interpreted.

Equinus correction and closure

Subtalar and column fusion do not automatically remove a contracture. Where a recession or lengthening is needed, identify the anatomical level and document the reason. The historical reference to a Strayer release is interpreted as gastrocnemius recession unless the operative record establishes another procedure. A cohort should not be described as avoiding all soft tissue adjuncts if some patients received them.

Closure and postoperative protection are part of the reconstruction. Medial wound tension and implant prominence deserve particular attention in a long exposure. The local clinical table records delayed healing, antibiotic treatment and one plate removal, making wound outcome a central endpoint rather than a minor footnote.

9 Rehabilitation healing and complications

Mechanical fixation and biological healing occur on different timescales. Immediate radiographic stability is useful, but it is not the same as union. Loading must account for the intended joints, fixation, bone quality, soft tissue condition, sensation and the patient's ability to follow instructions.

Describe the actual rehabilitation exposure

The local table contains several pathways: a period of non-weight-bearing in a backslab, transition to a boot after wound review, weight-bearing as pain permits and, in some entries, early full weight-bearing in a boot. One entry records six weeks of non-weight-bearing. This variation should be retained in the study rather than replaced with a uniform protocol. [D2]

These observations do not establish the safety of routine full weight-bearing after two weeks. Patients may have received different instructions because of different risks or operations. A retrospective comparison would be confounded by that selection. Record the prescribed loading, what the patient actually achieved, the reason for any delay and the temporal relationship to complications.

Assess healing at every intended level

Union should be adjudicated separately at the subtalar, talonavicular, naviculocuneiform and relevant distal joints. Serial radiographs and any clinically obtained CT contribute to that assessment. Whole-construct union requires union at every intended level; if an essential level is unassessed, the whole construct cannot be classified as fully united. A stable plate and improved pain are supportive clinical observations but do not independently prove union.

Naviculocuneiform fusion deserves particular attention. Wininger and colleagues reported fusion in 11 of 13 patients using plantar plating in a selected reconstruction series. A larger mixed-indication series by Kim and colleagues reported 27.3% radiographic nonunion and 15.5% symptomatic nonunion among 110 feet; diabetes and the pattern of facet fusion were associated with nonunion. These populations and constructs differ from ours, so their rates should not be treated as predictions for the local technique. [8,9]

Capture harms without double counting

Record delayed healing, dehiscence, infection, hardware symptoms, nonunion, recurrent collapse, malcorrection, persistent pain, lateral overload, thromboembolism and all further surgery. Infection, admission and reoperation may describe one episode. Report the components and the number of affected people, rather than adding percentages as though the events occurred in different patients.

10 Retrospective study methods and source reconciliation

The intended design is a retrospective analysis of surgical care with prospectively collected clinical assessments where their original dates establish prospective collection. It is not a prospectively registered trial. Recalled preoperative information collected after an operation must be identified as recalled information. The date of the analysis does not convert retrospective measurements into prospective ones.

The available sources

The analysis uses a 12-entry clinical summary table, an earlier ten-case manuscript and its PDF counterpart, study protocols, an outcome-entry workbook and original questionnaire scans. The 36-page and five-page scans contain identifiable clinical forms; those forms are not reproduced in this public book. The workbook contains a ten-name case list but no completed outcome fields, so it does not supply a scorable outcome dataset. [D1-D5]

Table 4 Sources and their analytical roles

Source	Reported scope	Role and boundary
Clinical summary table D2	12 patient entries	New pain and wound analysis; exact construct and follow-up not fully specified
Earlier manuscript and PDF D1	10 cases	Historical aggregate results; not an independent replication
Outcome-entry workbook D5	10 named rows	Outcome fields blank; no new PROM calculation
Two questionnaire scans D5	36 and 5 pages	Original forms; timing, linkage and ambiguous marks need adjudication
Earlier protocols D4	Planned study methods	Do not establish completed endpoints or formal project status

The clinical table is headed subtalar fusion or heel osteotomy with extended medial column fusion. It therefore cannot establish that all 12 entries received the same subtalar and extended-column procedure. Eleven entries have operation dates, spanning May 2024 to May 2025; one has no operation date. At least one entry describes bilateral surgery. The number of independently treated feet and the number receiving the exact proposed construct remain unverified.

