



Comparison between knot and Winograd techniques on ingrown nail treatment

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Objective: The aim of this study was to compare the Winograd and knot techniques based on efficiency, complication rate, surgery time, and amount of local anesthetic required. This study also aimed to determine the etiology of ingrown nails, whether due to involvement of the nail or soft *tissue*.

Methods: Seventy-five patients with a total of 90 ingrown nails (stages 2 and 3) who presented at our clinic between 2012–2014 were included in this study. Patients were divided into 2 groups: those treated with the knot technique and those treated with the Winograd technique. Patients in both groups were evaluated for the amount of local anesthetic required, intraoperative pain, effectiveness of preventing/stopping hemorrhage, surgery time, complications, postoperative nail size, recurrence, nail deformities, and secondary surgery rates.

Results: The mean surgical time, relapse rate, number of additional surgeries required, and amount of local anesthetic were significantly greater in the Winograd group than in the knot group. The mean nail diameter was significantly decreased, with a mean of 3 mm in the Winograd group. No statistically significant differences were found between the groups in the incidence of infection, intraoperative pain, hematoma, or nail deformity.

Conclusion: This study demonstrated that the knot technique, consisting of wedge excision of soft *tissue* without affecting the nail itself, is a simple technique to treat ingrown nails with a lower complication rate and shorter surgical time. We believe that successful treatment of ingrown nails depends only on excision of soft *tissue*, with no need to operate on the nail bed.

Keywords: Ingrown toe nail; knot technique; surgical treatment; Winograd technique.

Level of Evidence: Level III Therapeutic Study

Ingrown nails, also termed onychocryptosis, are defined by nail growth into the lateral or medial nail fold.^[1] It is a problem seen in all age groups, especially patients in their 20s and 30s, and this condition may become chronic if not treated. The most frequent symptoms of ingrown nails are pain, swelling, redness, and suppuration.^[1–3] While conservative treatment is favored in mild

cases, surgery is preferred for stages 2 and 3 ingrown nails.^[1–4]

Accurate instructions for cutting nails, avoidance of wearing tight-fitting shoes, application of gauze or special plastic material between the ingrown nail and flesh, and podiatric care are suggested as conservative treatments.^[1–4] Surgical treatment is usually based on

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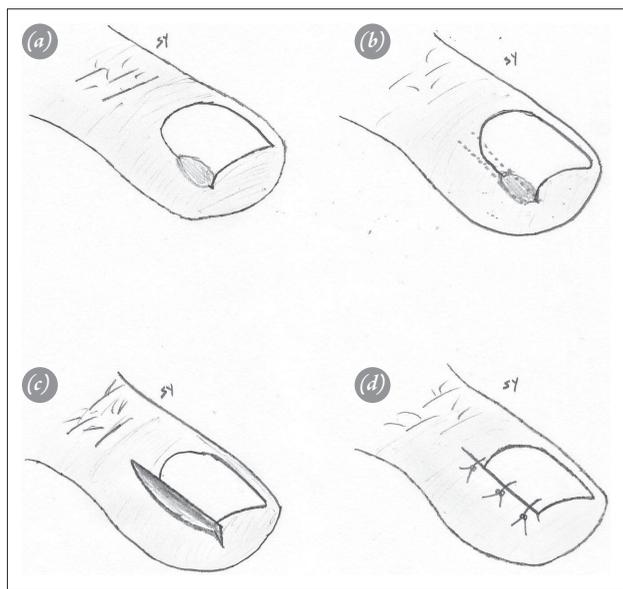


Fig. 1. Illustration of Winograd technique: **(a)** Appearance of ingrown nail; **(b)** Excision plan of the nail and nail matrix; **(c)** Longitudinal excision of soft tissues of the nail and nail matrix; **(d)** Postoperative appearance of nail.

