

Research Article

Ankle and Subtalar Arthrodesis with Retrograde Intramedullary Nail in Patients with Rheumatoid Arthritis

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Abstract

Background: Foot and ankle afflictions are common in patients with Rheumatoid Arthritis (RA) causing severe pain and disability. Operative intervention is considered when medical and orthotic management fails to improve symptoms, function and quality of life.

Objectives: We studied the efficacy of retrograde Intramedullary (IM) nail ankle and subtalar joint arthrodesis in a prospectively evaluated sub-cohort of 23 patients with RA and underlying symptomatic ankle and sub-talar arthritis in 34 operated feet with mean age 57 years and average follow-up of 13 months.

Results: All arthrodesis healed clinically and radiographically and no complications occurred. Walking pain and walking distance were improved. The SF-12 and the Manchester-Oxford Foot Questionnaire (MOXFQ) scores showed significant improvement. The majority of benefit occurred between 4-12 months operatively.

Conclusion: Ankle and subtalar arthrodesis with IM nail is a safe procedure with high healing rate, offering an improved quality of life in RA patients. Patients need to be counselled in relation to the long recovery and rehabilitation period. The functional benefit after ankle and subtalar fusion in patients with RA is comparable to the benefit after total knee and total hip replacement at 1 year follow-up.

Keywords: Rheumatoid arthritis; Intramedullary nail; Ankle arthrodesis

Introduction

Rheumatoid Arthritis (RA) affects the foot in 80% to 90% of patients [1]. Subtalar joint involvement in rheumatoid arthritis is relatively common and affects 29% to 42% of the patients [2,3]. Ankle joint involvement is less common [4,5] but leads to joint destruction in later stages [6].

The tibiotalar and subtalar joints contribute in normal foot function and stability during walking and standing [7]. In patients with RA, when both joints are affected the main problems are pain and progressive plano-valgus deformity which can lead to severe functional limitations [8]. Although the initial management is conservative with foot orthoses [9,10], in progressive cases it is not possible to control the symptoms with footwear and orthotics [11]. In advanced stages of rheumatoid arthritis surgical joint fusion (arthrodesis) is the treatment of choice [12,13]. Ankle replacement can be considered with adjuvant subtalar fusion in selected cases if no major deformity correction is required.

Arthrodesis of subtalar and ankle joints offers stability and deformity correction in order to maintain pain free ambulation and improve function [14].

Intramedullary (IM) nails have been used to fuse ankle and

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subtalar used and evaluated in patients with rheumatoid arthritis [19-22].

The aim of this prospective study is to evaluate the management of subtalar and ankle joint arthritis in RA patients with retrograde IM nail.

Material and Methods

34 Ankle and subtalar joint arthrodesis procedures performed in 23 patients, 21 women and 2 men, with rheumatoid arthritis with 34 treated feet were included in this retrospective study. The diagnosis was confirmed according to the criteria of Arnett et al. [23].

11 patients (all women) were operated bilaterally. The mean age at surgery was 57 years (range 36-76 years). The indication for surgery was severe ankle and subtalar joint destruction with concomitant planovalgus deformity which could not be managed with shoes or assistive devices.

The chosen intramedullary nailing systems were the OxBridge™ Ankle Fusion Nail (12 patients, 6/12 bilaterally) and the Phoenix™ Ankle Arthrodesis Nail System (10 patients, 5/10 bilaterally).

DMARD medication was withheld 1 week prior to surgery and restarted 1 week postoperatively to minimize the risk for Operative technique/postoperative management Patient is positioned supine on the operating table with sandbag under the buttock. The procedures were carried out under spinal anaesthetic with 1.5 g i.e., Cefuroxime as antibiotic prophylaxis. Contralateral foot-pumps were used for mechanical VTE prophylaxis A lateral transfibular approach was used to access both ankle and subtalar joint with an additional incision at the sole of heel for the insertion of the retrograde nail. The bony surfaces of the ankle and subtalar joint were prepared using a high-speed burr and morcelized autogenous bone graft was used from the harvested distal fibular. Under image intensifier (II) guidance one 2.5 mm × 320 mm entry guide wires was inserted retrograde through calcaneum, body of talus into the tibia. A further 2.5 mm