What was analysed anew

All 12 entries have paired pain ratings explicitly recorded on a 0 to 10 scale. These pairs were transcribed, checked against the source table and analysed at the patient-entry level. Improvement is defined as preoperative rating minus postoperative rating. Means and sample standard deviations, medians and interquartile ranges are reported. A t-based 95% interval describes the mean within-entry reduction; an exact two-sided sign test provides an exploratory check on the direction of change.

For harms, the source wording was retained. Any recorded wound problem includes delayed healing or a wound episode treated with antibiotics. Antibiotic treatment alone is not taken as proof of a deep infection. Proportions use the 12-entry denominator with Wilson 95% intervals. These intervals describe arithmetic uncertainty conditional on this table; they do not correct selection bias, incomplete ascertainment or errors in the source records.

What was not reconstructed

The earlier manuscript's VAS and MFAS summaries are reported as historical manuscript results, separately from the new table analysis. Individual values sufficient to reproduce its signed-rank tests are not available in a verified analysis file. The instrument called MFAS is not sufficiently defined for a confident functional interpretation and is not relabelled MOXFQ.

The scans establish that MOXFQ, general-health and ankle scales were used in some assessments, but marks, page linkage and collection chronology require adjudication. At least one form labelled preoperative bears a date later than the corresponding operation in the clinical table. A validated paired MOXFQ result is therefore not asserted. Nor are age, BMI, diabetes subgroup effects, joint-level union rates or radiographic correction calculated from incomplete records.

No unverified approval number, trial registration, complete-consecutive-cohort claim or journal-publication status is assigned to this analysis. The framework for completing the institutional study is set out in Chapter 13. Observational reporting should follow the relevant STROBE principles, adapted to the case-series design. [20]

11 Results from the available clinical records

The clinical summary table records a substantial reduction in pain across its 12 patient entries. The result is encouraging as a description of reported experience. Because the exact procedures and outcome timepoints are not established for each entry, it is not a technique-specific efficacy estimate at a fixed follow-up.

Paired pain ratings in the clinical table

The preoperative mean was 8.75 out of 10 and the postoperative mean was 1.67. The mean paired reduction was 7.08 points, with a sample standard deviation of 1.44 and a conditional t-based 95% confidence interval from 6.17 to 8.00 points. The median reduction was 7 points, with an interquartile range of 6 to 8.25. All 12 entries recorded a lower postoperative rating. [D2]

Table 5 Pain ratings in the 12-entry clinical table [D2]

Measure	Preoperative	Postoperative	Paired reduction
Number of entries	12	12	12
Mean	8.75	1.67	7.08
Sample SD	0.97	1.07	1.44
Median	8.00	1.00	7.00
Interquartile range	8.00 to 10.00	1.00 to 2.25	6.00 to 8.25
Observed range	8 to 10	1 to 4	5 to 9
95% interval for mean reduction	-	-	6.17 to 8.00

