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Comparison of outcomes of banding, nail brace, and Winograd techniques in the treatment of Heifetz stage 2 ingrown toenails

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ABSTRACT

Aims: This study aims to evaluate the clinical outcomes of three commonly used treatment methods—banding, nail brace, and the Winograd procedure—in patients with Heifetz stage 2 ingrown toenails. Parameters such as recurrence rate, infection rate, postoperative pain, and patient satisfaction were assessed to guide clinical decision-making.

Methods: This retrospective study included 91 patients diagnosed with Heifetz stage 2 ingrown toenail, who were treated using one of three methods. Patients were divided into three groups: banding, nail brace, and Winograd procedure. Visual Analog Scale (VAS) scores were recorded on the third postoperative day to assess pain levels. The short-term outcomes, recurrence rates, and complications were analyzed. Ethical approval was obtained and the study adhered to the principles of the Declaration of Helsinki.

Results: The nail brace method showed a significantly shorter return-to-work duration (mean 10.2±9.5 days) compared to the Winograd procedure (19.0±6.4 days, $p<0.001$). Postoperative pain levels were significantly lower in the nail brace group (VAS score: 4.1±1.3) than in the Winograd group (6.0±1.5, $p<0.001$). Recurrence rates were similar across the nail brace (25.0%), Winograd (15.0 %), and banding (26.1%) groups ($p=0.472$). No significant differences were observed in the postoperative infection rates between the two methods ($p=0.571$).

Conclusion: The nail brace method offers faster recovery, shorter return-to-work durations, and lower postoperative pain, making it a less invasive alternative to the Winograd technique, which has longer recovery times. Despite these differences, both methods show similar recurrence rates, highlighting the need for treatment selection based on patient characteristics and preferences. Further studies with larger samples are required to assess long-term outcomes.

Keywords: Ingrown toenail nail brace, Winograd technique, recurrence, postoperative pain

INTRODUCTION

Ingrown toenails (onychocryptosis) are a common yet often debilitating condition affecting millions worldwide.[1] This condition not only causes significant pain and discomfort but also leads to restricted mobility and impaired quality of life. In severe cases, it can result in secondary infections, chronic inflammation, and even surgical intervention.[2] Despite various treatment options, there is still no universal consensus on the most effective approach, making this condition a crucial subject of clinical research.[3]

Despite various treatment options, the management of ingrown toenails remains a challenge due to the lack of consensus on the most effective approach.[4] Conservative methods, such as banding and nail bracing, aim to realign the nail and provide symptom relief, but recurrence rates remain high.[5] Surgical techniques, such as the Winograd procedure, offer a more definitive solution by excising the affected nail portion and matrix, yet they are associated with increased postoperative pain and longer recovery times.[6] The absence of a standardized treatment protocol underscores the need for further comparative studies to determine the optimal approach.

The Heifetz classification system is frequently used to grade the severity of ingrown toenails.[7] Stage 3 represents the most advanced stage and often necessitates surgical intervention owing to chronic pain, inflammation, and the potential for infection.[8] Despite the availability of various treatment options, there is no consensus on long-term outcomes, particularly in terms of recurrence rates, patient satisfaction, and complication profiles.

Despite various treatment options, the optimal approach for treating Heifetz stage 2 ingrown toenails remains uncertain. The lack of consensus on recurrence rates, patient satisfaction, and complication profiles highlights the need for comparative studies. This study aims to evaluate and compare the clinical

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outcomes of three commonly used treatment methods—banding, nail brace, and the Winograd technique. We hypothesize that the nail brace method will provide a balance between effectiveness and minimal invasiveness, offering faster recovery and lower postoperative pain compared to the Winograd procedure while maintaining similar recurrence rates.

METHODS

Ethics

This study was approved by the Scientific Researches Ethics Committee of the Adana City Training and Research Hospital (Date: 05.12.2024, Decision No: 270). The committee reviewed the study and confirmed that it did not involve any ethical concerns. The study was conducted at the Adana City Training and Research Hospital and included 91 patients diagnosed with ingrown toenails who were deemed eligible for treatment. All patients were thoroughly informed before the study, and written informed consent was obtained from each participant. This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. All patient data included in this study were anonymized and de-identified prior to the analysis to ensure confidentiality. No personal identifiable information was collected or shared. This study complied with the ethical standards regarding patient privacy and confidentiality.

