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Comparing radiological examinations between hallux valgus night brace and a new dynamic orthosis for correction of the hallux valgus

Klaus A. Milachowski, Private Practice for Orthopaedics, Theatinerstr. 35, D-80333 Munich
Axel Krauss, Orthopaedics Technology, OT-M, Schuetzenstr. 35, D-83714 Miesbach

Key Words

Hallux valgus

hallux valgus night brace

new dynamic hallux valgus orthosis

Summary

Twenty feet were tested by radiological examination for correction of the hallux valgus. We used a conventional hallux valgus rigid night brace and a newly developed dynamic orthosis (BunionAid™). The patients had a light to moderate hallux valgus with a mean angle of 28,8 degree. The results show statistically significant correction of the hallux valgus angle in both orthosis, whereas the new dynamic orthosis was able to correct the hallux valgus to normal values. Additionally the correction of the intermetatarsal angle was statistically significantly better when the new dynamic orthosis was used. The results show that conservative treatment of the hallux valgus is possible and effective.

Introduction

Hallux valgus has become the most common foot affection. Numerous studies, for example from Sim-Fook and Hodgson (1958), demonstrate that the civilizational development from walking barefoot to wearing modern shoes massively increased the incidence of hallux valgus. A familial disposition towards hallux valgus is established. Most patients are women in their 4th–6th decade (Kato und Watanabe 1981, Coughlin 1966, Coughlin und Thompson 1966). However, the patients are becoming increasingly younger.

According to the textbooks, a conservative treatment of hallux valgus is not possible (compare Bischoff and Wirth 2001, Schuh et al. 2007). Contrary to that, new studies by Torkki et al. 2001 and 2003 demonstrate that a conservative treatment of hallux valgus by means of an orthosis is promising and otherwise necessary operations can be postponed.

However, a permanent correction of the axis was not possible so far. Up to now conservative measures meant using a hallux valgus night splint for therapy and postoperative treatment. Well-known disadvantages of this rigid night splint are the local pressure load on the one hand, lack of wearing comfort and, on the other hand, the impossibility of even walking a few steps. Besides, the hallux valgus night splint does not correct the splayfoot, which is the actual cause of hallux valgus (Bischoff and Wirth 2001, Milachowski et al. 2007, Schuh et al. 2007, Wülker 1997).

In cooperation with the Fraunhofer Institute a dynamic splint (BunionAid™) was developed for the active correction of light to moderate hallux valgus. The orthosis has six major functions:

- metatarsal bandage,
- supports the transversal arch with a pad
- anatomic splint for the 1st metatarsal
- soft part pad for pressure relief
- free mobility of the base joint of the big toe
- toe splint with corrective bandage.

The individually adjustable reins enable correction of the malpositioning. The splint is designed for day and night use and can also be worn in normal shoes. Initial clinical studies demonstrated a correction of the hallux valgus with this conservative therapy (Neumann 2005, Milachowski et al. 2007).

Postoperative studies on the treatment of hallux valgus have also been performed with the newly developed orthosis (Milachowski 2007, Werzinger 2006).

A comparative radiological study on the efficiency of the conservative correction of hallux valgus was performed with a conventional night splint and the newly developed orthosis (Fig. 1–3).

Patient records and methodology

The studies were performed on 20 feet with light to moderate hallux valgus.

A contracted severe deformity involving the other toes cannot be conservatively treated and therapy must either consist in orthopaedic shoes or an operation.

All feet were x-rayed with the patients standing natively, with a night splint (Valco® FA Bort) and with the new dynamic orthosis (BunionAid™).

The hallux valgus angle (α) and the intermetatarsal angle between the first and second ray (β) were determined (Haas 1981, Spinner et al. 1984).

Statistic evaluation was by means of the T-test with a level of significance set at $p < 0.05$.

There were 15 patients, 2 men and 13 women. 5 patients (1 man and 4 women) had a hallux valgus on both sides.

The average age of the patients was 49 years, the youngest patient was 23 years old and the oldest patient was 58 years old.

All patients came to the office because of pain in the forefoot, there was no prior treatment, e. g. by means of inlays, shoe adjustments, physiotherapy or an operation.



Fig. 1–3: 23 year old patient with light hallux valgus and painful bursitis (1), correction in a night splint (2) and with new dynamic orthosis (3)

Table 1 Correction of Hallux valgus with night splint and dynamic orthosis average values and standard deviation; n = 20

| Native | Night splint | BunionAid™ |
|--|--|---|
| Hallux Valgus angle α Standard deviation 28,8° 8,68° (20° to 46°) | Hallux Valgus angle α Standard deviation 18,4° 6,05° (10° to 30°) | Hallux Valgus angle α Standard deviation 11,6° 3,2° (8° to 8°) |
| Intermetatarsal angle β Standard deviation 16° 3,46° (12° to 24°) | Intermetatarsal angle β Standard deviation 13° 3,38° (8° to 18°) | Intermetatarsal angle β Standard deviation 10,2° 1,4° (8° to 12°) |

Results

The radiological studies of 20 feet with light to moderate hallux valgus demonstrate that the malpositioning can effectively be corrected by a night splint as well as the new dynamic orthosis (Tab. 1).

