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Prolonged Union in Conservative Treatment of Symphalangeal Toe Fractures: Case Series

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Background: Toe symphalangism is characterized by a fusion of the interphalangeal joint between the middle and distal phalanges. While typical lesser toe fractures heal well with conservative treatment, in our clinical experience, we encountered patients with symphalangeal toe fractures who experienced long-lasting pain and delayed radiographic union. Therefore, this study aimed to report radiographic outcomes following conservative treatment of symphalangeal fractures of the lesser toes.

Methods: We retrospectively reviewed 14 patients with symphalangeal lesser toe fractures who were treated conservatively. We investigated the mechanism of injury and measured the time from the initial injury date to the complete radiographic union. The fracture gap distance was measured on an initial lateral radiograph.

Results: Symphalangeal fractures involved the fourth toe in 4 patients (28.5%) and the fifth toe in 10 patients (71.4%). Regarding the mechanism of injury, 6 patients (42.9%) were injured by stubbing or bumping into the door, 5 patients (35.7%) were injured by tripping, 2 patients (14.3%) were injured by heavy objects falling directly on their toes, and 1 patient (2.3%) complained of pain after wearing pointed shoes for half a day. The mean time to complete union was 9.1 months, and the median period was 5.5 months (range, 0.8–29 months). The initial gap of the fracture was 0.60 mm (range, 0.30–1.04 mm).

Conclusions: The results of our case series may help counsel patients in the outpatient clinic that prolonged healing time may be required for the union of symphalangeal toe fractures.

Keywords: *Toes, Fracture healing, Symphalangism of toes*

Toe symphalangism is a congenital condition characterized by a fusion of the interphalangeal joint between the middle and distal phalanges.[1] It mainly involves the fourth and fifth toes, where the prevalence of this condition may vary according to ethnic groups, from 2.15% to 16% in the fourth toes and 35.5% to 80.6% in the fifth toes.[1-3] Patients are mostly unaware of the presence of symphalangism because most have no symptoms; however, if a fracture occurs in the area, it is often confirmed incidentally on plain radiographs.

Most lesser toe fractures heal well with conservative treatment. A previous study analyzed 339 toe fractures and reported that 95% were displaced < 2 mm and were managed conservatively with satisfactory outcomes.[4] In addition, Eves and Oddy[5] questioned the need for outpatient follow-up for undisplaced and stable toe fractures because no patient subsequently developed symptomatic malunion or required toe surgery during the subsequent 2 years. According to our clinical experience, while typical lesser toe

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fractures achieved complete union, patients with symphalangism experienced long-lasting pain, poor healing, or delayed radiographic union. To the best of our knowledge, only 1 study has reported 2 cases of fracture through symphalangism following blunt trauma.[6]

Although rarely reported, it may take a prolonged period for patients to return to their original activities. Therefore, it is important to review the results of conservative treatments, which may aid clinicians in counseling patients about this condition. This study aimed to report radiographic outcomes following conservative treatment of symphalangeal fractures of the lesser toes.

METHODS

This retrospective case series was approved by the Institutional Review Board of Seoul National University Hospital (No. H-2304-022-1419). The need for informed consent was waived owing to the retrospective design of the study. The study was conducted in accordance with the Declaration of Helsinki.

We retrospectively reviewed the records of 18 patients with symphalangeal toe fractures, who visited our institution between February 2017 and April 2021. The inclusion criteria were as follows: (1) fracture at the site of symphalangism and (2) conservative treatment. The exclusion criteria were as follows: (1) open fractures, (2) loss to follow-up, and (3) surgical treatment. Two patients who were lost to follow-up were excluded. Two patients underwent interphalangeal arthrodesis during the follow-up. Therefore, 14 patients were eligible for the analysis.

The patients were instructed to partially bear weight with their heels while wearing a postoperative shoe brace for a month. If union progressed or pain decreased gradually during the follow-up, the brace was changed to comfortable shoes with wide feet. If the fracture site was unceasingly painful, the patient was instructed to continue wearing braces. Radiographs were taken whenever the patient visited the outpatient clinic to check whether the union was achieved. The patients were informed that when the union was complete, it was no longer necessary to return to the clinic.

Plain anteroposterior and lateral toe radiographs were obtained for each patient. Radiographic measurements were performed by an orthopedic surgeon with 8 years of experience (MGK) using picture archiving and communication system (PACS) software (Infinitt PACS, Infinitt Healthcare Co.). We measured the time from the initial injury date to the complete radiographic union. The complete union was defined as the disappearance of the radiolucent line at the fracture site. The fracture gap distance was measured on an initial lateral radiograph.

All statistical analyses were performed using IBM SPSS ver. 29 (IBM Corp.). A box plot was used to graphically demonstrate the numerical data. Spearman's rank correlation test was used to calculate the correlation coefficient between the initial gap and the time to complete union. The level of significance was set at 5%.

RESULTS

The demographic data of the patients are presented in Table 1. Symphalangeal fractures involved the fourth toe in 4 patients (28.5%) and the fifth toe in 10 patients (71.4%). Regarding the mechanism of injury, 6 patients (42.9%) were injured by stubbing or bumping into the door, 5 patients (35.7%) were injured by tripping, 2 patients (14.3%) were injured by heavy objects falling directly on their toes, and 1 patient (2.3%) complained of pain after wearing pointed shoes for half a day.