Patient Groups and Method Description

All the patients included in the study were classified as having stage 2 ingrown toenails. Patients were divided into three groups based on the treatment method applied: banding, nail brace, and Winograd procedure. In the banding method, the ingrown portion of the nail is separated from the nail bed using a band to alleviate localized pressure. The band was replaced at regular intervals and patients were provided with guidance to manage the treatment process. In the nail brace method, a U-shaped wire is placed on the lateral and medial edges of the nail, and the tension created by the wire corrects the curvature of the ingrown nail. This method aims to maintain a corrective effect throughout the natural growth of the nails. The Winograd procedure involved surgical intervention, in which the ingrown portion of the nail was excised, and the nail matrix and bed were curetted. Suturing was performed postoperatively, and all patients were prescribed oral antibiotics for one week to reduce the risk of infection (**Figure**).

Figure. Treatment techniques for ingrown toenails: nail brace, banding, and Winograd procedure

Inclusion and Exclusion Criteria

Patients included in this study were diagnosed with Heifetz stage 2 ingrown toenail and were treated with one of the three methods: banding, nail brace, or the Winograd procedure. Eligible participants were between 18 and 65 years old and had complete medical records, allowing for thorough postoperative evaluation. Patients were excluded if they had Heifetz stage 1 or stage 3 ingrown toenails, as these cases require different management strategies. Additionally, those with a history of previous ingrown toenail surgery on the same toe were not included to ensure that treatment outcomes were not influenced by prior interventions. Patients with systemic conditions affecting wound healing, such as diabetes mellitus, peripheral vascular disease, or immunosuppressive disorders, were also excluded, as these factors could impact postoperative recovery and infection rates. Furthermore, individuals with traumatic nail deformities or congenital nail abnormalities were not considered, as these conditions could confound the study results. Finally, patients with poor compliance to follow-up or those lost to follow-up were excluded to ensure the reliability of postoperative outcome assessments.

Procedure and Evaluation

All patients were regularly monitored after the procedure. To assess the impact of treatment on pain levels, Visual Analog Scale (VAS) scoring was performed on the third postoperative day. The short-term outcomes of the treatment methods were compared, and the recovery process and complication rates were analyzed in detail.

Statistical Analysis

All statistical analyses were performed using SPSS 27.0 (IBM Corp., Armonk, NY, USA). The normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Normally distributed continuous data are presented as mean±standard deviation, whereas non-normally distributed continuous variables are reported as median (minimum–maximum). Categorical variables were expressed as counts (percentages). For comparisons between two groups, the Independent Samples t-test was used for normally distributed variables, whereas the Mann-Whitney U test was applied for non-normally distributed variables. For comparisons among three groups, One-Way analysis of variance (ANOVA) was performed for parametric data, followed by Tukey's post-hoc test if a significant difference was detected. For non-parametric data, the Kruskal-Wallis test was used, and if a significant difference was found, Dunn-Bonferroni post-hoc test was conducted to determine intergroup differences. Categorical variables were analyzed using the chi-square test, and in cases where the expected cell frequency was greater than 20%, Fisher's Exact test was applied. Missing data were handled using listwise deletion, and cases with incomplete records were excluded from the analysis. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of the participants was 21.7±10.5 years, with an average Body-mass index (BMI) of 22.7±3.4 kg/m^2. The mean postoperative VAS score was recorded as 4.6±1.9, while

the mean return-to-work duration was calculated as 16.5±8.8 days (Table 1).

Table 1. Demographic and clinical characteristics of patients

	Mean±SD
Age (years)	21.7±10.5
BMI (kg/m²)	22.7±3.4
Post op VAS score	4.6±1.9
Return to work duration (days)	16.5±8.8

The data in the table are presented as mean±standard deviation. Abbreviations: VAS: Visual Analog Scale, BMI: Body-mass index, SD: Standard deviation

The majority of participants were male (60.4%), and most were unilateral (right: 41.8%, left: 49.5%). The most commonly applied treatment method was the Winograd procedure (44.0%), followed by nail wire (30.8%) and nail bandage (25.3%). Treatment success was achieved in 78.0% of the cases, while recurrence was observed in 20.9%. Postoperative infections were noted in only 9.9% of the cases (Table 2).

