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Review

Perception and clinical outcomes of total ankle replacement and contralateral arthrodesis for ankle osteoarthritis: A narrative review

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Abstract

Objective: To evaluate the current evidence on perception, satisfaction, and functional outcomes in patients with bilateral ankle osteoarthritis treated with a total ankle replacement on one limb and contralateral arthrodesis.

Methods: This narrative review, conducted as a qualitative, descriptive thematic synthesis in accordance with the Scale for the Assessment of Narrative Review Articles, searched four electronic databases between March and April 2026 with no restriction on publication year. The intra-individual design was intended to reduce demographic and lifestyle heterogeneity, although it does not eliminate biomechanical interdependence between limbs.

Results: Three studies met the inclusion criteria, with mean follow-up ranging from 2 to 6.2 years across cohorts. Both procedures achieved comparable pain relief. Total ankle replacement preserved sagittal-plane motion, producing higher functional scores and a more intuitive, physiologic gait, whereas arthrodesis offered a stable weight-bearing base but restricted dorsiflexion, induced compensatory midfoot kinematics, and increased the cognitive burden of monitoring the environment to prevent falls. Patient-reported and general health measures showed comparable satisfaction between sides; replacement complications were predominantly mechanical, whereas arthrodesis complications were predominantly biological. The hybrid strategy was reported as more cost-effective than bilateral arthroplasty.

Conclusion: In bilateral end-stage ankle osteoarthritis, combining a replacement on one limb with a contralateral arthrodesis allows patients to alternate limb use according to task; standardized, long-term prospective studies are required to confirm these observations.

Level of Evidence V; Narrative review.

Keywords: Arthroplasty; Replacement, Ankle; Arthrodesis; Patient satisfaction; Gait.

Introduction

Ankle osteoarthritis is a chronic degenerative disease in which recurrent microtrauma drives progressive cartilage loss, ultimately producing persistent arthralgia and mechanical dysfunction[1]. Symptomatic ankle osteoarthritis affects approximately 1% to 4% of adults and remains a recognized clinical challenge[2]. Unlike hip or knee osteoarthritis, which are predominantly primary or age-related, 75% to 80% of ankle cases are post-traumatic, arising from complex fractures or chronic ligamentous instability[3]. Because it commonly affects a younger population after trauma, its long-term socioeconomic and functional burden is substantial[4,5].

Ankle arthrodesis remains a definitive option for end-stage degeneration, providing predictable pain relief, high osseous union rates (greater than 90%), long-term durability[6], and reported patient satisfaction of 77%[7]. Approximately 70% of patients require no subsequent intervention, with a lower revision profile than total ankle replacement[8]. However,

Study performed at the Instituto Roosevelt, Bogotá, Bogotá D.C., Colombia.

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these benefits are tempered by permanent loss of tibiotalar motion and compensatory gait kinematics, which precipitate moderate-to-severe subtalar arthritis in about 15% of cases[9]. Absolute contraindications include active infection, severe peripheral vascular disease, and significant ipsilateral hindfoot arthritis[3].

Total ankle replacement is an effective alternative for end-stage disease, offering significant pain reduction and superior short- to medium-term function[10]. Its principal advantage is preserving sagittal-plane motion, which reduces stress on adjacent joints and yields patient satisfaction of 81%[7]. Modern third-generation implants show 10-year survivorship of 78%[11], with a comparable rate of 86.6% reported over a mean follow-up of 7.75 years in an independent multicenter cohort[12]. Contraindications include active infection, talar avascular necrosis, Charcot arthropathy, and critical vascular or bone insufficiency[13].

Before arthroplasty, and even during the first generations of ankle implants, arthrodesis was the gold standard for eliminating pain at the cost of motion[14]. Whereas replacement seeks to preserve joint kinematics[14], the choice between arthrodesis and arthroplasty remains debated. Performing both procedures in the same patient offers a valuable methodological opportunity: the patient could serve as an intra-individual control, allowing direct comparison of subjective function and satisfaction while minimizing demographic and lifestyle biases inherent to independent-group studies[14-16]. Although compensatory gait adaptations after either procedure mean the two limbs are not fully biomechanically independent[17], each patient's simultaneous, first-hand experience of both a prosthetic and a fused ankle offers a uniquely informative perspective on perception, satisfaction, and quality of life.

