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Review Article

Ankle Arthritis: Which to Choose – Arthrodesis or Arthroplasty

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Abstract

The best treatment option in ankle arthritis have always been debated. It is either ankle arthroplasty or arthrodesis. The incidence of ankle arthritishas increased over the recent decades due to the increasing life span of the population and incidence of injuries sustained during sporting events. Although arthrodesis is still largely regarded as the gold standard for it is a safe procedure but in long term, several studies have reported complications such as arthritis in adjacent joints, hip dysfunction and knee problems. Currently results have shown that ankle arthroplasty offers a better long term results than arthrodesis especially in view of patient's satisfaction and its good functional outcome. This review article aims to analyse both options and their respective outcomes.

Keywords: Ankle, arthroplasty, arthrodesis, complications, options

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Introduction

Ankle arthritis is generally a debilitating condition that can cause limitation of movement that leads to poor quality of life (1,2). It is a challenging task in managing due to the complex interplay of the joints surrounding the ankle. When talking about ankle arthritis, there always question which option is better; sacrifice or salvage the joints. Ankle arthritis has an increased incidence over the past few decades due to more injuries during sport event and increased life span of the population. Approximately 1% of the adult population is affected by ankle arthritis (1,2).

Based on clinical experience and published clinical reports, occurrence of primary ankle problem is rare comparing to posttraumatic arthritis which is due to long standing ankle sprain or ligamentous injury and after alleged ankle fractures (2,3). Only about 50% of all patients had a normal alignment (4).

The treatment of this condition, whether arthrodesis or arthroplasty, is often complicated with superficial skin infection or soft tissue scarring due to it thin soft tissue envelope, malalignment, stiffness or development of surrounding joint arthritis.

Ankle Arthrodesis

It has been advocated that arthrodesis has been the treatment of choice for ankle arthritis due to its favourable outcome during short-term and mid-term follow-up in providing good functional outcome and reduction of pain. In several long-term studies however, have established that there was deterioration in patient's functional outcome and have associated with development of adjacent joint arthritis later on (4,5).

Ankle arthrodesis is also known as tibiotalar fusion. It is done commonly due to pain or joint inflammation that is localized to the ankle. It is fixed in a plantigrade position, about 0-5 degree of external rotation or valgus. As the movement of the ankle is reduced, there are possibilities that the neighbouring structures will have increase in load that eventually will cause early degeneration and secondary arthritis.

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Figure 1: Examples of different types of fixation in ankle

Gait analysis of patients who underwent ankle arthrodesis showed that shorter duration of single limb stance, limited knee flexion before heel strike, shorter interval between heel and toe off with an elevation centre of gravity upon stance (5).

Multiple techniques were developed to arthrodesis or fuse the ankle, including screw fixation, intramedullary nailing, external fixation and plate fixation. These techniques can be either done by open technique, semi-open or arthroscopic. These varieties aimed to improve the rate of fusion in primary procedure. In open technique using transfibular approach with screw fixation, Monroe et al. had achieved 93% of primary fusion (6). In arthroscopic assisted surgery, Glick et al. reported successful union in 97% of cases (7). Figure 1 shows the examples of types of fixation in ankle arthrodesis.

Although few of the techniques describe achieved high union rate, based on long term outcome in quality of life (QOL) 20 years after arthrodesis of the ankle by Fuchs et al. it was noted that after 25 years post arthrodesis, 95% of the patients develop hindfoot arthritis which is subtalar and talonavicular joint arthritis (8). In terms of quality of life based on SF-36 questionnaire, it was reported reduction in QOL comparing to the normal population. Patients also reported an increase in pain, physical and emotional stress (8).

In a another study by Coester et al. found that at 22 years after arthrodesis, there was almost 100% occurrence of OA in subtalar joint and 80% at the tarsal joints, 60% of patients had hip dysfunction and less than 25% patients reported experiencing knee problems (4). Waters et al. concluded that there was compromise of active daily living after ankle arthrodesis such difficulty in climbing stairs, standing up from sitting position, hiking and also driving a car. They also noted that oxygen comsumption increased of 10%, reduction of gait efficiency of 10% (9).

Based several other reports, in the long term, about 70% to 90% of patients developed hindfoot arhritis following ankle arthrodesis (10). It is even more significant in the younger generation as the onset is within 20-25 years post fusion.

Ankle Arthrodesis is still considered as the gold standard of treatment as it is a safe procedure with reliable technique. However, nevertheless it poses multiple limitations and endangers patients' quality of life in the long term.

Ankle Arthroplasty

Since the early 1970s, total ankle arthroplasty (TAR) have been an alternative to ankle arthrodesis in the treatment of late stage ankle OA.

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Early results were unsatisfactory and disappointing with unfavourable outcome. This was due to the difficulty in understanding the ankle joint's biomechanical nature. Ankle arthroplasty have taken a longer period to be establish as a treatment option due to several factors such higher resultant moment, compressive force, risk of malalignment, soft tissue contractures and due to the early onset of ankle OA, in patients of much younger generation comparing to hip of knee OA, have made surgeons preferring ankle arthrodesis as these group of patients can adapt better post arthrodesis.

