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Orthoses and other conservative methods in hallux valgus

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ABSTRACT

Introduction and objective: Hallux valgus is a common deformity (about 23%) in adult population. Deformation of the first ray and pain causes gait pattern changes and lower life satisfaction. There are many suggestions how to treat bunion. The method of first choice is conservative treatment. One of the most popular options are orthoses of different kinds and functions. The aim of this article is to review the conservative methods of treatment and orthotic management of bunions and its effectiveness.

Materials and methods: PubMed and Google Scholar databases were searched. The criteria for qualifying the articles for the review were the following keywords: bunion, hallux valgus, orthoses, foot deformity. 21 articles from 2018 to 2023 were analyzed.

Description of the state of knowledge: Conservative treatment includes orthoses, shoe modification, analgesics, and exercises. But the most popular are the first two methods. There are many types of orthoses used for hallux valgus, i.e. dynamic and static orthoses, separators, insoles and splints. Orthoses are used to reduce hallux valgus angle (HVA) and pain, and inhibit the progression of deformity in a long term. Studies show that dynamic orthoses have a greater effect on reducing HVA and pain compared to static orthoses. In addition, they are more frequently and willingly chosen by patients. Also, toe separators have a significant impact on minimizing pain and improving toe alignment.

Summary: Significant reduction of pain and HVA are observed in both short-term and long-term effects when using dynamic orthoses and toe separators. Dynamic orthoses are also more likely to be chosen by patients for their convenience. However, all types of orthoses are

beneficial to patients' well-being. A change of footwear also helps to stop the progression of the deformity and prevents recurrence after surgery.

Key words: bunion; hallux valgus; orthoses; foot deformity; foot

INTRODUCTION

Hallux valgus characteristics

Hallux valgus is characterized by hypermobility and pronation of the first ray, which cause subluxation and pain in the first metatarsophalangeal joint (MTP). According to the latest guidelines, the deformation is considered a 3-plane dysfunction of the first ray. [1] [2] As a result of changes in the structure of the first ray and the accompanying pain, we observe a change in gait pattern, balance disorders and an increased risk of falls. [3] The degree of deformity can be assessed by measuring the big toe adduction angle (HVA) and the angle between the first and second metatarsal bones (IMA). Currently, it is considered that $HVA \geq 20^\circ$ and $IMA \geq 9^\circ$ are indicative of hallux valgus. [1] [4]

According to research, the greatest load on the forefoot in people with a deformity of $\leq 40^\circ$ is located within the second metatarsophalangeal joint, while in the case of a deformity above 40° it is located within the first MTP joint. The intensity of pain and its location were also examined and it was shown that the strongest pain occurs within the second and third MTP joints and is directly proportional to the severity of the deformity. [5]

Epidemiology and etiology

Hallux valgus is a common deformity in the feet. It occurs in 23% of the population between 18 and 65 years of age, and the risk of developing this deformity increases to 36% after the age of 65. [4] [6] The deformity is more often observed in women and is 30% among this group. [4] The development of hallux valgus is influenced by many factors, both internal, i.e. abnormal foot arching, increased tension of the Achilles tendon, degenerative disease of the first metatarsophalangeal joint, and external, i.e. ill-fitting footwear or frequent walking in high heels. [4] It has also been shown that the formation of hallux valgus is linked to

inflammatory joint disease and the influence of genetics. Despite so many possibilities, the etiology is still not clear, and the most likely is the overlapping of many factors. [4]

Non-surgical treatment

Among the many proposals for conservative treatment of hallux valgus, two of the most popular can be identified: changing shoes and using orthopedic supplies.

Patients with hallux valgus are recommended to wear shoes with a flat, soft sole and a wide front. [3] It is also recommended to use orthoses that are designed to reduce pronation in the ankle joint. Splints are used to improve the position of the big toe and enable the adaptation of soft tissues. It is popular to use splints at night to allow correction without a stressing factor. Hallux separators play a similar role. [4]

Hallux valgus also treats manipulation and mobilization to reduce pain and improve function. However, there are no reports on the long-term effect of this type of therapy. [4]

Other conservative treatment options include: stretching exercises, cold therapy and painkillers. [4] [7]

Surgical treatment

Current guidelines indicate conservative treatment as the method of first choice. However, in the case of patients with severe pain or dysfunction that does not respond with improvement to conservative treatment, surgery is recommended. [4] The most popular methods are osteotomy of the first metatarsal bone, tarsometatarsal arthrodesis (TMT) and arthroplasty. [6] [8]

However, known methods of surgery do not always bring improvement. A recurrence of the deformity and a return of the ailment is often observed. [9]

AIM OF THE STUDY

The aim of the study was to analyze the current state of knowledge on the use and effectiveness of various types of orthopaedic equipment and other methods of conservative treatment in patients with hallux valgus.

MATERIALS AND METHODS

A non-systematic review of the scientific literature was carried out, according to the keywords: bunion, hallux valgus, orthoses, foot deformity. They searched the PubMed and Google Scholar database and analyzed 21 articles from 2018-2023. Review, quantitative and qualitative studies were qualified for the analysis. The criteria for qualifying the records for the review were: title, abstract content and topics related to the use of various types of orthopaedic supplies and conservative treatment in hallux valgus.