× 320 mm K-wire was inserted retrograde to maintain the rotational and neutral alignment of the ankle and hindfoot. Sequential reaming was performed and the adequate nail size was inserted and checked under II. One calaneal, one talar and two proximal locking screws were inserted in tibia to ensure rotational stability. Two further 20 mm × 20 mm memory stables were used to enhance ankle and subtalar fusion site stability (Figure 1. Reference to the radiographs I emailed). Wounds were closed and the sterile dressing and a non-weight bearing case were left intact for 2,5 weeks until review in the clinic with removal of sutures and re-application of cast. Non-weight bearing was instructed for 4 weeks followed by 4 weeks partial heel weight bearing. Chemical VTE prophylaxis with self-injection of LMWH for 4 weeks. The cast was removed at 8 weeks and replaced with a moon-boot walker for a further 2-4 weeks until normal foot wear was tolerated. Further clinically and radiographic follow-up was then at 6 and 12 months post-operatively. Further the longest follow-up was 34 months. The evaluation included clinical and radiological examination (Figure 1). Structured questionnaires were completed at three points: 1) pre-operative clinic, 2) six month review clinic and 12 month review clinic, 3) pain severity was graded on a scale from 1 to 10. The walking distance was classified from 1 to 5 (1=unable to walk, 5=unlimited distance). Patient satisfaction was ranked from 1 to 5 (1=Excellent, 5=poor). Postoperative need of shoe modification or orthotics was also recorded.

Improvement in Quality of life was assessed with the SF-12 scoring system [24]. It is a multipurpose short form survey with 12 questions comprising Physical and Mental Health Composite Scores (PCS & MCS). Functional outcome was evaluated with Manchester-Oxford Foot Questionnaire (MOXFQ) [25].

Results were considered to be significant at $P < 0.05$.

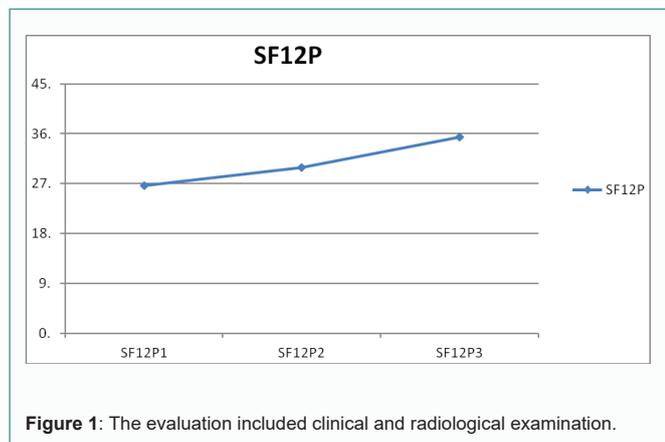


Figure 1: The evaluation included clinical and radiological examination.

Results

There were no complications noticed intra- and postoperatively. All wounds healed without complications. Bony union was achieved in all patients. The patients with bilateral arthrodesis did not present any compound complications or difficulties in rehabilitation as the procedures were carried out in a staged manner.

There was a significant reduction in mean pain scores from 6.7 in pre-operative period to 3.6 and 1.8 at 6 months and 12 months respectively. Only seven patients needed pain medication up to six months post-operatively (Figure 2) (Table 1).

Quality of life parameters also improved as indicated by SF12 survey scores.

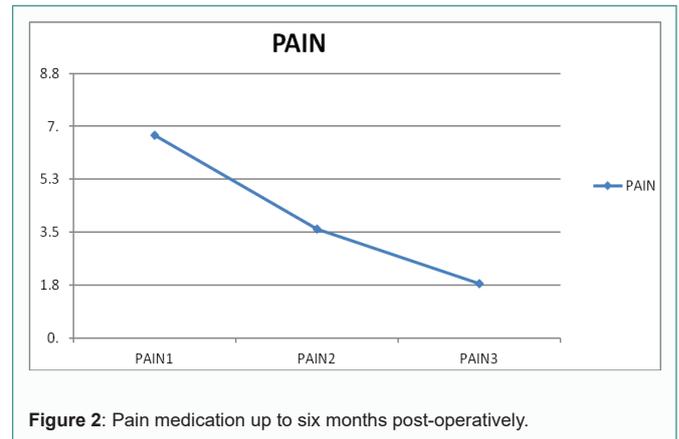


Figure 2: Pain medication up to six months post-operatively.