The design of the total ankle implant can be classified into six main factors such as:

1. Fixation type (cemented or non-cemented)
2. Constraint Type (constrained or non-constrained)
3. Number of component (two or three)
4. Congruenity (congruent or incongruent)
5. Shape of Component (anatomic or non-anatomic)
6. Type of Bearing (mobile or fixed)

Most of the first generation design of implant has higher risk of revision with high failure rates due to usage of cements in the implant of which it will become loose leading to high risk of periprosthetic fractures (11). The development of second generation looks more promising and currently now we are already in third generation. They have improvised by using a three component implant, less constrained, non-cemented with porous coated that allow interdigitating at the bone-implant interface. This will enhance the fixation and the fixation will depend more on osteointegration rather than cementation (12).

Total ankle replacement is also suitable for patients with bilateral ankle osteoarthritis as bilateral ankle fusion poses significant adverse effects on patients' gait and functional status. The main advantage of TAR comparing to ankle arthrodesis is the preservation of functional range of motion leading to improvements in active daily living and conceivably attaining athletic activities. The functional range of motion is sacrificed in ankle fusion. The ideal candidate for total ankle replacement are middle- to old-aged patients, reasonably ambulatory with no serious medical conditions, normal or lower body mass index, sufficient bone stock, well-aligned and stable hindfoot, fair soft tissue condition and no neurovascular problems of the lower extremity.

The relative contraindications for total ankle replacement are diffuse osteonecrosis, previous history and smoking. This also includes patients whom work heavy labour and those who are active in medium impact of sports activities such jogging, running and hiking. Preoperative findings of valgus and varus deformity of more than 10°, history of long-term steroids or immunosuppressive substances therapy, osteopenia were noted as contraindications for total ankle replacement as they may compromised osteointegration of prosthesis components.

Survivorship analysis following TAR based on several types of prosthesis has showed promising results over recent years. Barg et al. in 2013, using the HINTEGRA prosthesis reported 94.2% after 5 years and 84.5% after 12 years (2). Rippstein et al. reported 97.7% after 4 years in TAR using the Mobility prosthesis (13). Bonnin et al. noted 65.2% after 10 years in TAR using the Salto Prosthesis (14). Furthermore, Courville et al. concluded in a cost-effective analysis of a hypothetical 60 year old cohort that TAR remained cost effective alternative to ankle arthrodesis despite newer costly implants and longer follow-up (15).

The HINTEGRA implant is a three component system and unconstrained that provides inversion-eversion stability (16). For additional stability, the implant may be fixated with two screws. The talar, mimicking the normal anatomy of talus, is designed in a conically shaped and has 2.5-mm high rims on each side that stabilizes positioning and guides the anteroposterior translation of the mobile bearing. The anterior shield of the component helps prevent the adherence of tissue, increases primary bone support and avert limitations of range of motion in cases with arthrofibrosis. Figure 2 shows implant in place, intraoperatively.

Total ankle replacement is progressively obtaining acceptance an option for managing patients with late stage ankle osteoarthritis. Current literature review of

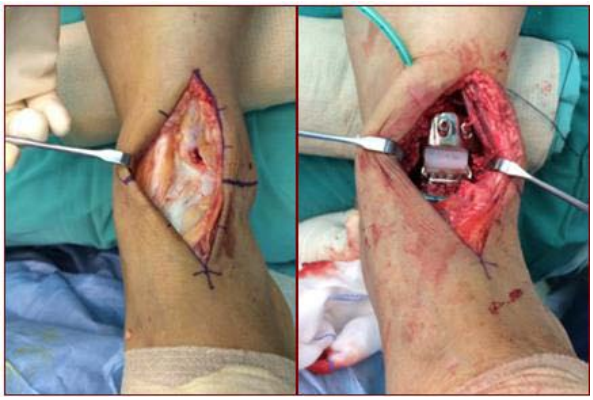

Figure 2: Intra operative pictures showing implants in place

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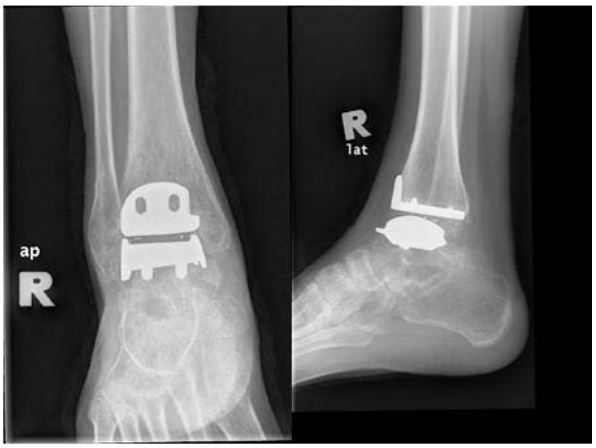

Figure 3: Post-operative x-ray showing implant in situ

such procedure showed persistently good to excellent mid-term outcomes such as pain relief and satisfying functional outcomes (17,18). Aggressive bone resection may remarkably restrict the revision surgery in case of total ankle replacement failure, especially on the talar side. Therefore, preservation of bone stock continues to be the main principles of total ankle replacement. Figure 3 shows post-operative radiograph showing implant in situ with good bone stock.