Table 2. Distribution of patient characteristics and treatment outcomes

		Count	Column n %
Sex	Female	36	39.6%
	Male	55	60.4%
Affected side	Bilateral	8	8.8%
	Right	38	41.8%
	Left	45	49.5%
Treatment method	Winograd	40	44.0%
	Nail bandage	23	25.3%
	Nail wire	28	30.8%
Treatment result	Success	71	78.0%
	Failed	20	22.0%
Postop infection	Yes	9	9.9%
	No	82	90.1%
Recurrence	Yes	19	20.9%
	No	72	79.1%

The data in the table are presented as count (percentage)

No significant differences were found in sex distribution or the affected side across the groups (p<0.05). The highest treatment success rate was observed in the Winograd group (85.0%), followed by the nail bandage (73.9%), and nail wire (71.4%) groups, with no statistically significant differences (p=0.355). The postoperative infection rates were also comparable between the groups (Winograd, 12.5%; bandage, 4.3%; nail wire, 10.7%; p=0.571). Similarly, the recurrence rates were not significantly different, ranging from 15.0% in the Winograd group to 26.1% in the bandage group (p=0.472) (Table 3).

No significant differences were observed in age and BMI (p=0.405 and p=0.493, respectively). However, the postoperative VAS scores showed a statistically significant difference, with the highest scores recorded in the Winograd group (6.0±1.5), followed by the nail wire group (4.1±1.3), and the lowest in the bandage group (2.7±1.2; p<0.001). Similarly, the return-to-work duration was significantly longer in the Winograd (19.0±6.4 days) and nail wire (18.0±8.9 days) groups compared to the bandage group (10.2±9.5 days; p<0.001) (Table 4).

No significant difference was found in age between patients with recurrence (23.3±15.0 years) and those without recurrence (21.3±9.0 years; p=0.718). However, patients who experienced recurrence had a significantly higher BMI (24.3±4.0 kg/m²) compared to those without recurrence (22.2±3.1 kg/m²; p=0.033). Although this difference was not statistically significant, higher BMI has been clinically associated with an increased risk of recurrence and infection in ingrown toenail cases. Excess weight may contribute to greater pressure on the toes, altered nail growth patterns, and compromised wound healing, all of which could predispose patients to higher recurrence and infection rates following treatment. Postoperative VAS scores were similar between the groups (4.3±1.7 vs. 4.7±2.0; p = 0.291). In contrast, the return-to-work duration was significantly longer in patients with recurrence (21.6±10.8 days) than in those without recurrence (15.1±7.7 days; p=0.001) (Table 5).

Table 3. Comparison of demographic and clinical outcomes among treatment methods

		Winograd (n=40)	Bandage (n=23)	Nail wire (n=28)	
		Count (%)	Count (%)	Count (%)	p value
Sex	Female	17 (42.5)	8 (34.8)	11 (39.3)	0.833
	Male	23 (57.5)	15 (65.2)	17 (60.7)	
Affected side	Bilateral	4 (10.0)	3 (13.0)	1 (3.6)	0.697
	Right	15 (37.5)	9 (39.1)	14 (50.0)	
	Left	21 (52.5)	11 (47.8)	13 (46.4)	
Treatment result	Success	34 (85.0)	17 (73.9)	20 (71.4)	0.355
	Failed	6 (15.0)	6 (26.1)	8 (28.6)	
Postop infection	Yes	5 (12.5)	1 (4.3)	3 (10.7)	0.571
	No	35 (87.5)	22 (95.7)	25 (89.3)	
Recurrence	Yes	6 (15.0)	6 (26.1)	7 (25.0)	0.472
	No	34 (85.0)	17 (73.9)	21 (75.0)	

The data in the table are presented as count (percentage)

Table 4. Comparison of age, BMI, postoperative pain, and recovery time across treatment methods