Table 1: Quality of life parameters also improved as indicated by SF12 survey scores.

	Mean ± SD	P-value
SF12P1	26.7 ± 6.9	
SF12P2	29.9 ± 9.5	0.02 (P1-P2)
SF12P3	35.4 ± 10.6	0.0006 (P1-P3)
SF12M1	47.7 ± 10.3	
SF12M2	51.1 ± 7.3	0.02 (M1-M2)
SF12M3	49.8 ± 11.6	0.22 (M1-M3)
Pain 1	6.7 ± 1.4	
Pain 2	3.6 ± 1.7	0.0000 (1-2)
Pain 3	1.8 ± 0.7	0.0000 (1-3)
MOXFQ1	64.8 ± 11.9	
MOXFQ2	45.3 ± 10.7	0.0000 (1-2)
MOXFQ3	35.2 ± 9.3	0.0000 (1-3)
Walk distance 1	2.6 ± 0.9	
Walk distance 2	3.46 ± 1.1	0.001(1-2)
Walk distance 3	3.75 ± 1.1	0.003(1-3)

The physical component of SF12 was significantly improved at 12 Months from 29.9 to 35.4, whereas the mental component showed an improvement only at six months beyond which it plateaued (Figure1) (Table 1).

The Manchester-Oxford Foot Questionnaire (MOXFQ) showed a significant improvement postoperatively with steady improvement at six months (64.8 to 45.3) and 12 months assessment (45.3 to 35.2) (Figure3) (Table 1).

Six patients required shoe modifications immediately and two patients needed orthotics postoperatively.

The walking distance was improved and walking pain also reduced significantly at 1 year after the surgery (Table 1). The walking distance

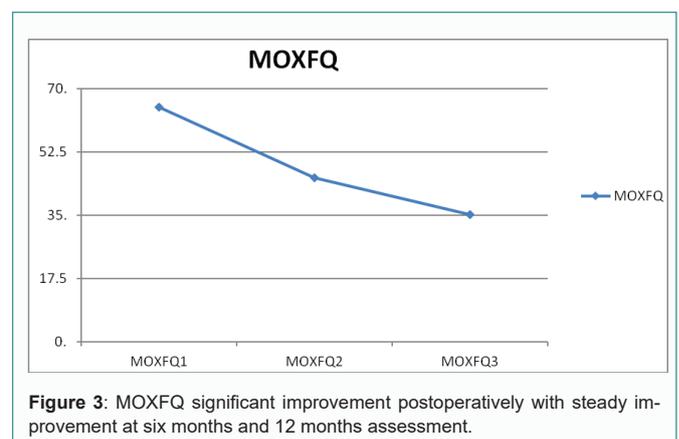


Figure 3: MOXFQ significant improvement postoperatively with steady improvement at six months and 12 months assessment.

improved in all patients from a mean score of 2.6 to a mean score of 3.8 at 12 months ($p < 0.05$). Prior to the procedure 2 patients could not walk, 51% of patients walked less than 100 yards, 15% walked 100 yards to half a mile and 21% could walk between half and one mile. At 12 months after procedure, only 20% walked less than 100 yards, 20% walked less than half mile, 20% walked between half to one mile and 37.5% of respondents claimed to be able to walk unlimited distance for the first time for many years.

At one year, 60% of respondents were very satisfied and 20% were satisfied with the operated foot. 64% of respondents felt that surgery met their expectations excellently and 44% felt the expectations were met well or very well. 12% of the respondents would not choose to have the procedure again however 76% of the respondents would definitely have the operation again if required.

Discussion

In rheumatoid arthritis the quality of life can be significantly limited due to pain and foot deformity [38,39]. Arthrodesis of the subtalar and ankle joints has been considered as the gold standard for management in RA patients with severe articular involvement of both ankle and subtalar joint with associated significant hindfoot deformity. The procedure has confirmed to be efficient in regaining mobility and walking endurance and provides lasting pain relief with a stable functional foot.

Ankle and subtalar arthrodesis in RA can be achieved using various techniques including compression screws [26,27], plates [28], arthroscopic assisted fusion [29], external fixation [11], use of fibular strut [30] and intramedullary nails [14,18,19,21,31]. Total ankle arthroplasty has limited indications concerning foot deformity, patient's age, talar necrosis etc [21].