DESCRIPTION OF THE STATE OF KNOWLEDGE

Types of orthoses

There are different types of orthoses available on the market. Manufacturers offer both dynamic splints with the possibility of angle adjustment, as well as static orthoses, with or without support for the transverse arch. In addition, you can find various types of separators and wedges. They come in different lengths and are made of different materials. [1]

Effectiveness of orthopaedic equipment in the conservative treatment of hallux valgus

The effectiveness of orthoses used in hallux valgus has been tested in several categories, i.e. change of the big toe adduction angle, pain and pressure on the forefoot. [1]

Dynamic or static?

It has been shown that both static and dynamic orthoses reduce the angle of adduction of the big toe. [1]

Dynamic orthoses allow to reduce the contracture of the first metatarsophalangeal joint and improve the position of the big toe through low torque and long-term stretching. They are also more comfortable for patients because they do not restrict the range of motion. [1]

Li G., Shen J., Smith E., Patel C. in their study compared biomechanical orthosis with angle adjustment with soft orthosis used moderately (HVA 20-40°) of hallux valgus for 12 months. They showed that a greater reduction in HVA occurs with the use of an angle-adjustable orthosis, increasing the angle every 2 months. [10]

It has been studied that using dynamic orthoses that allow joint movement and correct the position of the first ray during gait is more effective in reducing pain and hallux adduction angle (HVA) than using static orthotics. [11]

According to studies, the use of dynamic orthosis reduces HVA by 2-3° per month, but to achieve a satisfactory effect at least 6 months of therapy is needed. It also takes time for the lesions to become permanent, due to the elasticity of soft tissues. [11] Orthoses should be used 6 to 8 hours a day to observe the effects of treatment. [7] [10]

With all the advantages of dynamic orthoses, however, it is necessary to take into account the more frequent need for their replacement, due to greater wear and the risk of damage during walking. [11]

Among the static orthoses, the best effect was noticed when used with a big toe separator. Therefore, it can be concluded that the separator plays a key role in reducing the hallux adduction angle. [7]

Separatory

Compared to mobilization and night splints, separators have been shown to reduce pain to the greatest extent by improving the position of the big toe and reducing the stretching of the collateral ligaments. [1] [4] They also facilitate the stretching of contracted soft tissues and strengthening the abductor of the big toe. [7] In a study comparing the effects of a finger separator with a semi-rigid insole and a splint, a reduction in pain intensity was observed after 3 months in patients treated with a big toe separator. The change in pain was not significant in patients treated with a splint. HVA was not significantly reduced in either group. [12]

It has also been studied that orthoses with hallux separator not only have a short-term effect in the form of a reduction of the hallux adduction angle (HVA), but also have a long-term effect inhibiting the increase of this angle during the treatment process. [1]

What length?

Comparing orthoses of different lengths and orthoses supporting the transverse arch, it was found that full-length orthoses with arch support have the greatest effect on reducing pressure on the forefoot and pain in this area, while arch support may be an important factor in

achieving this effect. An improvement in weight distribution was also observed by relieving the first metatarsophalangeal joint. [1]

Custom-made or standard orthosis?

Comparing custom-made and ready-made orthoses available for sale, no differences in performance were found in the short time (0-6 weeks), medium time (7-12 weeks) and long time (12 months). Custom-made orthoses are characterized by a better fit, which translates into greater patient satisfaction. However, the costs should be taken into account, which are much higher in the case of custom-made orthoses. [7] [13]

Effectiveness of orthopaedic supplies after surgery

Postoperative treatment depends mainly on the type of surgery performed and includes pain management, healing of bones and soft tissues, and maintenance of the achieved correction. However, there is no clear answer as to which postoperative treatment brings the best results. [14] In the first stage of postoperative treatment, bandaging is usually used to support correction, provide a certain degree of immobilization and reduce swelling. [8] [14] Typical postoperative bunion dressings consist of a soft gauze folded between the first and second toes to maintain the corrected positioning of the big toe. Although studies comparing outcomes with different postoperative dressings are limited, no significant differences have been found in patient-reported outcomes, complications such as hallux valgus recurrence or nonunion, and radiographic parameters using less restrictive postoperative dressings. [14]

A non-adherent dressing, dry gauze, a 2-inch gauze bandage, a 2-inch plaster, a wooden spatula, and a 2-inch elastic bandage were tested and described. After the procedure, a non-adherent dressing is applied to the incisions, followed by dry gauze. The gauze is wrapped in a plaster padding extending from the bunion and forefoot to just behind the ankle, with a thickness of 2 layers. The wooden spatula is then placed centrally over the medial aspect of the bunion, the distal aspect of the spatula encompassing the distal phalange. [14]