The objective of this narrative review is to evaluate current evidence on perception, satisfaction, and functional outcomes in patients undergoing simultaneous contralateral total ankle replacement and arthrodesis for bilateral ankle osteoarthritis.

Methods

As this is a narrative review of previously published literature, Institutional Review Board approval was not required. This study was conceived as a narrative review; however, given the scarcity of literature directly addressing bilateral ankle osteoarthritis managed with contralateral total ankle replacement and arthrodesis, a structured, systematic-style search and selection process was adopted to enhance transparency and reproducibility. Given the limited number and heterogeneity of the studies identified, a formal systematic review with risk-of-bias assessment and meta-analysis was not considered methodologically appropriate; findings are therefore presented as a narrative synthesis.

A structured literature search was conducted across four electronic databases – PubMed (MEDLINE), Embase, Scopus, and LILACS (Virtual Health Library) – between March and April 2026, with no restriction on publication year. Records were limited to English- or Spanish-language publications. The search employed Boolean operators using the following terms: ankle, replacement, arthroplasty, prosthesis, arthrodesis, fusion, fused, bilateral, contralateral, simultaneous, concurrent, concomitant, and combined. The comprehensive search yielded 631 records.

Studies were eligible for inclusion if they reported on patients treated with ankle arthrodesis on one limb and total ankle replacement on the contralateral limb for bilateral ankle osteoarthritis, were of any human study design (case reports, case series, retrospective or prospective cohorts, qualitative studies), and reported at least one variable related to patient perception, satisfaction, or functional outcome. Studies were excluded if they analyzed ankle replacement or arthrodesis as isolated procedures, reported conversion of failed arthroplasty to arthrodesis or vice versa, addressed ipsilateral combined procedures without contralateral counterpart, or did not provide extractable outcome data relevant to the review objective. The reference lists of the three included studies were manually searched for additional relevant citations. Forward citation tracking was not performed, and unpublished studies and grey literature were not included.

Title/abstract screening and full-text eligibility assessment were performed independently by two authors (VH, LDCR); disagreements were resolved by discussion between reviewers, and any unresolved disagreement was adjudicated by a third author (CAS). Three studies met all inclusion criteria and are detailed in Table 1. The selection process is illustrated in Figure 1. Consistent with the narrative review design, this review was not registered in a protocol database, and no formal risk-of-bias assessment or certainty-of-evidence appraisal was performed; instead, studies were characterized by design type, sample size, follow-up duration, and outcome measurement tools used. Dependent variables and summary measures were not pooled quantitatively due to substantial clinical and methodologic heterogeneity. Results are presented through qualitative thematic synthesis organized by clinically relevant domains: gait kinematics and functional outcomes, patient satisfaction and perception, complication and reintervention rates, and cost-effectiveness.

Results

Comparative impact on gait patterns

While both procedures significantly reduce chronic pain, their kinematic profiles differ. Total ankle replacement more closely resembles physiologic walking by preserving sagittal-plane motion[14,16]; replacement limbs retain significantly greater total sagittal motion during the transition between dorsiflexion and plantarflexion, supporting superior performance in dynamic tasks such as navigating stairs and higher functional scores[16].

In contrast, arthrodesis eliminates tibiotalar mobility, producing a rigid gait with compensatory hypermobility of adjacent midfoot joints[16]. Although patients value the fused ankle for prolonged standing, restricted dorsiflexion and

Table 1. Characteristics of the studies included in the review (N = 3 studies, 38 patients)

Author (year)	Title	Study design	Patients (n)	Follow-up	Outcome measures/instruments
Chen et al. (2022)	Simultaneous total ankle replacement and contralateral ankle arthrodesis for bilateral ankle osteoarthritis: a retrospective study focused on clinical outcomes and cost-effectiveness	Retrospective	12	Minimum 2 years (assessed at 4 months, 1 year, and 2 years)	VAS (pain); goniometric ROM; AOFAS ankle-hindfoot score; 5-grade satisfaction questionnaire
Conlin et al. (2021)	Living with both a total ankle replacement and an ankle fusion: a qualitative study from the patients' perspective	Qualitative	10	Minimum 1 year since most recent ankle reconstruction (mean 4.6 years)	Semi-structured qualitative interviews with thematic content analysis; AOS scores collected only to characterize the sample
Henricson et al. (2016)	Total ankle replacement and contralateral ankle arthrodesis in 16 patients from the Swedish Ankle Registry: self-reported function and satisfaction	Retrospective	16	Mean 74 months (12–145) for the prosthesis side; mean 66 months (12–156) for the arthrodesis side	SEFAS (0–48); 5-grade satisfaction questionnaire (Likert)

