

A new, quick, effective and minimally invasive treatment technique applied to ingrown toenails

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ABSTRACT

Objectives: Existing surgical and conservative treatment techniques applied to ingrown toenails remain controversial. In this study, a new minimally invasive technique for the treatment of ingrown toenails is described which was found to provide rapid healing and effective results.

Methods: The presented study includes 39 patients with ingrown toenails treated with the newly developed technique. The technique is a minimally invasive procedure in which a half groove-shaped piece obtained from the intravenous drip set plastic was placed between nail and dermis and fixed on the nail.

Results: The patients treated with this technique were followed up after one week, one month and six months. According to six-month follow-up results of the patients, achievement rate of the presented technique was found to be quite high at 80%.

Conclusions: This new technique has many advantages compared to existing ingrown toenail treatment methods. It was revealed that this method is very effective and successful by not requiring dressing, ensuring low pain, rapid recovery from the first day of the treatment, uninterrupted return to daily life, and low recurrence rate. One of the most important advantages of the technique is that it ensures high patient satisfaction by providing good functional and aesthetic results.

Keywords: Ingrown toenail, toenail, onychocryptosis, minimally invasive technique

Ingrown toenail is a common and often painful nail disease that occurs when the periungual dermis is pierced by the edge of the nail plate [1]. It is also known as onychocryptosis (originating from Greek words *onyx*-nail and *crypto*-secret) or unguis incarnates [2]. It is characterized by foreign body reaction, and in a later stage, inflammation, and the development of granulation tissue. In some cases, the nail plate can penetrate the surrounding soft tissue, or the nail plate can be covered with soft tissue, resulting in infection [3-5]. Although the disease generally occurs in the great toes (hallux nail) (70%), in some unusual cases other fingernails may also be involved after the

trauma [6, 7]. Ingrown toenail occurs mostly in the lateral part of the nail, the incidence on the lateral and medial sides of the nail is 2:1 [8]. Ingrown toenail causes walking difficulties, and if not properly treated, it may cause permanent deformities in the nail and toe, or a secondary nail infection of varying severity. There are numerous methods for the treatment of ingrown toenails. The selection of the treatment method depends on the severity and the stage of the disorder. Total nail avulsion, partial nail avulsion or wedge resection, removal or reduction of lateral nail fold, excision of nail bed, surgical and chemical matrixectomies targeting nail matrix have been widely

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used as surgical methods for the treatment. Taping, dental floss, sleeve technique, band-aid method, angle correction, and nail braces, are among the conservative methods [9].

In this study, a new, quick, effective, and minimally invasive technique for treatment of ingrown toenails is presented. It was observed that this technique provides rapid recovery and return to daily life in patients. In the follow-up of patients at the end of first week, first month and sixth month after the treatment, it was observed that a very high recovery rate in the patients was achieved.

METHODS

This study includes the treatment of 39 patients with complaint of ingrown toenails who applied to the General Surgery Department of Sultan Abdulhamid Han Training and Research Hospital located in Istanbul. The period of the study includes the 4-month period between October 2018 and February 2019 when the patients were treated, plus the 6-month follow-up period for each patient.

The new method applied to patients consists of a minimally invasive technique, unlike the commonly applied nail avulsion. In this minimally invasive procedure, firstly, local anesthesia was applied to the toe to be treated. And then the nail edge of ingrown side was slightly lifted until the matrix. A half groove-

shaped 3 cm long piece obtained from the tubing part of intravenous drip set plastic was placed between the nail and dermis with the sandwich model. This half groove-shaped piece was fixed to the nail with the help of polypropylene suture, and the process was completed. The fixation method used was suture technique. The piece was not changed or dislodged. The materials used in this new technique are shown in Fig. 1.

The follow-up began immediately after the procedure. The suture was not removed. The suture and groove were cut by the patient along with the nail as the nail grew longer. It was ensured that the nail completely grew on the soft tissue thanks to this barrier in the period of approximately 3-4 months, and the treatment was finalized.

Ethical approval for this study was obtained by Ethics Committee of Health Sciences University, Istanbul, with approval number of 2020/1 and dated 10.02.2020.

Statistical Analysis

Descriptive data were presented as percentages, means and standard deviations.

RESULTS

The number of patients who applied to Sultan Abdulhamid Han Training and Research Hospital with in-



Fig. 1. The materials used in the newly developed technique.