The proximal end of the spatula should reach approximately the level of the metatarsal joints. The spatula is secured with a 2-inch gauze bandage followed by a 2-inch elastic bandage, making sure that the elastic bandage goes around the bunion at least twice in a similar way to a gauze bandage. Then a postoperative shoe is put on to relieve the forefoot. [14]

The patient keeps this surgical dressing intact until the first follow-up visit scheduled for 2 weeks after surgery. During the first follow-up visit, new surgical dressings are applied in a

similar way to intraoperative dressings, but without a non-adherent dressing layer. New dressings remain in place until the next follow-up visit 6 weeks after surgery. The postoperative forefoot relief shoe is used for a total of 6 weeks. The patient can then move on to carrying the body weight according to tolerance in a regular shoe. This technique is indicated for all correction procedures hallux valgus, regardless of the degree of preoperative deformity or the type of surgery performed to achieve correction (including, but not limited to, minimally invasive techniques, open Chevron osteotomies and Lapidus procedures). The spatula serves as a splint for rigid support along the medial aspect of the foot. [14]

According to the authors, the main advantages of such treatment are low cost, low risk of displacement of the second finger compared to a separator, and providing more support than gauze alone with less restriction than using plaster, which showed no additional benefits or reduced number of complications. [14]

In the next stages, treatment is mainly based on exercise and control of the recurrence of the ailment.

Post-operative rehabilitation, such as orthotics and exercises, plays an important role in redistributing the load and regaining foot function. Postoperative muscle training can enhance bunion function, restore joint mobility, and thus physiological gait patterns. It has been found that strengthening the peroneal longus muscle can facilitate better control of metatarsal pronation and thus correctly direct the load to the first radius. An arch support foot brace can also help control pronation, while a metatarsal pad can relieve pain and maintain the integrity of the transverse arch in cases of first radius insufficiency. In addition, despite the fact that an increase (or restoration) of the load on the first ray indicates a restoration of biomechanical function, it should be noted that the relief of the first ray by immobilization or partial loading in the early postoperative period is essential to facilitate pain management and reduce the risk of nonunion. [15]

After the surgery, partial relief with the use of an orthopedic shoe relieving the forefoot or full relief with elbow canes for 6 weeks is recommended. However, studies show that full weight in a rigid soled postoperative shoe (RSS) or CAM Walker is completely safe. [16] [17]

Anti-inflammatory drugs

Anti-inflammatory drugs are recommended to relieve pain. However, given that the risk of hallux valgus increases with age, attention should be paid to the multimorbidity occurring in the elderly. Comorbidities such as kidney dysfunction and peptic ulcer disease may preclude

the safe use of anti-inflammatory drugs. The use of opioid medications should be avoided as much as possible. [18]

Changing shoes

Wearing wide-front shoes on a flat, soft sole is a common treatment to reduce compressive forces in valgus deformity. It is recommended to refrain from wearing high-heeled shoes with a narrow toe. [3] [12] [19]

Exercise

Despite the fact that exercise is recommended among conservative treatments, there are few studies on the subject in the literature, and in most of them, exercises were not used alone, but in combination with other treatments. Exercise has been shown to increase mobility and reduce pain in people with advanced hallux valgus, reduce angle in mild and moderate form, and are effective in preventing and correcting deformities in the early stage. [20]

Nakamoto M. et al conducted research using exercises with VR (Virtual Reality) technology. Six months after hallux valgus surgery, improvements in hallux valgus load and chest and pelvic movements, as well as gait variability and hallux valgus sensation after VR exercise for 3 weeks, were observed. Despite this, no significant changes in deformity or pain were observed. [21]

This study suggests that the improvement in walking ability is associated with changes in toe function, plantar sensation, and adjustment of trunk and pelvic posture. The exercises used in this study most likely improved gait function by affecting sensorimotor function rather than through structural changes such as increasing range of motion or muscle strength. [21]

SUMMARY

1. The use of dynamic orthoses is more effective in eliminating pain and reducing the big toe adduction angle (HVA) than static orthoses.
2. Dynamic orthoses are better tolerated by patients in everyday functioning,
3. The orthoses should be used for a period of not less than 6 months, for 6-8 hours a day to achieve a long-term effect.
4. When using static orthoses, the greatest reduction in HVA is observed with the simultaneous use of a hallux separator.

5. Separators, compared to mobilization and the use of night splints, have the greatest impact on minimizing pain in a patient with hallux valgus.
6. Separators have a positive effect on inhibiting the increase in HVA.
7. The use of long orthoses with arch support minimizes forefoot pain and improves weight distribution.
8. Both custom-made and standard orthoses have similar short-term and long-term effects.
9. In postoperative patients, it is recommended to relieve the operated limb for 6 weeks using an orthopedic shoe relieving the forefoot and elbow canes.
10. Full load on the operated limb in the postoperative patient is possible with the use of RSS or CAM Walker.
11. Postoperative use of a splint correcting the position of the big toe reduces the risk of recurrence of the deformity.
12. Changing shoes inhibits the progression of deformation and prevents its development.
13. Exercises used together with other treatments can minimize pain, reduce HVA, and improve mobility and gait.

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All authors contributed to the article.

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