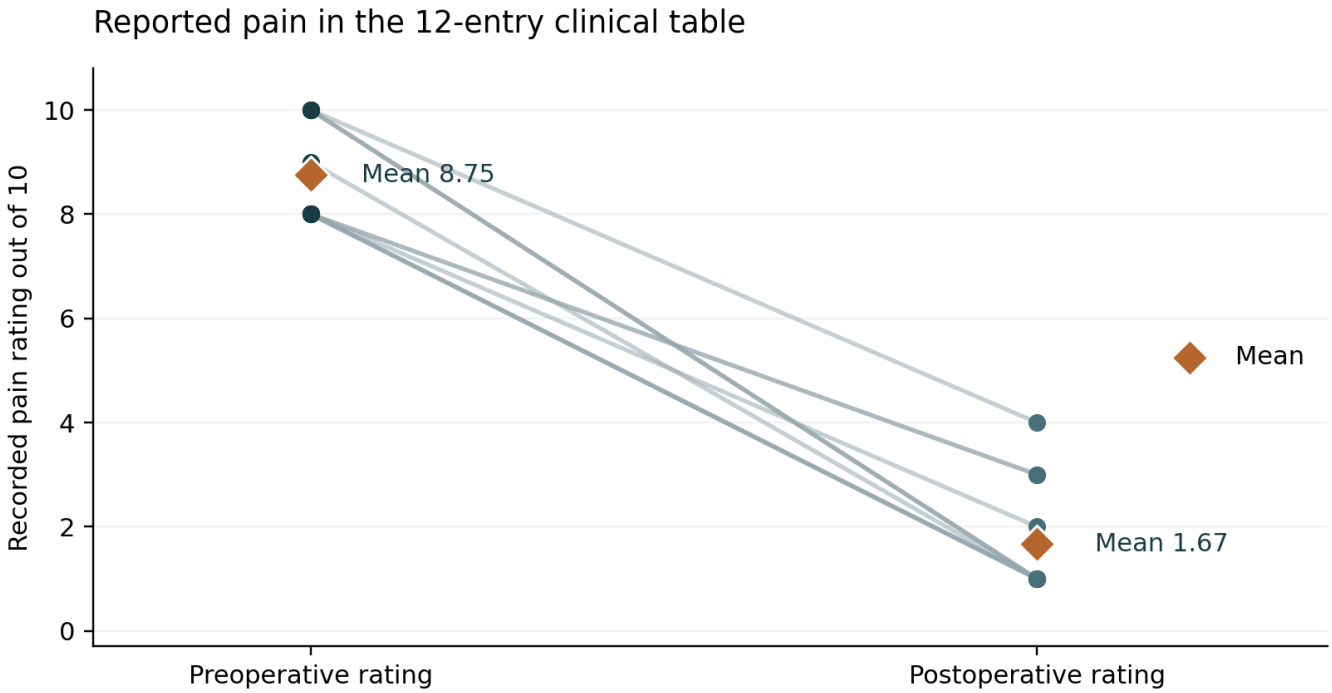


Figure 2 Pain pairs transcribed from the 12-entry clinical summary table. Several trajectories overlap. The time of each postoperative rating and the exact operation for each entry are not established; this is not a fixed-timepoint efficacy plot. [D2]

The exact two-sided sign-test p value is 0.00049. That calculation tests the symmetry of improvement and worsening under its assumptions; it does not demonstrate that the particular extended fusion caused the improvement or that this result applies to every eligible patient. Selection, non-standardised outcome timing and differences between procedures remain material limitations.

As a numerical sensitivity analysis, the first ten entries in source-table order have a mean preoperative rating of 8.70, a postoperative mean of 1.60 and a mean reduction of 7.10. This restriction shows that the overall mean is not driven by the two additional entries. It does not establish that these ten are the same analytic cohort as the earlier manuscript or that excluding the other entries is clinically justified.

Wound problems and further treatment

Five of 12 entries record a wound problem, giving 41.7% with a Wilson 95% interval of 19.3% to 68.0%. Three explicitly describe delayed healing at approximately six weeks. Two describe antibiotic treatment for a wound problem; one of these specifically describes infection followed by plate removal. At least one plate removal is documented. These categories overlap and should not be added. [D2]

Table 6 Recorded wound findings by patient entry [D2]

Finding	n / N	Percent	Wilson 95% interval
Any recorded wound problem	5 / 12	41.7%	19.3% to 68.0%
Explicit delayed healing	3 / 12	25.0%	8.9% to 53.2%
Antibiotic-treated wound episode	2 / 12	16.7%	4.7% to 44.8%
Explicitly described infection	1 / 12	8.3%	1.5% to 35.4%
Documented plate removal	1 / 12	8.3%	1.5% to 35.4%

The table does not provide a complete adverse-event register or a uniform observation window. The absence of an additional reoperation or nonunion in that table should be reported as not documented, rather than as a verified zero. A 41.7% wound-problem proportion in this limited summary warrants attention even though the pain ratings are favourable.