Fig. 2. Before and after treatment images of the patients treated with this new minimally invasive technique. (a) and (b) indicate images of two different patients.

grown toenail complaints was 39, and the mean age was 29.8 years with the range of 18-79. Male to female ratio was 2.9:1 (29 male and 10 female). The number of ingrown toenails treated was 40 because one patient was treated for both right and left toenail ingrown toenails.

The symptoms of the patients treated with this technique were observed as pain, exudate, swelling and erythema. Pain was a single symptom in almost half of the cases (19 patients), while in the other half the pain was accompanied by the other symptoms. These other symptoms accompanying pain were exudate (in 8 patients), erythema (in 4 patients), swelling (in 4 patients), exudate and erythema (in 2 patients), and exudate and swelling (in 2 patients) (Table 1).

The stage of ingrown toenails of the treated patients in this study is stage 2. The presented treatment technique is recommended for the treatment of ingrown toenails with symptoms of similar severity to those described in this study. In other words, with this treatment, it is expected that success will be achieved in the treatment of ingrown toenails with stages 1 and 2.

The patients were treated with the presented min-

imally invasive treatment technique. The images of two different patients before and after the treatment are shown in Fig. 2 (a and b).

After the treatment of the ingrown toenails, the patients were called for follow-up at the end of the first week, first month, and sixth month.

The results of the follow-up of the patients at the end of the first week, first month and six months demonstrated that the full healing rate was high with 80% at the end of six months (Table 2).

DISCUSSION

Ingrown toenail or onychocryptosis is a common health problem that can be observed in any age group in the population, but mostly seen in second or third decades of life, and usually in young adults or teenagers. Ingrown toenails are more common in men than women [10], and most frequently seen in males with an age range of 15 to 50 [11]. The etiology of the disease is multifactorial. In the literature, improper nail cutting and care, narrow shoe selection, abnormal nail structure, hormonal factors, genetic factors, hyperhidrosis or excessive sweating, nail fungal infection, trauma, history of nail surgery, bone abnormalities, and obesity are reported among the risk factors. Among these predisposing factors, improper nail cutting, and wrong shoe selection are more frequent ones [2, 7]. Ingrowing frequently starts at distal end of lateral nail grooves. Narrow shoe wearing compresses the tip of toe, short nail cutting causes the narrowing of the distal nail bed, and consequently it prevents the toenail to find enough space to grow properly. The patient tries to solve this discomfort by

Table 1. The complaints of the patients before the treatment

Complaints	Gender		Total
	Man	Woman	
Pain	15	4	19
Pain, exudate	6	2	8
Pain, erythema	2	2	4
Pain, swelling	4	-	4
Pain, exudate, erythema	-	2	2
Pain, exudate, swelling	2	-	2
Total	29	10	39

Table 2. Healing rate achieved with the developed minimally invasive technique

Follow-up period	Number of treated ingrown toenails		
	First week	First month	Sixth month
Healing status			
Complaint	6	5	8
No complaint	34	35	32
Total	40	40	40
Healing rate (no complaint)	85%	87.5%	80%

cutting the nail corner more which is difficult due to surrounding soft tissue. As result of this problem, the toenail grows into the nail groove and causes pain. This improper nail cutting and trying to relieve the pain causes a vicious cycle. The fact that wrong nail cutting is one of the most known predisposing factors of ingrown toenails reveals the importance of correct nail cutting. Toenails should be cut straight, not round, also if cut too shortly, it may cause inflammatory reaction in the tissue surrounding the toenail. Diabetes, obesity, having cardiac, renal, and thyroid disorders, and poor foot hygiene are also among the other causes [6]. Hyperhidrosis or excessive sweating increases the flexibility of the nail plate, facilitating skin perforation and thereby contributing to ingrown toenail [11]. Some nail deformities may also cause ingrown toenails such as pincer nail or onychogryphosis. Compared to a flat nail structure, the problem of ingrown toenail is more likely in a more curved nail. The most severe form of this type of nail structure is called 'pincer nail'. Also, an upturned nail structure, or anomalous hallux interphalangeal angles or reduced nail thickness can cause the development of ingrown toenail. Onychogryphosis is one of the toenail deformities with an 'oyster-like' or 'ram's horn nail' appearance, and clinically characterized by a yellow-brown, opaque thickening of the nail plate with increased curvature. It is more common patients with poor personal care and in older adults.