In RA patients the choice of the surgical method should take into consideration important several specific issues such as skin and soft tissue condition [32], medication [33] and bone quality [34]. The skin and the underlying vessels, especially with prolonged chronic corticosteroid use, are often thin and cannot tolerate tension and extensive incisions. Wound healing is often compromised in these patients due to above factors. Osteoporosis with poor bone quality is a common problem in RA due to the underlying condition, medication and limited ambulation and is often associated with delayed union and failure of fixation [35].

The retrograde IM nailing has several advantages in subtalar and ankle joint arthrodesis such as lesser risk of soft tissue problems and increased stability of fixation [36].

The IM nail allows relatively early weight bearing and prevents the bones from immobilisation induced osteopenia [22]. In our study all patients started weight bearing in the fifth postoperative week.

The IM nail addresses the ankle as well as the subtalar arthritis simultaneously which if not already existed, might be sequelae of the isolated ankle arthrodesis.

Takenouchi et al. [19] reported 27 RA patients (30 ankle arthrodesis) with retrograde intramedullary nail with fins. The average follow-up was 10 years. They observed neither non-union nor complications. Nagashima et al. [20] reported about 25 ankle arthrodesis in RA patients using IM nail with positive results in 7 year follow-up.

Fujimori et al. [21] also showed good results in 35 months follow-up in 15 RA patients. Moore et al. [37] reported IM nails in 7 RA patients with positive results.

Anderson et al. [22] reported about 25 ankle arthrodesis in 25 RA patients with retrograde nail with a mean follow-up of 3 years. The complications concerned non-union 1/25 ankles, wound healing 2/25 ankles, deep infection 2/25 feet, remaining sensory loss in dorsal and plantar aspect of the foot in 7/25 cases.

In our series all arthrodesis healed without any complications concerning the soft tissue. We noticed a significant reduction in walking pain which is a result of the successful bone healing and stable foot. The walking distance also improved significantly and this has a positive effect in both physical and mental health.

Anderson et al. [22] used the Mazur and AOFAS hind-foot ankle scoring systems and the Makwana satisfaction scale. They concluded that these scores are not optimal instruments for the evaluation of clinical results in rheumatoid arthritis. They suggested that the assessment of physical and mental health in RA patients should include validated means.

In our study the SF12P was significantly improved six months with continued substantial improvement at 12 months after surgery. The two scales of the SF12MP provide glimpses into mental and physical functioning and overall health-related-quality of life. While the physical component scores continued to improve for 12 months, the mental component scores showed significant improvement only at six month followup. This indicated the extent of significant impact ankle and subtalar joint pain has on the mental wellbeing of the patients and how the arthrodesis procedure improves their mental wellbeing.

We also used the Manchester-Oxford Foot Questionnaire (MOXFQ) is a patient-reported outcome measure for evaluating outcomes of foot or ankle surgery and comprises three subscales: pain, walking/standing and social interaction. Both scoring systems are validated; they are complimentary to each other and provide a detailed insight to the surgical outcome. The MOXFQ demonstrated a significant and steady improvement in patients' symptoms and quality of life at both six months and one year follow up.

The result of our study are will within the published outcome studies published on this topic, but in our opinion the results of our prospective monitoring provide additional useful information for patient guidance as it is important to advise patients about the protracted recovery period and the importance of ongoing improvement in the latter half of the first post-operative year.

Conclusion

The use of retrograde IM nail in RA patients with severe ankle and subtalar arthrosis is a safe and successful method which provides good stability, less pain and high patient satisfaction with high bone union rates. Patients need to be counselled in relation to the long recovery and rehabilitation period. The functional benefit after ankle and subtalar fusion in patients with RA is comparable to the benefit after total knee and total hip replacement at 1 year follow-up.

References

1. Grondal L, Tengstrand B, Nordmark B, Wretenberg P, Stark A. The foot: still the most important reason for walking incapacity in rheumatoid arthritis: distribution of symptomatic joints in 1,000 RA patients. *Acta Orthop.* 2008;79(2):257-61.