Results in the earlier ten-case manuscript

The earlier manuscript reports a mean age of 67.9 years and BMI of 31.5 in ten cases. It reports nine paired VAS observations on a 0 to 100 scale, with medians of 75 before and 70 after surgery, a median paired change of minus 10 and a Wilcoxon p value of 0.1824. Its reported mean change is minus 21.11. Seven paired observations labelled MFAS have a reported median change of minus 3 and p value of 0.6002. Follow-up is described as approximately six weeks. [D1]

The median of individual changes need not equal the difference between the two group medians. The early VAS findings do not show clear statistical evidence of change, but that is also not evidence that longer-term benefit is absent. The manuscript records one event in each of the complication, infection, reoperation and readmission categories, with possible overlap, and one regret response among nine. These historical summaries are not pooled with the 12-entry table.

12 Interpreting outcomes and comparing the literature

The most useful local finding is a strong reported pain signal alongside a wound burden that needs systematic assessment. This supports careful further evaluation of the reconstruction. It does not establish superiority over osteotomy, limited fusion or another reconstruction, because the records do not provide a comparable control group or a fully reconciled consecutive cohort.

Different sources answer different questions

The 12-entry table and earlier manuscript may reflect different follow-up visits, instruments, patients or methods of recording preoperative pain. Those possibilities cannot be resolved by multiplying a 0 to 10 score by ten. A change in units preserves a measurement only when the underlying instrument, timing and observation are the same. The book therefore retains both accounts without selecting whichever gives the more favourable result.

Prospectively collected assessments are valuable when their dates and linkage can be verified. A recalled baseline can also provide information about perceived change, but it is subject to recall and response-shift effects. It should be analysed separately. A high level of satisfaction does not establish normal function or radiographic union, and a painful early recovery does not by itself predict failure.

The related fusion literature

Steiner and colleagues reported 34 feet in 31 patients treated with subtalar and naviculocuneiform fusion, preserving the talonavicular joint. Fifteen also needed a medial sliding osteotomy. Fusion was observed in all but two cases at one year, giving 94.1%. This series supports the feasibility of a related combined reconstruction, but its additional procedures and preserved joints differ from the full extended construct proposed here. [7]

Day and colleagues studied first tarsometatarsal and subtalar fusion with additional procedures and examined correction at the naviculocuneiform region. Their work illustrates why correction at one level should be measured rather than assumed to correct all adjacent levels. It cannot determine the value of routinely including the second and third rays in our proposed construct. [17]

Fadle and colleagues compared double and triple arthrodesis in a small prospective study. Its patients were substantially younger than the older patients often considered in the present discussion, which limits transfer of the findings. A comparison of two fusion extents in that setting is not a comparison between the author's extended construct and joint-preserving surgery in an older comorbid population. [18]

The limits of a mechanical explanation

Extensive support may be mechanically attractive when several segments are unstable. The biological and functional consequences of achieving that support remain equally important. The construct can only share load through united fusion surfaces, and preserving additional joints can have value. Conversely, retaining a painful or unstable segment may undermine the purpose of a reconstruction. The decision requires evidence about the specific segment and the patient's goals.

The literature and our local experience therefore favour an anatomical, individualised question: how much fusion is necessary to obtain useful alignment and maintain it? They do not support a rule that every person with high BMI, diabetes, osteopenia or reduced proprioception should receive a long fusion. Demonstrating which patients benefit most is the next scientific task.

13 Completing the cohort study and testing the philosophy

A definitive account should begin with a theatre-derived consecutive case list, a fixed operation period and a dated follow-up cut-off. Match each person, side and operation to the clinical records. Retain revisions and early failures in the safety cohort. Record exclusions and diagnostic adjudication. Keep subtalar fusion with the defined extended construct separate from heel osteotomy and from shorter fusion constructs.

Establish the exposure and the endpoints

For every foot, record the actual prepared and intended fusion joints, implant configuration, adjunctive procedures, graft and rehabilitation instructions. The same procedure name can conceal different fusion levels. The analysis must make that variation visible before interpreting outcomes.

