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FUNCTIONAL OUTCOME OF BIMALLEOLAR ANKLE FRACTURES

Orthopaedics

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ABSTRACT

Background: Bimalleolar ankle fractures are common injuries of the ankle joint, comprising roughly 15–20% of all ankle fractures. These injuries often lead to ankle instability and require careful management to restore joint congruency and function. Open reduction and internal fixation (ORIF) is the standard treatment for unstable bimalleolar fractures, aiming to achieve anatomical reduction and stable fixation. However, the optimal management of these fractures – including comparisons between surgical and conservative treatment and among various surgical techniques – remains a topic of debate. This paper reviews the functional outcomes of bimalleolar ankle fractures, comparing different treatment methods and identifying factors influencing recovery. **Methods:** We conducted a comprehensive literature review of studies and meta-analyses on bimalleolar ankle fractures, focusing on functional outcome measures (such as the Olerud– Molander Ankle Score and other scoring systems) and comparisons of treatment modalities. Both prospective and retrospective studies, as well as systematic reviews, were included to provide a mixed evidence base. Key outcomes (e.g., patient-reported scores, complication rates, return to function) were extracted and synthesized. One illustrative graph and one summary table are provided to highlight major findings. **Results:** The literature indicates that surgical management of bimalleolar fractures generally results in good to excellent functional outcomes in the majority of patients, especially when anatomical reduction is achieved (often >80–90% satisfactory results at 6–12 months postORIF) (Gangadharan & Pillai, 2021; Jose et al., 2024). In comparison, nonoperative management can yield acceptable outcomes in select cases (particularly minimally displaced fractures or patients with low demand), but carries a higher risk of malunion or nonunion. Randomized trials and meta-analyses show no large long-term functional differences between surgery and casting for certain ankle fracture patterns, although surgery provides more reliable alignment and fewer late reductions (Donken et al., 2022). Within surgical options, modern techniques such as fibular intramedullary nailing have shown comparable functional scores to plating, with reduced wound complications (Zhao et al., 2024). Additionally, the use of appropriate fixation implants for each malleolus significantly influences outcomes – for example, tension-band wiring or screw fixation of the medial malleolus achieves better functional scores than K-wire fixation (Jose et al., 2024). Factors like quality of fracture reduction, integrity of the syndesmosis, patient age, and early mobilization all impact the recovery of function. Post-traumatic osteoarthritis remains a concern for long-term outcome, especially if congruity is not perfectly restored. **Conclusions:** Bimalleolar ankle fractures, when managed with timely and stable ORIF, tend to have favorable functional outcomes, with most patients regaining near-normal ankle function. Operative treatment is generally preferred for unstable fractures, as it ensures anatomical alignment which is critical for joint longevity. Conservative treatment may be reserved for specific low-risk scenarios or patients unfit for surgery, but must be carefully selected. Emerging surgical techniques continue to refine outcomes by minimizing complications. Overall, achieving and maintaining anatomic reduction is paramount, as even small residual malalignments can compromise joint function and predispose to arthritis. Future research should focus on long-term functional follow-up and on optimizing rehabilitation protocols to further improve outcomes for patients with bimalleolar ankle fractures.

KEYWORDS

Bimalleolar ankle fracture; functional outcome; open reduction internal fixation (ORIF); conservative management; ankle joint; anatomical reduction; complications; rehabilitation

INTRODUCTION

Bimalleolar ankle fractures are fractures involving both the lateral malleolus (distal fibula) and the medial malleolus (distal tibia) of the ankle joint. These injuries are clinically significant because they disrupt the stability of the ankle mortise on both the medial and lateral sides. Ankle fractures in general account for about **9–10% of all fractures in adults** (Court-Brown & Caesar, 2006), and bimalleolar fractures represent approximately **15–20% of these ankle fractures** (Zimmermann et al., 2024). The typical epidemiology is bimodal – occurring from sports or high-energy trauma in young males, and from low-energy falls in older females with osteoporotic bone. Regardless of patient demographics, restoring ankle stability and function after a bimalleolar fracture is a primary goal of treatment, as the ankle must bear the full weight of the body during locomotion.