2. Seltzer SE, Weissman BN, Braunstein EM, Adams DF, Thomas WH. Computed tomography of the hindfoot with rheumatoid arthritis. *Arthritis Rheum.* 1985;28(11):1234-42.
3. Vidigal E, Jacoby RK, Dixon AS, Ratliff AH, Kirkup J. The foot in chronic rheumatoid arthritis. *Ann Rheum Dis.* 1975;34(4):292-7.
4. Vainio K. The rheumatoid foot; a clinical study with pathological and roentgenological comments. *Ann Chir Gynaecol Fenn Suppl.* 1956;45(1):1-107.
5. Alsuwaidi M, Ehrenstein B, Fleck M, Hartung W. Asymptomatic Versus Symptomatic Ankle Joints in Rheumatoid Arthritis: A High-Resolution B-Mode and Power Doppler Ultrasound Study. *Arthritis Care Res (Hoboken).* 2016;68(6):861-4.
6. Sammarco VJ. Ankle arthrodesis in rheumatoid arthritis: techniques, results, and complications. *Foot Ankle Clin.* 200;12(3):475-95.
7. Andrew Haskell, Roger A Mann. Biomechanics of the Foot and Ankle. In Michael J Coughlin, Roger A. Mann, Charles L Saltzman, editors. *Surgery of the Foot and Ankle.* Netherlands: Elsevier - Health Sciences Division; 2007 .p. 19-28.
8. Dubbeldam R, Baan H, Nene AV, Drossaers-Bakker KW, van de Laar MA, Hermens HJ, et al. Foot and ankle kinematics in rheumatoid arthritis: influence of foot and ankle joint and leg tendon pathologies. *Arthritis Care Res (Hoboken).* 2013;65(4):503-11.
9. Woodburn J, Barker S, Helliwell PS. A randomized controlled trial of foot orthoses in rheumatoid arthritis. *J Rheumatol.* 2002;29(7):1377-83.
10. Williams AE, Rome K, Nester CJ. A clinical trial of specialist footwear for patients with rheumatoid arthritis. *Rheumatology (Oxford).* 2007;46(2):302-7.
11. Felix NA, Kitaoka HB. Ankle arthrodesis in patients with rheumatoid arthritis. *Clin Orthop Relat Res.* 1998;(349):58-64.
12. Thompson FM, Mann RA. Chapter 14: arthritides in: Mann RA, Coughlin MJ (Editors) *Surgery of the foot and ankle.* 6th edition. Mosby, St. Louis (MO); 1993:615-71.
13. Jaakkola JI, Mann RA. A review of rheumatoid arthritis affecting the foot and ankle. *Foot Ankle Int.* 2004;25(12):866-74.
14. Chou LB1, Mann RA, Yaszay B, Graves SC, McPeake WT 3rd, Dreeben SM, et al. Tibiotalocalcaneal arthrodesis. *Foot Ankle Int.* 2000;21(10):804-8.
15. Jehan S, Shakeel M, Bing AJ, Hill SO. The success of tibiotalocalcaneal arthrodesis with intramedullary nailing--a systematic review of the literature. *Acta Orthop Belg.* 2011;77(5):644-51.
16. Franceschi F, Franceschetti E, Torre G, Papalia R, Samuelsson K, Karlsson J, et al. Tibiotalocalcaneal arthrodesis using an intramedullary nail: a systematic review. *Knee Surg Sports Traumatol Arthrosc.* 2016;24(4):1316-25.
17. Thomas RL, Sathe V, Habib SI. The use of intramedullary nails in tibiotalocalcaneal arthrodesis. *J Am Acad Orthop Surg.* 2012;20(1):1-7.
18. Mendicino RW, Catanzariti AR, Saltrick KR, Dombek ME, Tullis BL, Statler TK, et al. Tibiotalocalcaneal arthrodesis with retrograde intramedullary nailing. *J Foot Ankle Surg.* 2004;43(2):82-6.
19. Takenouchi K, Morishita M, Saitoh K, Wauke K, Takahashi H, Nagashima M. Long-term results of ankle arthrodesis using an intramedullary nail with fins in patients with rheumatoid arthritis hindfoot deformity. *J Nippon Med Sch.* 2009;76(5):240-6.
20. Nagashima M, Tachihara A, Matsuzaki T, Takenouchi K, Fujimori J, Yoshino S. Follow-up study of ankle arthrodesis in severe hind foot deformity in patients with rheumatoid arthritis using an intramedullary nail with fins. *Mod Rheumatol.* 2005;15(4):269-74.