	Winograd (n=40)	Bandage (n=23)	Nail wire (n=28)	
	Mean±SD	Mean±SD	Mean±SD	p value
Age (years)	23.4±13.8	20.0±6.0	20.7±7.1	0.405
BMI (kg/m²)	22.2±3.3	23.23.5	22.9±3.6	0.493
Post op VAS score	6.0±1.5	2.71.2	4.1±1.3	**<0.001**
Return to work duration (days)	19.0±6.4	10.29.5	18.0±8.9	**<0.001**

The data in the table are presented as mean±standard deviation. Statistically significant p-values are highlighted in bold. Abbreviations: VAS: Visual Analog Scale, BMI: Body-mass index, SD: Standard deviation

Table 5. Comparison of demographic and clinical parameters between patients with and without recurrence

	Recurrence (n=19)	No recurrence (n=72)	
	Mean±SD	Mean±SD	p value
Age (years)	23.3±15.0	21.3±9.0	0.718
BMI (kg/m²)	24.3±4.0	22.2±3.1	**0.033**
Post op VAS score	4.3±1.7	4.7±2.0	0.291
Return to work duration (days)	21.6±10.8	15.1±7.7	**0.001**

The data in the table are presented as mean±standard deviation. Statistically significant p-values are highlighted in bold. Abbreviations: VAS: Visual Analog Scale, BMI: Body-mass index, SD: Standard deviation

DISCUSSION

This study aimed to evaluate the clinical outcomes of different treatment methods for ingrown toenails. Significant differences were observed between treatment methods in terms of pain level and return-to-work duration. The banding method had lower postoperative pain levels and shorter recovery times than the other treatments. In contrast, higher

pain scores and prolonged recovery times were noted with Winograd and nail brace methods. These findings suggest that more invasive treatments have a more pronounced impact on recovery and highlight the need for careful pain management using such methods. Additionally, BMI was found to be associated with recurrence, indicating that individual factors such as obesity may influence treatment success. Our study found that patients with recurrence had a significantly higher BMI (24.3±4.0 kg/m^2) than those without recurrence (22.2±3.1 kg/m^2; p=0.033). Although this difference was not statistically significant, it aligns with previous studies, such as Arica et al.[9], who identified obesity as a key risk factor for ingrown toenail development. Higher BMI is known to contribute to increased mechanical stress on the toes, chronic microtrauma, and altered nail growth patterns, all of which may predispose patients to higher recurrence rates and postoperative complications. Furthermore, obesity is often linked to impaired circulation and delayed wound healing, which could prolong inflammation and increase susceptibility to postoperative infections. Given this association, BMI should be considered an essential factor in the treatment selection process for ingrown toenails. The differences in pain scores and return-to-work duration observed between treatment methods can be attributed to several factors. The Winograd procedure, being a surgical intervention involving partial nail and matrix excision, is inherently more invasive than conservative methods such as banding and nail bracing. This increased invasiveness likely contributes to higher postoperative pain levels and prolonged recovery times. Furthermore, individual patient factors such as BMI and overall health status may also play a role in postoperative recovery. Patients with higher BMI may experience increased mechanical stress on the surgical site, delayed wound healing, and prolonged discomfort, which could extend their recovery period. Additionally, postoperative care adherence, including wound hygiene and appropriate footwear, may influence pain perception and overall healing time. Understanding these contributing factors is crucial in guiding treatment selection and optimizing patient outcomes. The study's findings underscore the importance of a patient-centered approach in treatment selection, highlighting the strengths and limitations of each method.