The ankle joint is a congruent hinge joint, and even minor malalignment can have major consequences for joint health. It has been famously noted that the ankle is "the most injured joint in the body but the least well treated" (Sir Robert Jones, as quoted in Jose et al., 2024). Biomechanically, **a 1 mm lateral shift of the talus can reduce the tibiotalar contact area by ~40%**, leading to increased contact stress and a high risk of post-traumatic osteoarthritis (Michelson, 1995). Therefore, achieving **anatomical reduction** of the fracture fragments is critical; any disturbance of the normal articular alignment may result in progressive arthrosis and functional impairment (Michelson, 1995; Gangadharan & Pillai, 2021). With bimalleolar fractures being intra-articular injuries to a weight-bearing joint, accurate reduction and stable fixation are generally necessary to optimize outcomes.

Management approaches for bimalleolar ankle fractures can be broadly divided into nonoperative (conservative) and operative treatment. Conservative management typically involves closed reduction (manipulating the bones into alignment) followed by prolonged immobilization in a cast or brace. Operative management usually means open reduction and internal fixation (ORIF) with hardware (plates, screws, wires, etc.) to stabilize the medial and lateral malleoli. In unstable fracture patterns (such as most bimalleolar fractures), ORIF is considered the standard of care to restore stability. This is supported by the fact that unstable fractures treated nonoperatively have a high risk of displacement, malunion, and late instability. Indeed, **unstable ankle fractures "often require ORIF" and multiple studies report better short- and long-term results with surgical treatment, including easier rehabilitation, earlier weight-bearing, and lower incidence of stiffness and arthritis compared to casting** (Monestier et al., 2022). On the other hand, surgery carries risks such as infection and wound complications, and certain less-displaced fractures in low-demand patients may do well without surgery. The decision between operative and nonoperative treatment should thus consider fracture stability, patient health status, and functional needs.

Functional outcome after a bimalleolar fracture refers to the patient's ability to return to normal activities, work, and sports without significant pain or limitation. It is typically assessed using standardized scoring systems. Common outcome measures include the **Olerud– Molander Ankle Score (OMAS)** – a patient-reported questionnaire scoring 0–100 (higher is better function) – and the **American Orthopaedic Foot & Ankle Society (AOFAS)**

AnkleHindfoot score, also 0–100 (incorporating pain, function, and alignment domains). Another frequently used metric, especially in older studies, is the **Baird and Jackson ankle scoring system**, which categorizes results as excellent, good, fair, or poor based on pain, stability, and functional limitations. These tools allow clinicians to quantify recovery and compare outcomes across different treatments (Zhao et al., 2024).

The purpose of this paper is to review and synthesize the current evidence on the functional outcomes of bimalleolar ankle fractures. We particularly focus on comparing different treatment methods (operative vs. conservative, and variations of surgical technique) and highlight factors that influence the results. Understanding these factors is vital for guiding management decisions and counseling patients about prognosis.

Treatment Methods And Considerations

Nonoperative Vs. Operative Treatment: In the case of a truly bimalleolar fracture (both malleoli broken), the ankle is by definition unstable because the major stabilizing columns on both sides are disrupted. Nonoperative management (closed reduction and casting) can sometimes be considered if the fracture is minimally displaced and stable after reduction, or if the patient has prohibitive surgical risks. However, historically, the trend has shifted towards operative fixation for most bimalleolar fractures, given the benefits of precise joint realignment. A Cochrane systematic review (Donken et al., 2022) analyzed four randomized trials (292 patients) comparing surgical vs. conservative treatment for ankle fractures. It found **no clear long-term functional advantage** of one approach over the other in aggregate – the largest trial reported **no difference in patient-reported outcomes at 7 years** between ORIF and casting, and other trials had mixed results (some showing slightly better function with surgery, others showing no difference) (Donken et al., 2022). Importantly, however, **initial treatment failures (loss of reduction requiring surgery) were significantly higher in the conservative groups** – many patients randomized to casting ended up needing surgical fixation due to inability to maintain alignment. Moreover, nonunion and malunion rates are higher without surgical fixation (for example, one study noted a 10% nonunion rate with conservative care vs. 0% after surgery for similar fractures) (Hoelsbrekken et al., 2013). Due to these concerns, **operative treatment is generally recommended for unstable ankle fractures** to ensure proper healing alignment (Monestier et al., 2022). In practice, conservative treatment for bimalleolar fractures is usually reserved for patients who are poor surgical candidates (e.g. due to advanced age, severe comorbidities) or for fractures that are truly low displacement and can be held in excellent position in a cast.