AOFAS: American Orthopaedic Foot and Ankle Society; AOS: Ankle Osteoarthritis Scale; ROM: range of motion; SEFAS: Self-Reported Foot and Ankle Score; VAS: visual analogue scale.

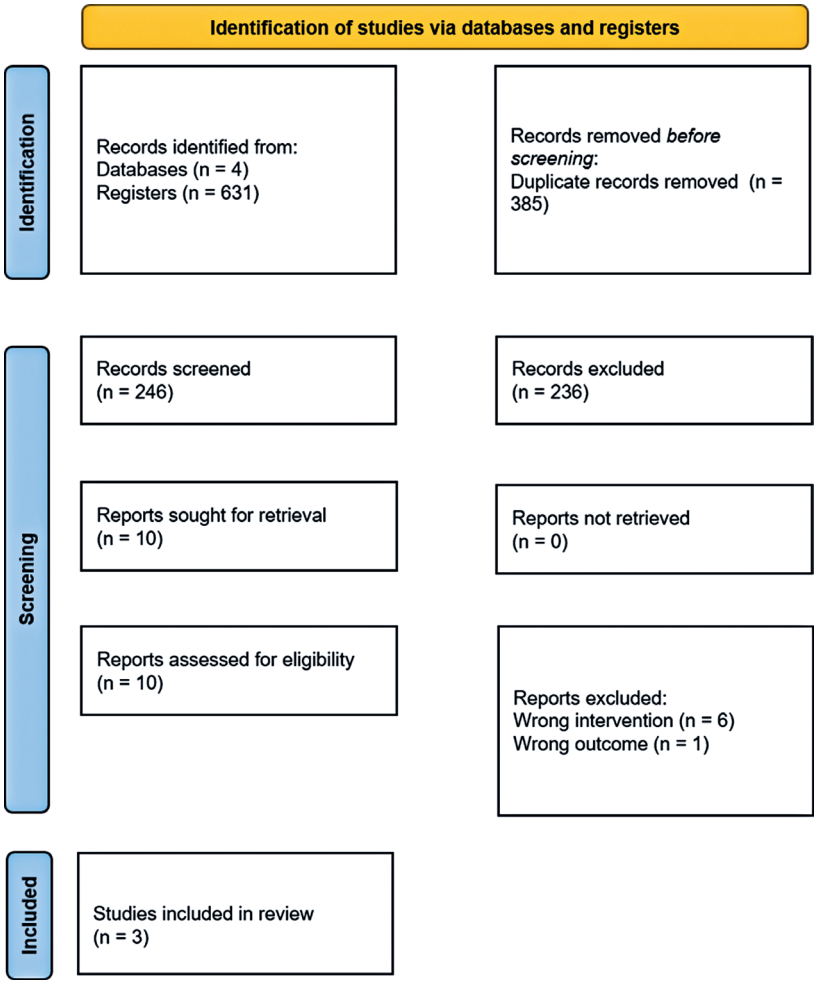

Figure 1. Flow diagram of study identification, screening, and selection, based on the PRISMA 2020 flow diagram template[18]. From 631 records retrieved across four databases, 3 studies met the inclusion criteria.

plantarflexion often cause a catching sensation or tripping on irregular surfaces[15]. This compromises global equilibrium and requires constant environmental vigilance, as patients must visually monitor each step to compensate for obstacles the ankle can no longer accommodate[16].