The initial hallux valgus angle (α) was an average of 28.8° (minimum 20°, maximum 46°). The night splint allowed a – statistically significant – reduction to 18.4° with a low value of 10° and a high value of 30°. The newly developed BunionAid™ orthosis corrected the malpositioning to normal values with an average value of merely 11.6°, minimum 8° up to a maximum of 18°. The differences are statistically significant ($p < 0.05$).

Naturally, the splayfoot could not be corrected as well with the night splint as with the newly develo-

ped dynamic orthosis, which simultaneously serves as a metatarsal bandage.

Thus the average intermetatarsal angle DI – DII (β) was an average of 16° within a range from a minimum of 12° to a maximum of 24°.

The night splint enabled a mild correction to an average of 13° (min. 8°, max. 18°), the differences are not statistically significant ($p > 0.05$).

With the newly developed dynamic orthosis the intermetatarsal angle was also normalized at a value of 10.2° (min. 8°, max. 12°). The difference to the initial result is also significant in this case ($p < 0.05$), this correspondingly applies to the night splint and hallux valgus for the correction of the intermetatarsal angle (Fig. 4–12).

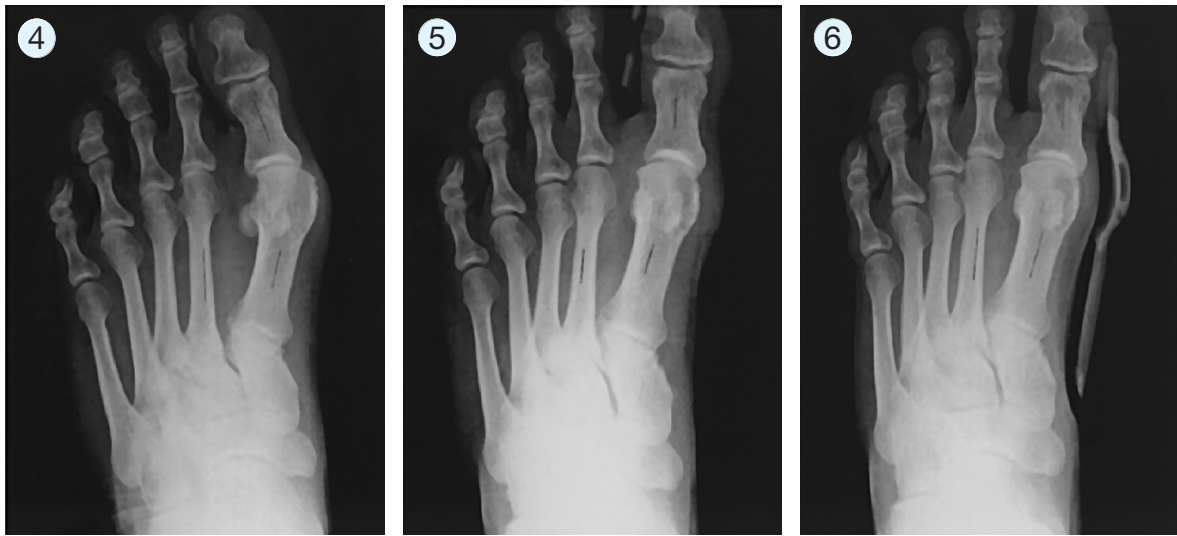


Fig. 4–6: 39 year old patient with a hallux valgus angle of 40° , correction with a rigid night splint to 20° (5) and to 18° with the dynamic orthosis (6). Normalization of the metatarsal angle (β) to 8° .



Fig. 7–9: 57 year old patient with a hallux valgus angle of 30° (7), correction with a rigid night splint to 22° (8), however, no correction of the metatarsal angle ($\beta = 14^\circ$). With the dynamic orthosis correction of the hallux valgus angle to physiological 12° and the intermetatarsal angle to 10° (9).

Discussion

So far, the conservative therapy to correct hallux valgus was considered not possible. One managed by using a rigid night splint, particularly after operations. Our initial radiological studies on light to moderate hallux valgus demonstrate for the first time that the hallux valgus angle can effectively be corrected with a rigid night splint as well as the newly developed orthosis whereas the new orthosis was able to correct to normal values. The differences are statistical-

ly significant. Correction of the intermetatarsal angle was also significantly better with the new orthosis, in this case normal values could also be achieved.

Due to the better wear comfort as a day and night splint and the simultaneous correction of the splay-foot, the newly developed BunionAid™ bandage is more suitable for conservative correction of hallux valgus than the standard night splints used until now. The differences to the initial values are significant.