It should be noted that short-term functional recovery can sometimes appear similar between operative and nonoperative treatment in certain patient populations. For instance, a randomized trial by Hoelsbrekken et al. (2013) on elderly patients with unstable ankle fractures found **mean functional scores (OMAS and AOFAS)** around 80–81 at 1–3 years in both the ORIF group and the cast group, without a statistically significant difference. However, longer-term outcomes and radiographic results must be considered: inadequate reduction can predispose to chronic pain and arthritis. In Hoelsbrekken's study, **10% of the nonoperative patients had a nonunion of the medial malleolus**, which potentially could affect later stability (though some asymptomatic nonunions might be tolerated) – whereas the surgical group had more consistent fracture healing. Another study (Tosun et al., 2018) reported that patients treated with ORIF had significantly higher functional scores at 1+ year follow-up (mean OMAS ~92) compared to those treated conservatively (mean OMAS ~70), highlighting that in many cases surgery yields superior ankle function (Tosun et al., 2018, as cited in Monestier et al., 2022). The overall interpretation is that **while certain low-energy ankle fractures might manage okay in a cast, for typical bimalleolar fractures surgical fixation gives more reliable outcomes**, especially in active individuals.

Surgical Techniques: For those fractures managed operatively, there are several fixation methods and strategies to consider. The classic surgical treatment is open reduction of each malleolus with internal fixation using hardware. Typically, the **lateral malleolus** (fibula) is fixed with a plate and screws along the fibula (a one-third tubular plate or contoured locking plate) or occasionally with other techniques like tension band or intramedullary devices. The **medial malleolus** is often fixed with two parallel cancellous screws or with tension band wiring (if comminuted or small fragments); less commonly, a small plate can be used on the medial side for multifragment fractures. In the presence of a syndesmotic injury (widening of the distal tibiofibular joint), one or two syndesmotic screws (or suture-button devices) are placed to stabilize the mortise.

Recent advances have introduced **minimally invasive techniques**. One example is the **intramedullary fibular nail**, which is a rod inserted within the fibula to stabilize distal fibula fractures. This technique avoids a large surgical incision over the fibula and has shown advantages in reducing wound complications. A 2024 meta-analysis of randomized trials by Zhao et al. (2024) compared fibular intramedullary nailing to plate fixation. It found that while **functional outcomes at 3, 6, and 12 months (e.g., OMAS, AOFAS scores) were statistically equivalent** between nail and plate groups, the **infection rate was significantly lower** with the intramedullary nail (around 2.4% vs 13.0% with plating) due to the less invasive approach. On the other hand, that study noted a slightly higher incidence of "hardware failure" (e.g., loss of reduction or need for revision) with nails in some cases. Overall, both methods achieved a **~99% bone union rate**, and the choice may depend on patient factors (such as soft tissue condition) and surgeon familiarity.

The key point is that modern surgical techniques continue to evolve, but any method that provides stable fixation and alignment can lead to good functional results.

Within traditional ORIF techniques, the **choice of implant for each malleolus can influence outcomes**. A recent prospective study by Jose et al. (2024) compared different fixation modalities in 40 patients. For the medial malleolus, three methods were used: cannulated screws, tension-band wiring (TBW), and K-wire fixation. All methods led to generally high rates of good outcomes, but **the best results were observed with TBW or screw fixation**, each yielding **excellent or good outcomes in the vast majority of patients**, whereas simple K-wire fixation had a higher proportion of fair/poor results (Jose et al., 2024). In the same study, for lateral malleolus fractures fixed either with a plate, with screws alone, or with Kwires, **plating and screw fixation outperformed K-wires**, with K-wire fixation of the fibula resulting in some cases of residual ankle stiffness or malalignment.

These findings underscore that adequate hardware (especially plating the fibula for unstable patterns, and solid fixation of the medial side) is important for optimizing functional recovery. K-wires, while minimally invasive, may not provide enough stability in many bimalleolar fractures, leading to suboptimal outcomes.

Another consideration is the **timing of surgery**. It is generally advocated that unstable ankle fractures be fixed as soon as it is safe to do so, often within 24–48 hours of injury (Monestier et al., 2022). Early fixation can reduce the duration of immobilization, allow earlier mobilization, and may decrease the risk of soft tissue complications and post-traumatic arthritis by promptly restoring alignment.