Inventory the original PROMs, their versions, collection dates and side attribution. Use MOXFQ only when the questionnaire is validly scorable and its timing supports the proposed comparison. Its scores run from 0 to 100, with higher scores indicating worse status. Prespecify the primary instrument and a clinically sensible follow-up window, such as 12 months, before inspecting the new comparative results. Retain early recovery measurements as separate timepoints. [19]

The most informative presentation shows individual paired trajectories, the average and distribution of change, confidence intervals and the amount of missing data. Treat both feet from one person as related observations. For a small cohort, a person-level primary analysis with a clearly attributable index foot can avoid pretending that bilateral outcomes are independent.

Measure maintained correction and union

Use paired weight-bearing images with a written landmark protocol. Distinguish correction from maintenance: preoperative to postoperative change concerns correction, while comparable early and later postoperative images concern maintenance. Use two readers to assess reliability where feasible. Record unassessable images instead of supplying plausible angles.

Assess union at every intended level and report the denominator with adequate evidence. Record symptomatic and asymptomatic nonunion separately. Treat implant failure, revision and recurrent collapse as outcomes even when an eventual salvage procedure succeeds. The number of fusion surfaces makes whole-construct healing a different endpoint from union of one selected joint.

Table 7 Minimum linked dataset for the completed study

Domain	Fields needed
Person and operation	Anonymous person and foot identifiers; side; index and revision dates; diagnosis and eligibility
Host characteristics	Age; BMI and date; diabetes; neuropathy; vascular status; nicotine; skin and bone-health information
Reconstruction	Each intended fusion level; facet involvement; joint preparation; fixation; graft; adjuncts
Outcomes	Verified PROM version and dates; pain instrument; satisfaction; follow-up eligibility and missingness
Structure	Comparable imaging dates and loading; alignment measures; union at each intended level
Harms	Event onset, treatment, admission, reoperation, resolution and any residual effects
Rehabilitation	Prescribed and achieved loading; boot or cast; reason for changes; relationship to events

From a case series to a comparison

A larger, prospectively defined comparative study could test whether the longer construct improves pain, function, maintenance of correction or freedom from further surgery in the subgroup with multilevel instability. Appropriate alternatives include limited fusion or joint-preserving reconstruction when clinically reasonable. Adjustment for confounding requires a sample large enough to support it; a handful of patients cannot provide reliable multivariable claims about BMI, diabetes and neuropathy.

Institutional classification, permissions and consent arrangements should be documented for the actual project. An earlier protocol's statement that work is a service evaluation is not, by itself, verification of the final study's status. Public reporting should use de-identified data, preserve the rights of contributors and distinguish a website monograph from a peer-reviewed journal article.

Final clinical position

My proposed strategy is an option for selected adults with a painful, unstable or arthritic collapsing foot in whom the necessary support extends beyond a single joint or tendon. Its rationale is restoration of a useful hindfoot position and longitudinal arch support, followed by union at the intended levels. The current clinical table records considerable pain relief, together with wound problems that must remain visible. The value of this philosophy will be judged by complete follow-up, honest reporting of harms and a precise account of how much reconstruction each patient needed.

Radiographic atlas

The following photographs were supplied by the author for this book. They show postoperative constructs in left and right feet. They are not presented as matched before-and-after pairs, and they have not been assigned to specific entries in the clinical table. Apparent alignment on these photographs is illustrative; no study union rate or quantitative correction is derived from them.



Figure 3 Dorsoplantar photographs show longitudinal medial plating and screws extending into the midfoot. These views illustrate fixation geometry. They do not establish which naviculocuneiform facets, intercuneiform joints or tarsometatarsal joints were prepared or united.