In a qualitative study of 10 patients living with both procedures, participants described a marked preference for the physiologic feel of replacement, characterized as intuitive and fluid, whereas the fused ankle was perceived as a rigid structure requiring compensatory limb or torso movement to turn[15]. Patients with one replacement and one fusion often alternate the lead foot by task, using the flexible side for pivoting or descending steps and the stable side for weight-bearing[15]. Despite occasional apprehension that the implant might give way on uneven surfaces, these qualitative accounts describe a subjective preference for replacement, attributed to the reduced cognitive burden of gait monitoring[15].

Reintervention and complication rates

Current evidence indicates no clear difference in overall reintervention between the two procedures, although failure mechanisms differ markedly[14]. All-cause reoperation rates tend to be higher after replacement[16]; revisions are primarily mechanical, including polyethylene wear or fracture, aseptic loosening, and component instability[19,20].

Complications of arthrodesis are predominantly biological, centered on consolidation failure (non-union) and accelerated secondary osteoarthritis of adjacent joints from compensatory load transfer[9]. Replacement does not appear to compromise neighboring joint biology; combined subtalar fusion and replacement achieves a high fusion rate of 92%[21], and cohorts undergoing simultaneous bilateral surgery (one replacement, one fusion) reported no short-term revisions in either limb[16].

Although registry data suggest a higher long-term mechanical revision risk for replacement, this is frequently offset by superior function: a greater sagittal arc of motion, higher functional scores, and a more physiologic gait. Arthrodesis provides stable support but is associated with stiffness-related limitations and midfoot overload[14]. For most patients, the functional benefits of preserved mobility outweigh the mechanical risk, and patients generally prioritize physiologic mobility over the limitations imposed by fusion rigidity[15].

Quality-of-life outcomes and functional scales

Patients undergoing both procedures report significant improvement over their preoperative state, although outcomes vary by metric[16]. On objective clinical scales, patients consistently assign higher scores to the replacement limb, reflecting greater range of motion and functional capacity[14].

The distinction narrows with patient-reported outcome measures and general health surveys. Swedish Ankle Registry data show a median Self-Reported Foot and Ankle Score of 32 (range, 16-44) for replacement and 27 (range, 14-47) for arthrodesis, a difference that did not reach statistical significance (p = 0.271), suggesting comparable function in daily activities[14]. The 12-Item Short Form Survey showed substantial and equivalent improvement in physical and mental components for both techniques[14].

No bias related to limb dominance or laterality was reported; preference was driven primarily by kinematic flexibility. Most patients expressed a subjective inclination toward the replacement side for its more natural motion while valuing the fused side for reliable stability and weight-bearing. Once pain is eradicated, both procedures reach remarkably similar satisfaction, indicating a subjective equilibrium between the sturdiness of a fusion and the mobility of a prosthesis[15].

Factors influencing technique selection

Technique selection rests on a multidimensional balance of functional demand, biological constraints, and long-term mechanical stability. Activity level is a primary determinant: replacement is typically favored for patients prioritizing physiologic gait and dynamic flexibility, whereas arthrodesis is preferred for high physical demands or occupations requiring prolonged weight-bearing, where a strong, stable base is essential[3,11].

Age and bone stock further influence the decision; the risks of mechanical wear and implant failure must be weighed against life expectancy[11], and coronal alignment and soft-tissue integrity are technical prerequisites for arthroplasty to prevent premature loosening[13]. Arthrodesis offers a more reliable framework for rigid correction of severe deformity, yet replacement remains viable in complex, multi-joint scenarios when combined with auxiliary procedures such as subtalar fusion, which maintains a 92% consolidation rate[21]. In bilateral end-stage disease, the hybrid approach has been reported as 34.1% more cost-effective than bilateral arthroplasty while achieving comparable pain relief and global functional recovery[16].

Discussion

This narrative review examined the emerging evidence for combining total ankle replacement with contralateral arthrodesis in bilateral end-stage ankle arthrosis. Based on a limited evidence base of three studies and 38 patients, predominantly retrospective and with short follow-up, the hybrid approach appears to be a promising option for appropriately selected patients: it has been reported as 34.1% more cost-effective than bilateral replacement while maintaining equivalent satisfaction[16], and in cases complicated by hindfoot degeneration, combining replacement with subtalar fusion is a reasonable alternative to tibiotalocalcaneal arthrodesis[21]. Nonetheless, the cost-effectiveness estimate derives from a single retrospective cohort within one healthcare system and is highly sensitive to implant costs, reimbursement structures, revision rates, and country-specific economic factors, and should not be generalized to other settings. These findings should be

regarded as hypothesis-generating rather than a basis for definitive treatment recommendations.