However, if there is significant swelling or compromised soft tissues (e.g., fracture blisters), surgeons might delay ORIF and use a temporary immobilization (splint or external fixator) until conditions improve. The priority is to perform surgery under optimal conditions to avoid wound complications.

Functional Outcomes After ORIF

When bimalleolar ankle fractures are treated surgically, the **short-to-medium term functional outcomes are generally very favorable**. Multiple prospective studies have reported high rates of patients achieving good or excellent function after ORIF of bimalleolar fractures. For example, Gangadharan and Pillai (2021) followed 45 patients for 6 months post-ORIF using the Baird & Jackson score: **65% had excellent or good outcomes**, 27% fair, and only 8% poor, with overall 90% considered a satisfactory result.

In a similar vein, Jose et al. (2024) found in 40 patients that **87.5% had excellent or good outcomes** (52.5% excellent, 35% good) by one year after surgery, with only 12.5% fair/poor. These figures indicate that roughly **8 to 9 out of 10 patients regain strong ankle function** following surgical fixation, corroborating the notion that ORIF is effective in restoring ankle stability and movement.

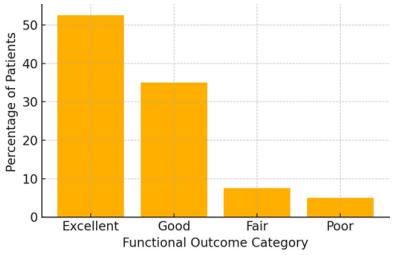

Figure 1. Functional outcome distribution (percentage of patients with excellent, good, fair, or poor outcomes) at final follow-up after ORIF of bimalleolar ankle fractures, based on BairdJackson criteria (data from Jose et al., 2024).

Interestingly, functional improvement continues over time during the rehabilitation period. Jaiswal et al. (2021) demonstrated a clear improvement in the Olerud–Molander score from the early postoperative period to later follow-up. In their study of 30 patients, the **mean OMAS increased from about 57 at 3 months to 78 at 6 months post-ORIF**, reflecting significant functional gains with rehabilitation and time for recovery. Another study with longer followup by Dwivedi et al. (2020) in Nepal assessed 29 patients at a mean of over 1 year post-ORIF: the **average AOFAS hindfoot score was 89.9**, and 86% of patients achieved an excellent or good result, while only ~14% remained in a fair category (no poor outcomes were noted) (Dwivedi et al., 2020). Moreover, they observed that many patients continued to improve between 1 year and 3 years: the median OMAS in a subset was **75 at around 1 year and improved to 85 by 3 years** post-surgery (indicating that some ankle function can continue to recover or patients adapt with time to reach a higher functional level). These outcomes reaffirm that, for most patients, **surgical fixation of a bimalleolar fracture allows a return to nearnormal function**, including pain-free daily activities and often resumption of work and sports.

To summarize a range of findings from the literature, **Table 1** presents a selection of studies reporting functional outcomes after bimalleolar ankle fractures, including both purely operative case series and comparative studies:

Table 1. Summary Of Functional Outcome Results From Selected Studies On Bimalleolar Ankle Fractures.

Study (Year)	Sample (N)	Treatment Method(s)	Follow - up	Outcome Measure	Key Functional Outcome
Gangadharan & Pillai (2021)	45	ORIF (plates/screws as needed)	6 months	BairdJackson score	65% good/excellent; 27% fair; 8% poor (90% satisfactory overall).
Jose et al. (2024)	40	ORIF (various implants studied)	~12 months	BairdJackson score	52.5% excellent; 35% good; 7.5% fair; 5% poor (87.5% good/ excellent).
Jaiswal et al. (2021)	30	ORIF (standard technique)	6 months	Olerud–Molander (OMAS)	Mean OMAS 56.7 at 3 mo → 78.5 at 6 mo (significant improvement).
Dwivedi et al. (2020)	29	ORIF (cross-sectional study)	~14 mo (avg)	AOFAS score	Mean A~89.9; excellent, OFAS 65% 21% good, 14% fair, 0% poor. Superficial infection in 14%.
Hoelsbrekken et al. (2013)	82	ORIF vs. Cast (randomized trial)	~36 months	Olerud–Molander + AOFAS	OMAS ~81 (ORIF) vs 80 (cast), n.s. difference; 10% nonunion in cast group vs 0% in ORIF.
Monestier et al. (2022) Systematic Review	33 studies (varied)	Unstable ankle fractures (mostly ORIF; some conservative comparisons)	varied (mostly 1–5 years)	Various (OMAS, AOFAS, etc.)	Generally high good/excellent rates after ORIF across studies; ORIF recommended within 48 hours for best outcomes; emphasizes fixing posterior malleolus for stability.