All patients achieved complete union at the final follow-up. The mean time to the complete union was 9.1 months, and the median period was 5.5 months (range, 0.8–29 months) (Fig. 1). The initial gap of the fracture was

Table 1. Patients' Demographic Data

Variable	Value
Age (yr)	53 (22–76)
Sex (male : female)	1 : 13
Body mass index (kg/m^2)	22.9 (19.6–27.3)
Side (left : right)	4 : 10

Values are presented as mean (range) or number.

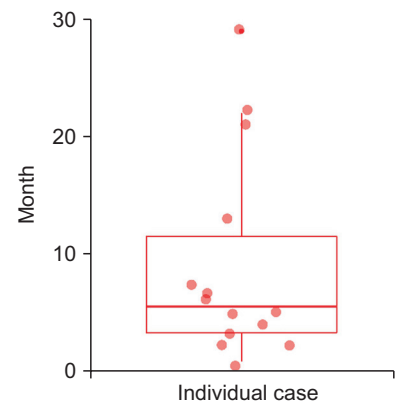

Fig. 1. Box plot demonstrating the time to radiographic union. The large dots indicate individual cases.

Fig. 2. (A) A representative radiograph of the fourth symphalangeal fracture at the initial state. (B) Achievement of the complete union at the final follow-up (13 months from initial injury).

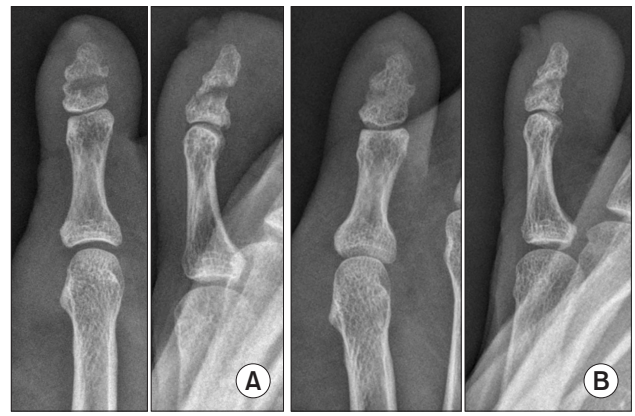

Fig. 3. (A) A representative radiograph of the fifth symphalangeal fracture at the initial state. (B) Achievement of the complete union at the final follow-up (5 months from initial injury).

0.60 mm (range, 0.30–1.04 mm). Spearman's correlation coefficient between the initial gap and time to complete union was 0.007 (p = 0.982). Figs. 2 and 3 demonstrate representative cases of the fourth and fifth symphalangeal fractures, respectively.

DISCUSSION

In this study, we showed various periods to achieve complete union; however, the overall prolonged union was observed with conservative treatment of symphalangeal toe fractures. Owing to its rare prevalence, only 1 case report regarding symphalangeal toe fractures has been published. Sammarco and Hockenbury[6] reported 2 cases of fractures following blunt trauma. One patient achieved healing of the fracture 26 weeks after the initial injury, whereas the other developed delayed healing and revealed nonunion 6 months post-injury. In contrast, our case series showed results of a much larger number of patients, all of whom achieved radiographic union after a prolonged time after injury.

One reason it takes longer to heal a symphalangeal toe fracture than a typical toe fracture may be attributed to reduced vascularity. A previous study reported that consistent shoe-wearing may increase the incidence of biphalangeal fifth toe owing to reduced vasculature and toe disuse.[7] In addition, local vascularity at the fracture site has been regarded as one of the most important factors influencing healing.[8] Although our study did not confirm the blood flow of toes using plethysmography or angiography, we believe that delayed union may have been caused by reduced vascularity, and future studies are needed to confirm this.

The second reason is the low mobility and stiffness of symphalangeal toes. As the interphalangeal joint between the middle and distal phalanges is fused, the toes are stiffened with less mobile segments, and the ability to absorb the energy of trauma is decreased.[6] Furthermore, fused phalanges are usually longer than separate distal or middle phalanges, which results in a longer lever arm,[6] making them susceptible to fracture and delayed bone healing. Thompson and Chang also noted that a stiff 2-boned toe predisposes patients to a clinically significant pathology and increases their risk of trauma.[2]

The initial average gap of the fracture was 0.60 mm, and the correlation coefficient between the initial gap and time to complete union was extremely low. Our findings were contrary to those of a previous study that analyzed 339 toe fractures and reported that 95% were displaced < 2 mm and managed conservatively with satisfactory outcomes.[4] Although we could have considered surgical treatment if the gap was > 2 mm, the gap was too small, and there was a risk of vascular compromise by fixing the lesser toes with Kirschner wire;[9] therefore, we treated them conservatively.

Regarding the causes of the occurrence, these were mostly stubbing or tripping, which can occur commonly in our lives. Therefore, when patients with symphalangeal toes visit the outpatient clinic, our study results may help counsel the patients stating that such fractures may occur in the future by stubbing, tripping, or a heavy object falling on their toes and help explain the reason for delayed bone healing and additional time to return to preinjury activities.

Our study has several limitations. First, owing to the retrospective nature of the study, only a small number of

patients were included. Therefore, other factors leading to the delayed union could not be analyzed in detail. However, as symphalangeal toe fractures are rare, we believe that reporting the results of conservative treatment in our study is meaningful. Second, no control group, such as patients treated by the operative method or patients with typical lesser toe fractures, was included. Future studies may consider these limitations. A prospective randomized study with a large number of patients is needed to further understand the characteristics of symphalangeal toe fracture healing.

In conclusion, the conservative treatment of symphalangeal fractures of the lesser toes demonstrated an overall prolonged period until radiographic union. Clinicians should be aware of these characteristics and counsel patients in the outpatient clinics.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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