21. Fujimori J, Yoshino S, Koiwa M, Nakamura H, Shiga H, Nagashima S. Ankle arthrodesis in rheumatoid arthritis using an intramedullary nail with fins. *Foot Ankle Int.* 1999;20(8):485-90.
22. Anderson T, Linder L, Rydholm U, Montgomery F, Besjakov J, Carlsson A. Tibiotalocalcaneal arthrodesis as a primary procedure using a retrograde intramedullary nail: a retrospective study of 26 patients with rheumatoid arthritis. *Acta Orthop.* 2005;76(4):580-7.
23. Arnett FC. Revised criteria for the classification of rheumatoid arthritis. *Bull Rheum Dis.* 1989;38(5):1-6.
24. Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med Care.* 1996;34(3):220-33.
25. Morley D, Jenkinson C, Doll H, Lavis G, Sharp R, Cooke P, et al. The Manchester-Oxford Foot Questionnaire (MOXFQ): Development and validation of a summary index score. *Bone Joint Res.* 2013;2(4): 66-9.
26. Chen YJ, Huang TJ, Shih HN, Hsu KY, Hsu RW. Ankle arthrodesis with cross screw fixation. Good results in 36/40 cases followed 3-7 years. *Acta Orthop Scand.* 1996;67(5):473-8.
27. Kennedy JG, Hodgkins CW, Brodsky A, Bohne WH. Outcomes after standardized screw fixation technique of ankle arthrodesis. *Clin Orthop Relat Res.* 2006;447:112-8.
28. Zhang C, Shi Z, Mei G. Locking plate versus retrograde intramedullary nail fixation for tibiotalocalcaneal arthrodesis: A retrospective analysis. *Indian J Orthop.* 2015;49(2):227-32.
29. Sekiya H, Horii T, Sugimoto N, Hoshino Y. Arthroscopic tibiotalocalcaneal arthrodesis with intramedullary nail with fins: a case series. *J Foot Ankle Surg.* 2011;50(5):589-92.
30. Maenpaa H, Lehto MU, Belt EA. Why do ankle arthrodeses fail in patients with rheumatic disease? *Foot Ankle Int.* 2001;22(5):403-8.
31. Nagashima M, Tachihara A, Matsuzaki T, Takenouchi K, Fujimori J, Yoshino S. Follow-up study of ankle arthrodesis in severe hind foot deformity in patients with rheumatoid arthritis using an intramedullary nail with fins. *Mod Rheumatol.* 2005;15(4):269-74.
32. McCauliffe DP, Sontheimer RD. Dermatologic manifestations of rheumatic disorders. *Prim Care* 1993;20(4):925-41.
33. Howe CR, Gardner GC, Kadel NJ. Perioperative medication management for the patient with rheumatoid arthritis. *J Am Acad Orthop Surg.* 2006;14(9):544-51.
34. Bogoch ER, Moran EL. Bone abnormalities in the surgical treatment of patients with rheumatoid arthritis. *Clin Orthop Relat Res.* 1999;(366):8-21.
35. Sowa DT, Krackow KA. Ankle fusion: a new technique of internal fixation using a compression blade plate. *Foot Ankle.* 1989;9(5):232-40.
36. Berend ME, Glisson RR, Nunley JA. A biomechanical comparison of intramedullary nail and crossed lag screw fixation for tibiotalocalcaneal arthrodesis. *Foot Ankle Int.* 1997;18(10):639-43.
37. Moore TJ, Prince R, Pochatko D, Smith JW, Fleming S. Retrograde intramedullary nailing for ankle arthrodesis. *Foot Ankle Int.* 1995;16(7):433-6.
38. Stolt M, Suhonen R, Leino-Kilpi H. Foot health in patients with rheumatoid arthritis-a scoping review. *Rheumatol Int.* 2017; 37(9):1413-22.
39. Wickman AM, Pinzur MS, Kadanoff R, Juknelis D. Health-related quality of life for patients with rheumatoid arthritis foot involvement. *Foot Ankle Int.* 2004;25(1):19-26.