ORIF = open reduction and internal fixation; Baird-Jackson score = categorical outcome (excellent/good/fair/poor); OMAS = Olerud–Molander Ankle Score (0–100); AOFAS = American Orthopaedic Foot & Ankle Society Ankle-Hindfoot score (0–100). Note: Hoelsbrekken et al. (2013) included primarily older patients; Monestier et al. (2022) is a comprehensive review of 33 studies of unstable (bi/tri-malleolar) fractures.

As shown in **Table 1**, the operative treatment consistently yields a majority of patients in the excellent/good range of function by 6–12 months. The incidence of poor outcomes is low in modern series. Even when comparing to conservative treatment, the differences in **functional scores** can sometimes be small at final follow-up (as in Hoelsbrekken et al., 2013), but it is critical to note the **higher complication rates** with nonoperative care (e.g., unfused fractures, malalignment).

Another noteworthy point is the **role of posterior malleolar fragments**. Though by definition a "bimalleolar" fracture involves only the two malleoli, in practice many so-called bimalleolar fractures have an associated small posterior malleolar fracture (a piece of the tibial plafond). Traditionally, if the posterior fragment is small (<25% of joint surface) and not badly displaced, it might not be fixed. However, recent evidence suggests that fixing the posterior fragment (even if small) can improve syndesmotic stability and potentially improve outcomes. In the context of functional outcomes, failure to address a significant posterior fragment can leave residual instability or cartilage step-off, contributing to pain and arthritis. Monestier et al. (2022) emphasize that **the posterior malleolus should be fixed regardless of size when treating unstable ankle fractures**, as long as the fragment is displaced, to restore the incisura and load-bearing surface. Fixation of the posterior fragment (often via a posterolateral approach with screws/plate) has been associated with **better patient-reported outcomes** in some studies (Miksch et al., 2023). Thus, comprehensive management of all fracture components leads to the best functional results.

Factors Influencing Functional Outcome

While most patients do well after a properly managed bimalleolar fracture, there is a spectrum of outcomes, and several factors have been identified that influence the end result:

- **Quality Of Reduction:** Perhaps the most critical factor is how accurately the fracture is reduced and stabilized. **Residual articular incongruity or talar shift** is a strong predictor of worse outcomes. Roberts et al. (1983) (cited in a review) found that ankles with **malreduced fractures had significantly lower functional scores (OMAS ~57)** compared to those with an anatomic reduction (OMAS ~71) in the long run. This highlights that even small misalignments can degrade function. Anatomical reduction lowers the risk of post-traumatic osteoarthritis, which can severely impact function. In essence, the closer to normal the joint is restored, the better the patient will function.
- **Patient Age And Activity Level:** Younger, healthy patients tend to have better regenerative capacity and muscle strength, aiding recovery. However, paradoxically, **younger athletic patients may subject the ankle to higher demands**, potentially perceiving more deficits in high-level activities. Zimmermann et al. (2024) studied young active patients and found that even "simple" ankle fractures treated with ORIF led to measurable deficits in demanding activities (like jumping and sudden stops)

when compared to uninjured controls. Older patients might have lower functional expectations, but they are also at higher risk for complications like wound healing problems or delayed bone healing due to osteopenia. Age itself doesn't preclude a good outcome – many studies (including those in Table 1) had average ages in the 40s–50s and still high scores – but older age correlates with more comorbidities that can slow rehabilitation.