In conclusion, ankle arthrodesis may be the gold standard of management for unilateral ankle osteoarthritis, but in bilateral ankle osteoarthritis poses detrimental effect to gait and function. Total ankle replacement with improvement in its implant, equipment and techniques, shows that the ankle arthrodesis is no longer the "gold standard" treatment for severe late stage ankle osteoarthritis. It is the step forward with reliable results in ensuring better quality of life for patients. A well functioning arthroplasty is better than a well functioning arthrodesis. If still in doubt, arthrodesis is the option.

References

1. Takakura Y, Tanaka Y, Kumai T, Sugimoto K, Ohgushi H. Ankle arthroplasty using three generations of metal and ceramic prostheses. Clin Orthop Relat Res 2004; (424): 130-6.

2. Barg A, Zwicky L, Knupp M, Henninger M, Hintermann B. HINTEGRA Total Ankle Replacement: Survivorship Analysis in 684 Patients. J Bone Joint Surg Am 2013; 95(13): 1175-83.

3. Nihal A, Gellman RE, Embil JM, Trepman E. Ankle arthrodesis. Foot Ankle Surg 2008; 14(1): 1-10.

4. Coester LM, Saltzman CL, Leupold J, Pontarelli W. Long-term results following ankle arthrodesis for post-traumatic arthritis. J Bone Joint Surg Am 2001; 83-A(2): 219-28.

5. Thomas R, Daniels T, Parker K. Gait analysis and functional outcomes following ankle arthrodesis for isolated ankle arthritis. J Bone Joint Surg Am 2006; 88(3): 526-35.

6. Monroe M, Beals T., Manoli A. Clinical outcome of arthrodesis of the ankle using rigid internal fixation with cancellous screws. Foot Ankle Int 1999; 20(4): 227-31.

7. Glick JM, Morgan CD, Myerson MS, Sampson TG, Mann JA. Ankle arthrodesis using an arthroscopic method: Long-term follow-up of 34 cases. Arthroscopy 1996; 12(4): 428-34.

8. Fuchs S, Sandmann C, Skwara A, Chylarecki C. Quality of life 20 years after arthrodesis of the ankle. J Bone Joint Surg Br 2003; 85(7): 994-8.
9. Waters RL, Barnes G, Husserl T, Silver L, Liss R. Comparable energy expenditure after arthrodesis of the hip and ankle. J Bone Joint Surg Am 1988; 70(7): 1032-7.

10. Haddad SL, Coetzee JC, Estok R, Fahrbach K, Banel D, Nalysnyk L. Intermediate and long-term outcomes of total ankle arthroplasty and ankle arthrodesis. A systematic review of the literature. J Bone Joint Surg Am 2007; 89(9): 1899-905.

11. Kitaoka HB, Patzer GL. Clinical results of the Mayo total ankle arthroplasty. J Bone Joint Surg Am 1996; 78(11): 1658-64.

12. Younger A, Penner M, Wing K. Mobile-bearing total ankle arthroplasty. Foot Ankle Clin 2008; 13(3): 495–508.

13. Rippstein PF, Huber M, Coetzee JC, Naal FD. Total ankle replacement with use of a new three-component implant. J Bone Joint Surg Am 2011; 93(15): 1426-35.

14. Bonnin M, Gaudot F, Laurent JR, Ellis S, Colombier JA, Judet T. The Salto total ankle arthroplasty: survivorship and analysis of failures at 7 to 11 years. Clin Orthop Relat Res 2010; 469(1): 225-36.

15. Courville XF, Hecht PJ, Tosteson AN. Is total ankle arthroplasty a cost-effective alternative to

https://doi.org/10.17576/JSA.2017.0701.02

ankle fusion? Clin Orthop Relat Res 2011; 469(6): 1721-7.

16. Hintermann B. Total Ankle Arthroplasty. Historical Overview, Current Concepts and Future Perspectives. Vienna (Austria): Springer-Verlag, 2005;pp-25-6.

17. Hintermann B, Knupp M, Zwicky L, Barg A. Total ankle replacement for treatment of end-stage osteoarthritis in elderly patients. J Aging Res 2012; 2012: 345237.

18. Lee KB, Cho SG, Jung ST, Kim MS. Total ankle arthroplasty following revascularization of avascular necrosis of the talar body: two case reports and literature review. Foot Ankle Int 2008; 29(8); 852–8.