The treatment method for ingrown toenails is selected depending on the clinical stage and severity of the disease. Staging is done according to pain, edema, erythema, infection, and granulation tissue. Most of the patients with ingrown toenails have complaints of pain, erythema and swelling [7]. Initially, pain, erythema, and swelling are seen in patients. In addition to these findings, inflammatory granuloma tissue for-

mation accompanied by seropurulent exudate and infection is observed. Epithelialized granulation tissue and abscess formation are observed in more severe cases. There can be transitions between the stages depending on the patient's self-care [4]. Emmert first described three stages of ingrown toenails [12], later, Heitfiz divided the disease into three phases [13]. In a more recent study, Mozena described four stages. The first stage is called the inflammatory stage and characterized by the presence of slight edema, erythema, and pain in the case of applying pressure to the lateral nail fold. The second stage is the abscess stage which is divided into two substages. Initially, there is an increase in pain, erythema, edema and hyperesthesia, and the nail plate exceeds the nail bed by less than 3 mm. In the second phase of this stage, together with the similar symptoms seen in the previous stage, nail plate exceeds the nail bed by more than 3 mm. The development of granulation tissue and hypertrophy in the nail becomes chronic in the third phase. Untreated ingrown toenail at this stage can progress further, causing significant chronic deformations. In the fourth stage, severe chronic deformities are observed in the toenail, and unlike stage three, distal hypertrophy is observed [14].

Numerous conservative and surgical methods are applied in treatment of ingrown toenails, and there has been a long debate about the best treatment method. In selection of the most appropriate treatment method for ingrown toenails, several factors are evaluated together about the severity and stage of the condition. These factors are pain, and severity of inflammation if any, whether the patient had a history of ingrown toenail or not, and which treatment was applied to ingrown toenail and its success, as well as whether the patient had concomitant disease such as diabetes [9]. Conservative treatment is more reasonable in patients

having ingrown toenails with mild and moderate severity, and reduction in accompanying pain and being a cost-effective approach are considered as the advantages of this method [11]. Main conservative methods for treatment of ingrown toenails are reported as sleeve technique, cotton-wick insertion, band-aid method, dental floss technique, nail wiring, angle correction technique, and other methods such as using nail brace and acrylic artificial nail. Use of antibiotics, foot hygiene measures can also be counted among conservative methods. Surgical treatments include several techniques applied on the nail bed, nail plate and soft tissues surrounding the nail. Common surgical techniques are total nail avulsion, partial nail avulsion or wedge resection, removal or reduction of lateral nail fold, excision of nail bed, surgical segmental matrix excision, segmental matrix horn cauterization. None of the surgical methods applied for the treatment of ingrown toenails can be stated as the best method alone. It was stated by various authors that total nail avulsion has a high general recurrence rate in the range of 64-83% when used as a single technique in the treatment of ingrown toenails [15-17].

Among the various conservative and surgical methods used in the treatment of ingrown toenails, in patients having mild symptoms and those who do not prefer surgery due to the risks of surgical complications, conservative methods are preferred, while in more severe cases and patients who do not respond to conservative treatment, surgical methods can be applied. Elimination of symptoms, minimizing the healing process and patient satisfaction are the results expected from the applied treatment methods. The most appropriate method is the one that provides both functionally and aesthetically high patient satisfaction, has a low recurrence rate, enables the patient to recover rapidly and return to daily activities quickly [9]. The minimally invasive new treatment technique applied to the ingrown toenails presented in this study largely meets the above-mentioned expectations, and it is recommended for the treatment of ingrown toenails of similar severity to the patients included in this study.

CONCLUSION

The new minimally invasive technique presented in

this study has many advantages compared to existing ingrown toenail treatment methods. It does not require dressing, ensures low pain, rapid recovery from the first day of the treatment, uninterrupted return to daily life on the day of the procedure, and high healing rate from the first day. The patients treated with this technique were able to wear comfortable shoes and return to their daily activities the day after the treatment. The achievement rate of the technique is also quite high according to the results of the one-week, one-month, and six-month follow-up of the treated patients. The results of this study revealed that the healing rate is high in the six-month follow-up period which demonstrates the effectiveness of this new treatment technique. It is an effective and successful technique due to its advantages such as fast recovery, low recurrence rate, high patient satisfaction by providing good functional and aesthetic results.

Authors' Contribution

Study Conception: ZŞ; Study Design: ZŞ; Supervision: ZŞ; Funding: ZŞ; Materials: ZŞ; Data Collection and/or Processing: ZŞ, TG; Statistical Analysis and/or Data Interpretation: ZŞ; Literature Review: ZŞ; Manuscript Preparation: ZŞ and Critical Review: ZŞ, TG.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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