- **Energy Of Injury And Soft Tissue Damage:** High-energy fractures (for example, fractures from motor vehicle accidents) often involve more comminution (bone fragmentation) and soft tissue injury. These cases may have worse outcomes because of associated cartilage damage and a higher chance of complications (such as compartment syndrome or severe swelling requiring delay in fixation). Lower-energy rotational fractures (common in sports or simple falls) generally have cleaner fracture lines and recover more predictably. Also, **open fractures or fracture-dislocations** (where the bone breaks the skin or the talus dislocates) portend a more complex course and slightly lower functional results on average, due to soft tissue damage and higher infection risk. Most of the studies reviewed excluded open fractures for this reason, focusing on closed injuries.
- **Complications:** Postoperative complications can adversely affect function. The most common complication in ankle ORIF is **wound infection**, especially superficial wound infection. Reported rates of superficial infection ranFfigurege from ~2% up to 15% in various series, often higher in diabetic patients or when the injury was high-energy. In the studies by Jose et al. (2024) and Gangadharan (2021), minor infections occurred in about 5–7% of patients, all of which resolved with antibiotics and wound care. Such minor complications generally did not significantly alter long-term function in those cases. **Deep infections** (osteomyelitis) are more serious but fortunately uncommon (~1–2%). Another issue is **hardware irritation or failure** – occasionally patients have pain from prominent screws or plates, which can limit function until the hardware is removed. In one database study (SooHoo et al., 2009, see Monestier review), about 10% of ankle ORIF patients eventually had hardware removal, often for irritation. In rare cases, fixation can fail (e.g., screws pull out if weight is applied too early), leading to malunion; these cases obviously have poorer outcomes and may need revision surgery.
- **Rehabilitation And Weight-bearing Protocol:** Early motion and weight-bearing have been associated with improved functional scores, as they promote cartilage nutrition and prevent stiffness. There has been debate on when patients should start weightbearing after ORIF. Traditional teaching kept patients non-weight-bearing for ~6 weeks, but more recent trials (e.g., the 2016 UK AIM trial) showed that **early weightbearing (as early as 2 weeks in a boot) did not harm outcomes and helped patients mobilize sooner**. Allowing the patient to begin **range-of-motion exercises in the immediate weeks after surgery** can reduce stiffness and improve intermediate outcomes (Willits et al., 2009). Thus, a well-structured rehabilitation program is vital. Patients who are unable or unwilling to participate in therapy (due to pain or other issues) might experience more ankle stiffness and muscle atrophy, leading to a worse functional result.
- **Syndesmotic Injury:** If the distal tibiofibular syndesmosis (the ligaments holding the tibia and fibula together above the ankle) is disrupted (common in Weber C or high fibula fractures, and many bimalleolar fractures), it must be recognized and properly addressed with fixation. Undiagnosed syndesmotic instability can cause chronic ankle pain and dysfunction even if the malleoli heal. Studies indicate that functional outcomes are significantly worse if a syndesmotic injury is missed (meaning the ankle remains unstable). Proper placement of syndesmotic screws or tightrope fixation, followed by later removal of hardware if necessary, helps ensure the ankle mortise is stable during weight-bearing and can improve outcomes (Petruccelli et al., 2017).

Finally, one must consider **pre-existing conditions**. Patients who already had ankle arthritis or poor limb circulation (e.g., peripheral vascular disease, diabetes) may have less optimal outcomes simply because the injury compounds their prior issues. Conversely, healthy patients with no prior ankle problems have the best chance at full recovery.

Long-Term Outcomes and Prognosis

In general, the **long-term prognosis** after a well-managed bimalleolar ankle fracture is positive, but not without potential issues. Many patients remain asymptomatic or only mildly symptomatic for years. However, **post-traumatic osteoarthritis (PTOA)** is a concern in the long run. Even with anatomical reduction, the cartilage has experienced a trauma and some die-back of chondrocytes can occur. The Cochrane review (Donken et al., 2022) noted that at 3.5 to 7 years post-injury, around **50–70% of patients show radiographic signs of ankle arthritis** on follow-up X-rays (this includes even mild joint space narrowing). Interestingly, in that review, the incidence of radiographic arthritis was similar between initially operative and nonoperative groups – likely because a well-reduced fracture and a well-healed conservative fracture both still suffered the initial injury impact. The presence of arthritis on X-ray does not always correlate with poor function; many patients with mild arthritic changes remain clinically well (as seen by high functional scores at 3+ years in studies like Dwivedi 2020). But in some patients, particularly if the reduction was imperfect or if they had a significant cartilage shear (for example, a large posterior malleolar fragment that wasn't fixed in older protocols), **arthritis can progress to cause pain, stiffness, and reduced function**. Late outcomes studies (e.g., 10–20 years post-fracture) have found that a subset of patients eventually require ankle arthrodesis (fusion) or arthroplasty due to painful arthritis. The percentage is not high in modern series, but it is a reminder that **a bimalleolar fracture is not a benign injury** – it is an articular injury that can have lasting implications.