A clinical decision algorithm is proposed for bilateral disease (Figure 2). The surgeon should balance biomechanical optimization with economic sustainability, tailoring management to each limb rather than enforcing strict symmetry. For patients prioritizing natural gait and dynamic flexibility, isolated replacement remains preferred for its physiologic kinematics[10]; isolated arthrodesis provides a more reliable, stable base for high physical demands or severe structural instability[4].

Bilateral arthrodesis remains a high-satisfaction option for end-stage disease, providing substantial pain relief and functional improvement[14]. However, its gait burden should not be underestimated. Permanent motion loss forces reliance on compensatory midfoot and hindfoot hypermobility, producing gait abnormalities more pronounced than after unilateral procedures; bilateral patients report difficulty with inclines, stairs, and uneven surfaces and score significantly lower in social-functioning domains despite effective pain relief[15,22]. The procedure also carries an approximately 9% non-union rate and the risk of progressive adjacent-joint arthritis[14]. Notably, a recent 25-year national population

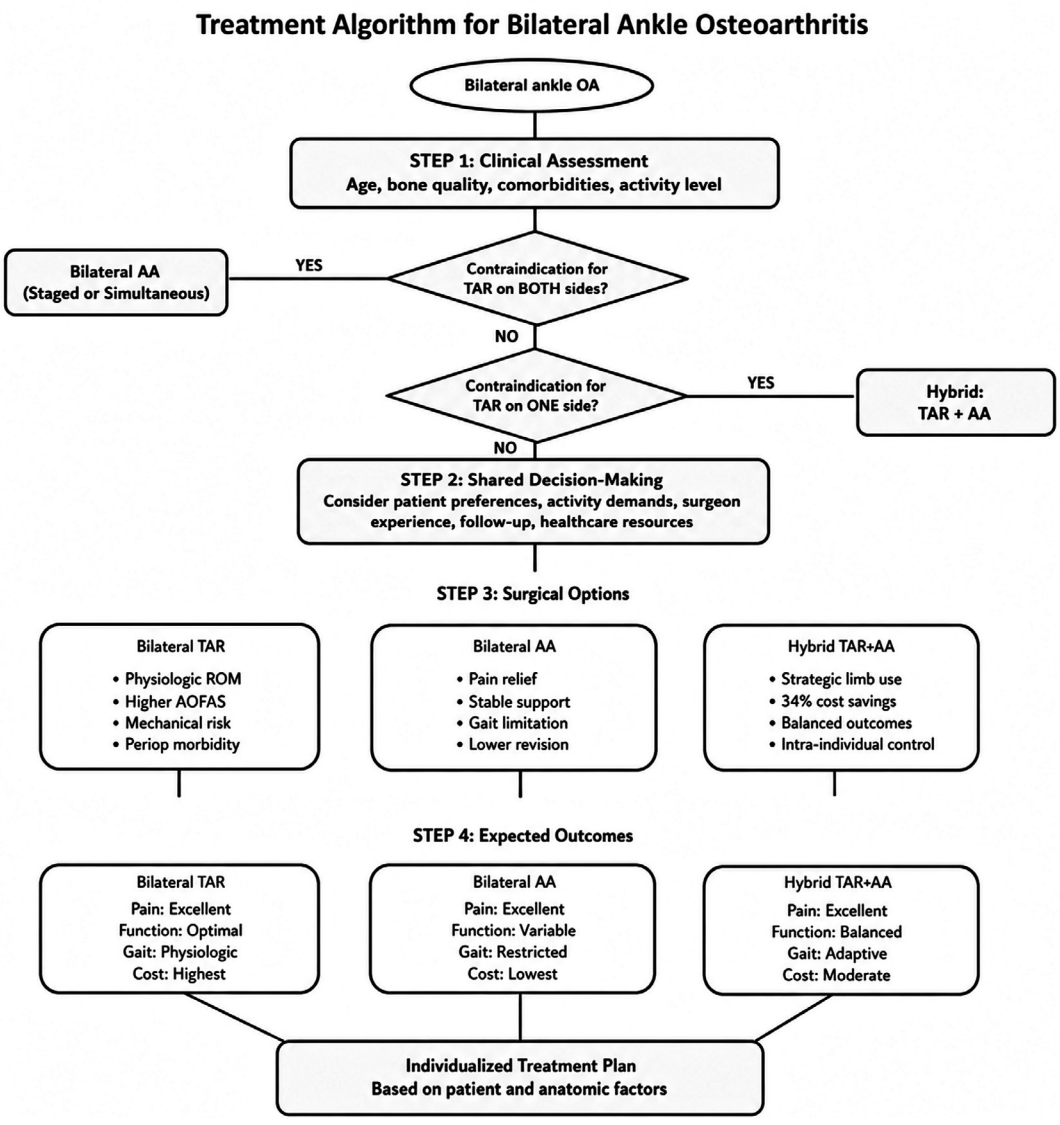

Figure 2. Proposed treatment decision algorithm for bilateral ankle osteoarthritis, based on the authors' clinical expertise and interpretation of the reviewed literature; it does not represent an evidence-based ranking of options, given the limited number of studies included. AA: Ankle arthrodesis; AOFAS: American Orthopaedic Foot and Ankle Society score; OA: Osteoarthritis; ROM: Range of motion; TAR: Total ankle replacement.

study of over 40,000 patients found no significant difference in the long-term risk of subsequent hindfoot fusion between arthrodesis and replacement (8.64% vs 6.82%, respectively), suggesting that this biomechanical burden may not translate into a proportionally higher rate of adjacent joint failure over time[23]. These functional costs should nonetheless remain central to shared decision-making.

Bilateral replacement, performed simultaneously or sequentially, is a highly effective alternative, yielding long-term functional recovery comparable to unilateral procedures, with midterm implant survival of 91% to 100%; however, perioperative complication rates remain substantial, between 22% and 24%[24]. Overall, replacement excels at restoring sagittal range of motion and functional scores, whereas arthrodesis is equally effective for isolated pain relief[14]. A balanced hybrid approach uses replacement to preserve pivoting and flexibility on one side and arthrodesis for prolonged weight-bearing and stability on the other, optimizing global function[15,16].

