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Casting and Splinting Options for Pseudo-Jones Avulsion Fractures: An Evidence-to-Practice Review

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ABSTRACT

Avulsion fractures of the fifth metatarsal bone occur when a portion of the bone is broken or pulled off the rest of the bone. These fractures are often seen in athletes, especially those of a young age. Avulsion fractures of the fifth metatarsal bone are commonly treated non-surgically with immobilization of the foot. There are several different options for immobilization of the foot with no clear result as to which immobilization method is the most effective. The purpose of this evidence-to-practice review was to summarize a systematic review on comparative outcomes of immobilization interventions on avulsion fractures of the fifth metatarsal. The authors included five studies in this review that compared two intervention methods including short leg casting and removable splinting of the foot. The authors reviewed foot function scores and non-union rates of the foot. It was found that both foot function scores and non-union rates of the fifth metatarsal bone were better in the removable splinting intervention group. From the results of this evidence-to-practice review, we recommend the use of a removable splint for avulsion fractures of the fifth metatarsal bone.

Key Phrases

Patient education, healthcare information technology, preceptor training and development

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SUMMARY

CLINICAL PROBLEM AND QUESTION

Fractures of the metatarsals are the most common fractures of the foot. Specifically, fractures of the fifth metatarsal account for approximately 50% of all metatarsal fractures,¹ and a large majority of these occur in young, active individuals.² A Jones fracture is defined as a transverse fracture of the proximal end of the fifth metatarsal bone in the foot,² whereas a pseudo-Jones fracture is an avulsion fracture of the base of the fifth metatarsal.³ A pseudo-Jones fracture is also referred to as a Zone 1 fracture, and occurs when a portion of the bone is pulled off from the remaining bone.² The typical treatment for a fifth metatarsal fracture, including an avulsion fracture, is a non-surgical, conservative approach.⁴ Immobilization of avulsion fractures has been determined to ensure union and proper healing of the bones occurs, which is a common concern with this injury.² For athletes that sustain pseudo-Jones fractures, effective immobilization is essential, as it can dramatically affect return to play. The method of immobilization for an avulsion fracture of the fifth metatarsal has been compared in several different studies,⁵⁻⁷ including use of a short leg cast versus a removable device such as a splint. The effect of each of these methods has been debated with no clear results as to the effectiveness of a short leg cast as compared to a removable support for the patient.⁵⁻⁷ As the best method of non-operative care for a pseudo-Jones fracture is debated, there is a need to review and compare the functional outcomes of treatment between a short leg cast and removable splint for avulsion fractures of the fifth metatarsal.

SUMMARY OF LITERATURE

The authors of the guiding systematic review performed a structured search of Medline and Scopus databases to locate published clinical trials of treatment options for fractures of the fifth metatarsal bone published between database inceptions to October 29, 2016. The authors established 4 criteria for published studies to be included in the guiding systematic review. The criteria included: (1) Patients diagnosed with pseudo-Jones avulsion fractures, (2) studies that utilized a comparison of outcomes between short leg cast and removable splint for treatment, (3) use of foot functional outcome scales or the Visual Analog Scale (VAS) for pain as outcome measures, (4) studies that were written in English.⁸

The database search of Medline and Scopus identified 127 total studies, and 104 studies were reviewed after 17 duplicate studies were removed. A quality assessment was conducted for risk of bias using the Preferred Reporting Items for Systematic Reviews and Meta-analysis guidelines for randomized control trials and the modified Newcastle-Ottawa scale for cohort studies. The search yielded five studies that were included in the guiding systematic review and meta-analysis as they matched all inclusion criteria listed above. The eliminated studies included: 86 that were non-comparative, 13 studies with other interventions and 2 that were non-English. All five included studies utilized a foot functional outcome measure, four studies assessed patients with non-union fractures, two studies were randomized control trials, and three studies were cohort studies. Four of the studies included a follow-up assessment after 12 months, while the fifth study had a follow-up after 24 months.⁸

SUMMARY OF INTERVENTIONS

The guiding systematic review compared the short leg cast and the removable splint as treatment

options for pseudo-Jones fractures. The 5 studies used in the systematic review all used the short leg casting. A short leg cast is defined as a foot cast that immobilizes one joint above and below the fracture.⁸ Additionally, in the guiding systematic review, there were 3 types of removable splints that were discussed. A removable splint, for the purpose of the guiding systematic review, included devices such as an elastic bandage, a Jones' bandage, and a boot splint. Three of the studies used a bandage as their removable splint,^{7,9,10} one study used a boot splint,⁶ and the final study used a Jones' bandage.⁵

SUMMARY OF OUTCOMES

The five studies in the guiding systematic review all used the American Orthopaedic Foot and Ankle Society (AOFAS) score for the ankle-hindfoot and the VAS for foot and ankle pain. Four of these studies also checked for the fracture nonunion. From the 5 studies included in the systematic review, three studies assessed mean function within 1 month of the fracture. The last follow-up to assess mean function was at 12 months in four of the studies and 24 months in the fifth study.