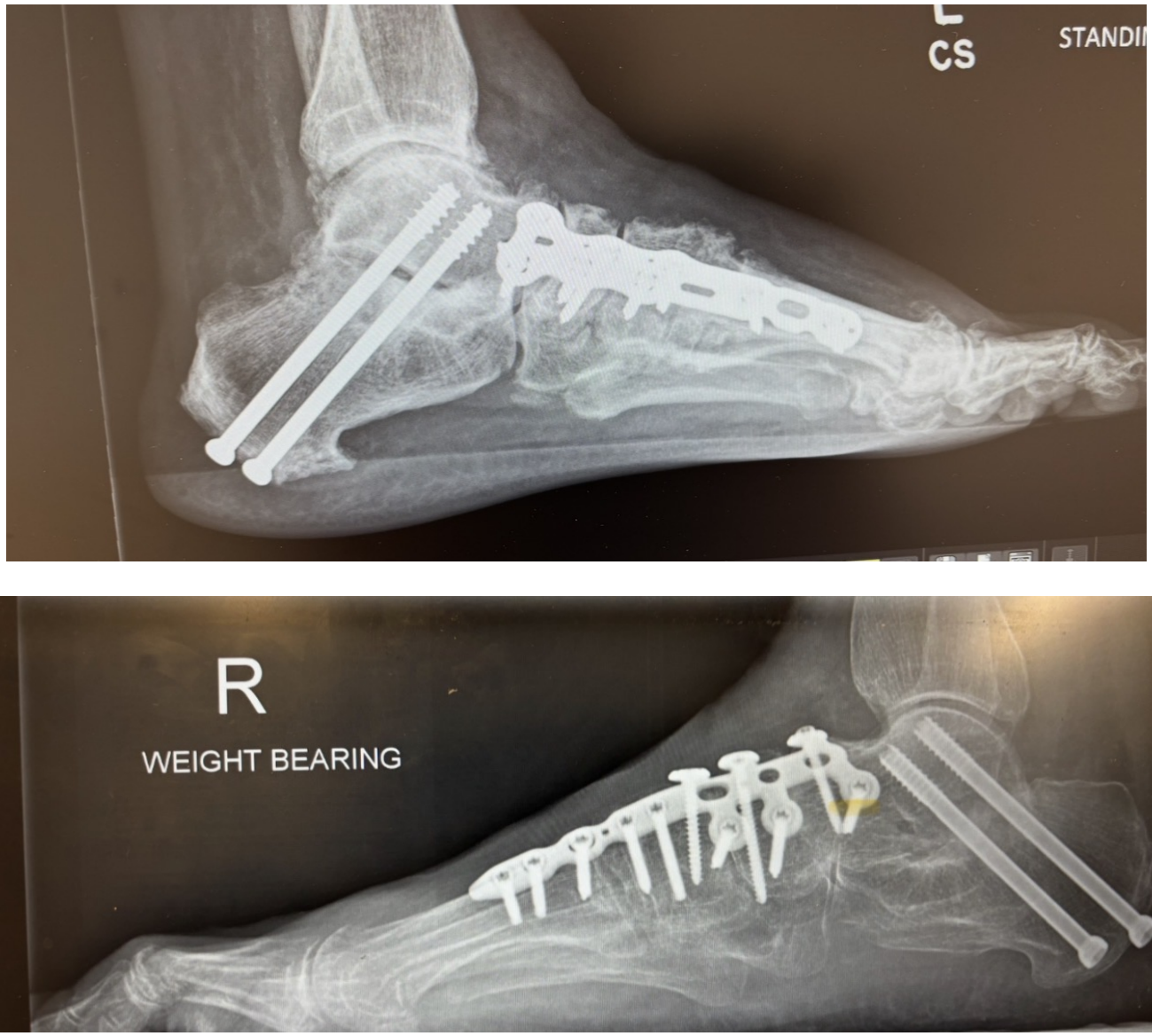


Figure 4 Left and right lateral views show two subtalar screws and a longitudinal medial column plate. They are different clinical views, not a matched before-and-after comparison. A lateral projection alone cannot establish coronal heel position or whole-construct union.





Figure 5 Further weight-bearing lateral photographs demonstrate the longitudinal support strategy. Differences in apparent arch contour may reflect different feet, anatomy, operations, projection or loading; they are not used to calculate a study correction angle.