Intra-individual controls are a valuable methodological strategy but are not a definitive solution to the debate, because the limbs do not function in isolation; patients develop compensatory motor strategies that introduce biomechanical bias. Generalizability is further limited by small samples – 10 to 16 patients per study – stemming from the rarity of bilateral pathology treated with mixed techniques, which risks missing subtle clinical differences. Unfortunately, several clinical comparisons and the reported cost-effectiveness estimate (34.1%) rely predominantly on a single retrospective study with only 12 patients[16], limiting the robustness and generalizability of these findings.

A lack of technical standardization, with diverse prosthesis designs and varying fixation methods, introduces additional confounding. The search was also restricted to English- and Spanish-language publications, which may have excluded relevant studies published in other languages. Predominantly retrospective designs limit control of selection bias, while short follow-up (1-2 years) fails to capture long-term survivorship or adjacent-joint degeneration. Bilateral gait biomechanics, return to sport or physical activity level, and revision of a replacement following contralateral arthrodesis remain largely unaddressed in the literature specific to this population, and specific fourth-generation implant outcomes fall outside the scope of the included studies. These gaps, together with the limited number of studies and absence of randomized prospective trials, should be considered when interpreting the present findings and point to clear directions for future research.

In conclusion, preliminary evidence from a limited number of studies suggests that a hybrid total ankle replacement and contralateral arthrodesis approach may allow patients to use replacement flexibility for dynamic tasks and balance while relying on arthrodesis stability for heavy weight-bearing, potentially representing a cost-effective alternative to bilateral arthroplasty in appropriately selected patients. Rather than mutually exclusive, the two procedures appear complementary, although this observation is drawn from a small, methodologically heterogeneous evidence base. These observations should be interpreted with caution and used to inform future randomized controlled trials and prospective cohort studies evaluating modern implant survivorship, cognitive load, validated patient-reported measures of balance and physiologic feel, and reciprocal mechanical stress between reconstructed limbs.

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