FINDINGS AND CLINICAL IMPLICATIONS

The guiding systematic review utilized the AOFAS and VAS for foot and ankle scores in the 5 studies. The short cast intervention reported lower scores for function compared to the removable splint intervention. By utilizing these patient-rated outcome measures, the authors were able to objectively measure the patients' functions. The lower function scores were observed in the 1 month and the last follow-up visits in the respective studies. **Table 1** illustrates the last follow-up scores and non-union rates for the short leg cast group compared to the removable splint group. All five studies reported mean function scores at the last follow-up with patients, which was 12 months for four of the studies and 24 months for the

Table 1. Comparison of Outcomes of Interest for Intervention of fifth Metatarsal Fracture

Study	AOFAS foot functional score (mean \pm SD)		Nonunion of fifth Metatarsal	
	Short Leg Cast	Removable Splint	Short Leg Cast	Removable Splint
Zenios et al. ⁹	80 \pm 11.6	89.5 \pm 13.6	Yes: 3 No: 22	Yes: 0 No: 25
Gray et al. ⁶	87.5 \pm 5.8	90.5 \pm 5.2	Yes: 0 No: 17	Yes: 1 No: 19
Shahid et al. ⁷	93 \pm 7	96 \pm 7	N/A	N/A
Akimau et al. ¹⁰	93 \pm 19.8	93 \pm 23.7	Yes: 0 No: 24	Yes: 0 No: 36
Wiener et al. ⁵	86 \pm 16	92 \pm 16	Yes: 0 No: 30	Yes: 0 No: 30

remaining study. Once again, it was found that the foot function scores were lower for the short leg casting intervention group. Four of the studies reported non-union rates of the fifth metatarsal bone and found that there was a lower risk for fracture non-union with the splinting intervention group. Between better foot function scores and a lower risk of fracture non-union rates, the removable splint is the better intervention.

There are other studies that have explored the outcomes from other interventions such as a controlled motion ankle boot, a hard-sole shoe, and a foot cast. For the foot cast, the methods were to immobilize above (tarsometatarsal joint) and below (metatarsophalangeal joint) the fifth metatarsal. The investigation of the foot cast and the short leg cast also utilized the AOFAS and the VAS for pain, where they took the patients' responses at 6-weeks and 8-weeks. The authors were able to determine with both the AOFAS and the VAS scales that there were no significant differences in pain level.¹¹ A different study that explored the controlled ankle motion (CAM) boot, and the hard-sole shoe for non-casting options of treatment for a Zone 1 avulsion fracture of the proximal fifth metatarsal also utilized the VAS for pain, AOFAS score, and return to activity timeline to investigate patients' clinical outcomes. The study found that at 8 weeks, both the hard-sole shoe and the CAM boot had the

same score output for both the VAS for pain and the AOFAS. Similarly, there was no significant difference between the two groups for the VAS for pain and the AOFAS at 12 weeks. The study also identified that both groups had similar timeframes when participants were returning to their activities and sports.¹² Patients who utilized the removable splint for avulsion fractures of the fifth metatarsal had better function scores and non-union rates and had a faster return to activity, making the removable splint the ideal intervention for this injury.

CLINICAL BOTTOM LINE

Patients that experience avulsion fractures of the fifth metatarsal will want the most effective treatment with the best outcomes. The patients may include athletes, and it is important that the immobilization method allows them to return to activity at the same level prior to injury. Increased foot function and non-union rates are both essential when determining the course of treatment for an avulsion fracture. In the pursuit of providing better care for patients, as clinicians we need to know and explore what options are available. In the literature that we have reviewed and provided, there are several non-surgical treatment options for immobilization of the foot and ankle for patients with fractures of the fifth metatarsal. Short leg casting and splinting were two of the most common methods of immobilization for pseudo-Jones fractures. Foot

function scores and nonunion rates both had better results with a removable splint as an intervention. Ultimately, the patient should be included in the shared decision making relevant to their care plan and make an informed choice based off their goals and potential to adhere to the plan. As the healthcare provider, the athletic trainer should use this review to educate the patient on the best option for non-surgical treatment of fifth metatarsal avulsion fractures. For those fractures that do not require surgery, utilizing a removable splint has better results for overall patient outcome and function, which is ideal for athletes returning to play after an injury.

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