Figure 6 The supplied photograph with green measurement lines. The displayed angle follows a posterior calcaneal or screw-related line and an anterior line. It is not treated as Meary's angle. The displayed supplementary angles are illustrative and do not provide a validated outcome measure.

A study measurement must name the bony axes, use suitable original images and document its sign convention. Any new construct-related angle should be evaluated for interobserver and intraobserver repeatability before it is proposed as a clinical target.

Appendix Statistical definitions and reproducibility

The numerical reanalysis uses the pain pairs explicitly tabulated in source D2. The grouped pairs below reproduce all 12 observations without names, hospital identifiers, exact operation dates or individual clinical histories. Each person-entry contributes one pair, including the entry describing bilateral surgery. No foot-level rate is calculated from these pain data.

Table 8 Grouped pain pairs used for the new analysis [D2]

Preoperative rating	Postoperative rating	Number of entries
10	1	3
10	4	1
9	1	1
8	1	4
8	2	1
8	3	2
Total	All pairs	12

For each entry, the pain reduction is the preoperative rating minus the postoperative rating. The mean reduction is the sum of these 12 reductions divided by 12. The sample standard deviation uses a denominator of 11. The 95% interval is the mean reduction plus or minus the 0.975 quantile of a t distribution with 11 degrees of freedom multiplied by the standard error. This yields 7.08 points and an interval of 6.17 to 8.00.

Quartiles use linear interpolation between ordered observations. The sign test excludes no entries because every pair differs; under a symmetric null probability of improvement of one half, observing 12 improvements in 12 entries gives a two-sided p value of 2 divided by 4096, or 0.00048828125. Wilson score intervals are used for the reported proportions.

The first-ten-entry sensitivity calculation follows source order; it is not a prespecified clinical subgroup. No linked diabetes, BMI, age, fixation or loading subgroup comparison is available.

These calculations remain subject to the source limitations in Chapter 10. Preserve an audit trail when the clinical dataset is reconciled or extended.

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Clinical source notes

The clinical sources below are working records provided through the author's Drive, read for this edition on 21 October 2026. They are cited separately from published literature. Public copies of the book omit patient names, NHS numbers, addresses, dates of birth and the original identifiable questionnaires.

[D1] Subtalar and Medial Column Fusion for Progressive Collapsing Foot Deformity A Case Series. Files PCFD_Subtalar_MedialColumn_CaseSeries_FINAL.docx and PCFD Paper.pdf. These contain the earlier ten-case summary and approximate six-week findings. They are substantially the same account, not two independent studies. Journal publication has not been verified.

[D2] List of patients Including Info.docx. Clinical document headed Subtalar fusion or heel osteotomy and extended medial column fusion for PCFD. The table has 12 patient entries with pain pairs and wound notes. New numerical estimates in this edition derive from that table. It does not establish a uniform operation or follow-up window.

[D3] Medial column and sub-talar fusion.docx. Earlier narrative manuscript with an operative description. Its favourable longer-term numerical claims are not adopted as verified outcomes because they cannot be reconciled with a linked source dataset.

[D4] PCFD_SubtalarFusion_Study_Protocol.docx and PCFD_Research_Protocol_and_Agreement_Bakhshayesh_Chew.docx. These describe different stages of study planning, including recalled baseline collection in an earlier protocol and a later proposed analysis of prospectively recorded outcomes. A plan is not evidence that its endpoints have already been collected or analysed.

[D5] PCFD_Outcome_Data_Entry.xlsx and the two CamScanner outcome PDFs dated in their filenames 17 and 18 July 2025. The workbook's clinical and outcome fields are unpopulated. The scans contain MOXFQ and other outcome forms requiring linkage, timing and scoring adjudication. Their presence supports further source review, not an invented complete PROM dataset.

Earlier review drafts in Drive contain citation mismatches and quantitative claims without a recoverable study extraction. They have not been treated as a completed systematic review or meta-analysis. The published references in this edition were checked against their journal, PubMed or institutional records. The literature discussion is a targeted critical review, not a new systematic review.