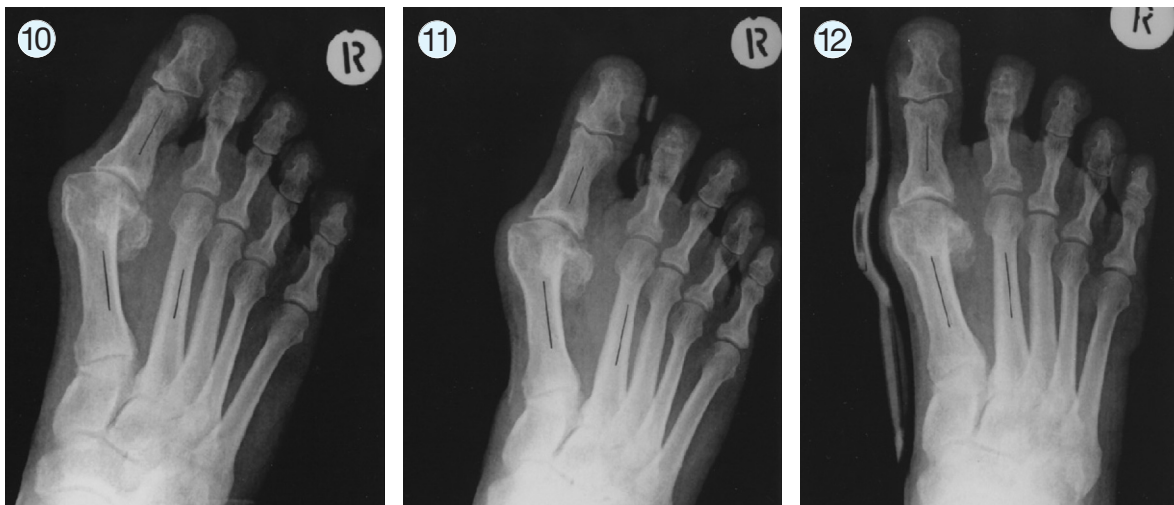


Fig. 10–12: 58 year old patient with a hallux valgus angle of 46° (10), correction with the rigid night splint to 30° (11) and with the BunionAid™ orthosis to 16° (12).

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Bibliography

- 1) Bischoff HP, Wirth CJ Praxis der Orthopädie. Thieme. Stuttgart 2001.
- 2) Coughlin MJ. Hallux valgus. J. Bone Joint Surg Am. 1996; 78(6):932–966
- 3) Coughlin MJ, Thompson FM. The high price of high-fashion footwear. In Instructional Course Lectures, The American Academy of Orthopaedic Surgeons. 1966; 44:371–377.
- 4) Haas M: Radiographic and biomechanical considerations of bunion surgery. In Gerbert J (Ed): Textbook of bunion surgery. Mt Kisco, NY, Futura Publishing Co, 1981.
- 5) Kato T, Watanabe S. The etiology of Hallux valgus in Japan. Clin. Orthop. 1981; 157:78–81
- 6) Milachowski KA. Neue Orthese nach Hallux valgus OP. Orthopädie und Rheuma. 2007; 2:53–54
- 7) Milachowski KA., Neumann R, Krauss A. Neues Therapiekonzept bei Hallux valgus. Orthopädie und Rheuma 2007; 5:32–34.
- 8) Neumann R, Präoperativer Einsatz der BunionAid™ Schiene. München 2005
- 9) Schneider W, Aigner N, Pinggera O, Knahr K. Chevron osteotomy in hallux valgus. Ten-year results of 112 cases. J. Bone Joint Surg Br. 2004; 26(7):1016–1020
- 10) Schuh A, Jezussek D., Fabiani R., Hönle W. Hallux Valgus. Orthopädie und Rheuma 2007; 2:36–40
- 11) Sim Fook L, Hodgson AR, A comparison of foot forms among the non-shoe and shoe-wearing Chinese population. J. Bone and Joint Surg Am. 1958; 40(10):1058–1062
- 12) Spinner SM, Lipsman S, Spector F: Radiographic criteria in the assessment of hallux abductus deformities. J. Foot Surg 1984; 23:25.
- 13) Torkki M, Malmivaara A, Seitsalo S, Hoikka V, Laippala P, Paavolainen P. Hallux valgus: immediate operation versus 1 year of waiting with or without orthosis. Acta Orthop.Scand. 2003; 74(2):209–215
- 14) Torkki M, Malmivaara A, Seitsalo S, Hoikka V, Laippala P, Paavolainen P. Surgery vs Orthosis vs Watchful Waiting for Hallux Valgus – A Randomized Controlled Trial JAMA 2001; 285:2474–2480
- 15) Werzinger RA. Die Arthrose des Großzehengrundgelenkes. Orthopress 2006; 2:11–13
- 16) Wülker N. Hallux valgus. Der Orthopäde 1997; 26:654–664
- 17) Wülker N, Sückel A. Osteotomien des Mittelfußes beim Hallux valgus. Der Orthopäde 2005; 34(8): 26–734.