Patient-reported outcomes many years later often reflect this: while early outcomes are excellent for most, some decline in function can occur over a decade due to gradual arthritic changes. A study by Verhage et al. (2016) on longer-term results noted that patients with anatomical reduction and no complications largely maintained good function at 5–10 years, whereas those with any residual incongruity or early post-op complications were more likely to report functional limitations later.

Despite these caveats, it's important to emphasize that **the majority of patients with bimalleolar fractures regain a high level of function**. They can walk normally, often run, and engage in low-impact sports. Many return to physically demanding jobs. For example, in one series, over 90% of patients were able to return to their pre-injury employment and recreational activities after a year of recovery (Mingo-Robinet et al., 2011). Pain levels tend to be low (in one review, median pain scores on a visual analog scale were 1–2 out of 10 at one year post-ORIF). Thus, while some stiffness or aching in cold weather might be reported by patients, severe functional impairment is uncommon after proper treatment.

In summary, long-term outcome largely hinges on whether the joint was restored and whether complications (like infection or arthritis) intervened. With current surgical techniques and good rehabilitation, **the prognosis for functional recovery after a bimalleolar ankle fracture is excellent for most individuals**. Patients should be counseled to maintain good muscle strength around the ankle, possibly avoid excessive high-impact activity if there were any articular cartilage concerns, and to have periodic follow-ups if they develop pain, as early management of arthritis (e.g., physical therapy, orthotics) can help.

CONCLUSION

Bimalleolar ankle fractures are significant injuries that have the potential to greatly affect a patient's mobility and quality of life. The management of these fractures has evolved to favor surgical intervention in the majority of cases, given that **anatomic restoration of the joint is key to optimal functional outcomes**. Our review of the literature indicates that ORIF of bimalleolar fractures yields high rates of good to excellent functional results, allowing most patients to resume their daily activities with minimal limitations. In contrast, while conservative treatment can occasionally be successful in carefully selected cases (e.g. truly non-displaced fractures or patients with low functional demands), it carries a higher risk of malalignment and complications like nonunion, which can compromise function.

A comparison of different treatment methods shows that **no single surgical technique fits all** – the fixation method should be tailored to the fracture pattern. Contemporary techniques (such as fibular nailing or anatomic posterolateral fixation of the posterior fragment) are promising adjuncts that can reduce complications and potentially improve outcomes. However, what remains consistent across all methods is the principle of achieving and maintaining **stable fixation**

and perfect alignment. Surgeons should pay meticulous attention to reducing the medial malleolus, lateral malleolus, and any posterior fragment, as well as securing the syndesmosis when needed.

Functional outcome is influenced by patient and injury factors, but even in less-than-ideal scenarios, patients benefit from the improvements in surgical care and rehabilitation protocols. The expectation of treatment today is that a patient with a bimalleolar ankle fracture, after appropriate management, can regain near-normal function of the ankle. **Humanized care**, including patient education, physical therapy, and gradual return to activity, further enhances outcomes by addressing not just the bone healing but the recovery of strength and proprioception.

Long-term follow-up suggests that some patients may develop post-traumatic arthritis, underscoring the importance of the initial treatment quality. Continued research and longerterm studies are needed to fully understand how to prevent or mitigate late osteoarthritis after ankle fractures. In addition, future studies should explore optimal rehabilitation strategies (for instance, the ideal timing for weight-bearing and exercise) to maximize functional recovery.

In conclusion, the **functional prognosis for bimalleolar ankle fractures is generally very good** when managed with timely surgery and proper aftercare. Both patients and clinicians should be aware that the **best outcomes** are achieved through a combination of surgical excellence (achieving anatomical reduction), attentive postoperative management (protecting soft tissues, preventing infection), and dedicated rehabilitation. By comparing and refining different treatment methods, the orthopedic community continues to improve the care for these common injuries, aiming for every patient to regain a pain-free, stable ankle joint and a return to their desired activities.

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