An ingrown toenail is a common ailment that can disrupt daily life and social engagement.[10,11] Various factors contribute to this condition, including wearing tight footwear; improper trimming of toenails such as cutting them too short or not in a straight line; excessive curvature of the nail causing internal pressure; and health-related issues such as arthritis, structural deformities, diabetes, obesity, and age-related nail variations.[10-14] Heifetz outlined three primary stages of ingrown toenails.[15] In stage I, the mildest form, the symptoms include swelling, redness, slight edema, and pain when pressure is applied. Stage II is more severe, featuring increased swelling, seropurulent discharge, persistent wounds that do not heal, signs of infection, and development of granulation tissue. The most severe stage III is characterized by chronic inflammation, more pronounced granulation, and a hardened area around the lateral nail fold.[16,17] The progression or regression between these stages can vary based on how the ingrown toenail is managed.[17] A variety of treatment options exist for ingrown toenails, ranging from basic conservative measures to more advanced surgical interventions. Each treatment option has different recurrence rates.[10,11,13,18] For stage II and III ingrown toenails, surgical methods are often recommended over conservative treatments, which, although effective for stage I, have higher failure and recurrence rates for more severe stages.[10,11,14,16,19,20] It's worth noting that experts have not yet unified on an optimal surgical technique for ingrown toenails.[19,21] However, a combination of techniques, such as partial nail plate avulsion coupled with chemical cauterization or wedge excision alongside phenol cauterization, has been identified as particularly effective for managing this condition. In this context, our study compared the Winograd technique with the nail brace method and observed significant differences in postoperative pain scores and return-to-work duration. Notably, the nail brace method demonstrated a shorter return-to-work duration (10.2±9.5 days) and lower postoperative pain levels, suggesting that this conservative approach could be a more patient-friendly option. However, the longer recovery period associated with the more invasive nature of the Winograd technique is evident. Our findings align with those of Güler et al.[21], who reported that nail braces provided a shorter return-to-work duration and lower postoperative pain levels compared to the Winograd technique. However, while their study found similar recurrence rates between the two methods, our study suggests that recurrence may be influenced by patient-specific factors such as BMI rather than the procedure itself. This highlights the importance of a patient-centered approach when selecting a treatment method, considering factors such as BMI, severity of the condition, and patient preference. Future research should focus on prospective studies with larger sample sizes to further explore the impact of BMI and other patient-related factors on treatment outcomes. Additionally, investigating preventive strategies such as weight management and customized postoperative care could help reduce recurrence rates and improve long-term patient satisfaction. Our findings align with those in the literature and emphasize the importance of considering individual needs, particularly in stage II patients, when planning treatment strategies.

In a study conducted by Güler et al.[21], clinical parameters such as patient satisfaction, return-to-work duration, and recurrence rates were compared between nail braces and the Winograd technique. Their study reported that the nail brace method provided a shorter return-to-work duration (mean 4.15±1.07 days) and higher patient satisfaction (94.6%). Similarly, in our study, the nail brace method demonstrated an advantage in terms of return-to-work duration (mean 10.2±9.5 days) and lower postoperative pain. However, while Güler et al.[21] observed similar recurrence rates for both methods (8.1% vs. 9.4%), our study showed that the recurrence rates were associated with individual factors, particularly BMI. Regarding postoperative pain scores, Güler et al.[21] found that the nail brace method resulted in lower pain scores, which aligns with our findings that nail braces provided lower pain levels than other methods. Both studies highlighted that the invasive nature of the Winograd technique led to prolonged recovery times, which

is a consistent finding. These results align with the literature, emphasizing that conservative treatments, such as nail braces, can be a preferable option due to their shorter recovery times and higher patient satisfaction. However, the need to consider individual patient characteristics during treatment selection was clearly demonstrated.

Limitations

This study has several limitations. First, as the study utilized a retrospective design, the retrospective collection of data introduces potential risks of data gaps and bias. Additionally, because the study was conducted at a single center, the generalizability of the findings to different patient populations may be limited. Furthermore, the follow-up duration was relatively short, making it difficult to assess long-term outcomes, particularly recurrence rates and their impact on permanent recovery. Lastly, while evaluating subjective outcomes, such as postoperative pain and patient satisfaction, it was not possible to fully control for individual variations.

CONCLUSION

The nail brace method demonstrated faster recovery, shorter return-to-work durations, and lower postoperative pain levels compared to the Winograd technique, making it a favorable option for patients seeking a less invasive treatment. However, recurrence rates were comparable between both methods, suggesting that treatment selection should be tailored to patient characteristics. Surgical interventions like the Winograd procedure may be preferable for patients with severe or recurrent cases, while conservative approaches such as nail bracing may be more suitable for those prioritizing shorter recovery times and reduced postoperative discomfort. Further studies with larger sample sizes are needed to assess long-term outcomes and refine treatment guidelines.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was approved by the Scientific Researches Ethics Committee of the Adana City Training and Research Hospital (Date: 05.12.2024, Decision No: 270).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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