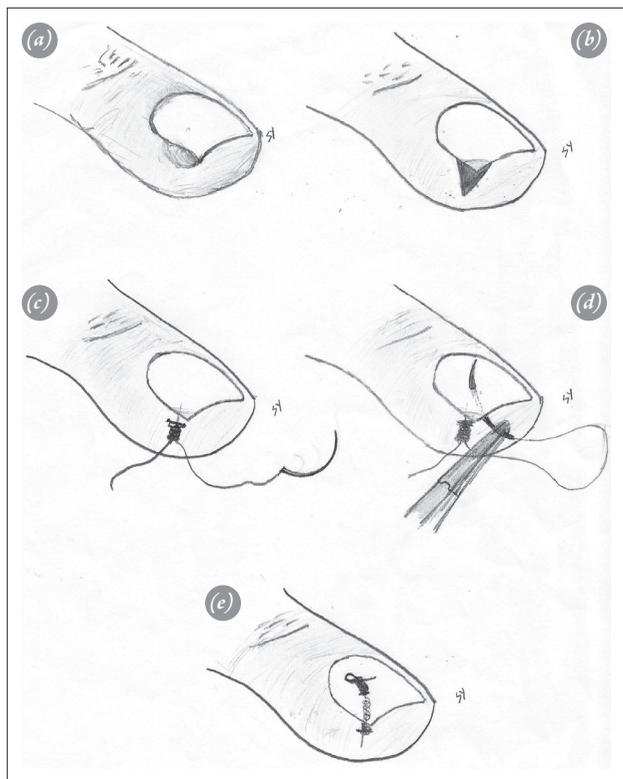


Fig. 2. Illustration of knot technique: **(a)** Appearance of ingrown nail; **(b)** Wedge excision of the upper and lower soft tissues of the nail; **(c)** 8–10 knots were tied without cutting the stitches under the nail; **(d)** Placing a knot under the nail after the needle had been passed inside the nail, without cutting the suture before another knot was tied above the nail; **(e)** Postoperative appearance of nail.

avulsion of the ingrown nail, followed by surgical and chemical destruction of the lateral matrix to prevent nail regrowth in the affected area.^[4,5]

The available techniques for treatment of stages 2 and 3 ingrown nails are total removal of the nail, total excision of the germinal matrix, Winograd method, Bartlett method, knot technique, chemical matricectomy, and partial resection of the nail bed and matrix.^[1–7] The Winograd technique is the most frequently used, which entails partial avulsion of the ingrown nail followed by surgical destruction of the lateral matrix to prevent nail regrowth in the affected area (Figure 1). However, delays in wound healing, poor nail appearance, and recurrence of nail deterioration can be seen in patients treated with this technique.^[1,2,4,7] In the knot technique, the principle of surgical treatment is different. There is no intervention to the nail itself in this technique. Instead, a wedge excision of the upper and lower soft tissues of the nail is first performed. Permanent suturing, which forms a mass with a thick subungual knot, is performed (Figure 2).^[7] Although both techniques can be used to treat ingrown nails, they are based on different principles, and no comparison of the 2 methods has been reported in the literature. We believe that understanding the etiology of ingrown nails and choosing the correct surgical technique may increase surgical success.

The aim of this study was to compare the Winograd and knot techniques based on efficiency, complication rate, surgery time, and amount of local anesthetic required. This study also aimed to determine the etiology of ingrown nails, whether due to involvement of the nail or soft tissue.

Patients and methods

Seventy-five patients with a total of 90 ingrown nails (stages 2 and 3) who presented at our clinic between 2012–2014 were included in this study. Patients were divided into 2 groups: those treated with the knot technique (Group 1) and those treated with the Winograd technique (Group 2). According to the outpatient application order, nails were enumerated. Odd numbers were defined as Group 1, and even numbers were defined as Group 2. Patients with diabetes mellitus, circulatory system problems, anatomic disorders, fungal infections, and patients with a history of trauma were excluded from the study. Patients with bacterial infection were included following successful antibiotic treatment. The study was approved by the local ethics committee, and written informed consent was obtained from all study participants. All operations were performed and all data were collected by the same surgeon. Conservative

treatment was applied to patients in whom relapse was observed following surgery. Additional surgery was required in patients who did not heal despite conservative treatment. Patients in both groups were evaluated for the amount of local anesthetic required, intraoperative pain, effectiveness of preventing/stopping hemorrhage, surgery time, complications, postoperative nail size, recurrence, nail deformities, and secondary surgery rates. Intraoperative pain was evaluated by visual analog scale (VAS). Postoperative nail size and nail deformities were evaluated by 2 plastic surgeons, each blinded to patient data. In this evaluation, postoperative nail size was measured by tape measure, and nail deformities were classified as present or not.

In all patients, local anesthesia with prilocaine was administered following surface cleaning with povidone iodine 10%.

In Group 1, which included 45 nails of 35 patients, the knot technique was applied. A wedge excision of the upper and lower soft *tissues* of the nail was performed. Wound margins were simply sutured using 2/0 sharp polypropylene. Approximately 8–10 knots were tied without cutting the stitches under the nail. These knots were used to depress the soft *tissue* and raise the nail. This was achieved by placing a knot under the nail after the needle had passed inside the nail, without cutting the suture, before another knot was tied above the nail. Therefore, the ingrown portion of the nail was raised. Care was taken during the procedure to avoid passing the stitch through the proximal portion of the ingrown nail, as this area is generally weaker and more fragile than the remainder of the nail. Stitches were removed after the nail had grown past the previously ingrown portion (approximately 3–5 weeks later).

In Group 2, which included 45 nails of 40 patients, the Winograd technique was applied. The nail matrix was shaved after 1/3 of the lateral nail, and granulated hypertrophic *tissues* were excised. Skin and nail were approximated using 2/0 polypropylene sutures. Stitches were removed after 2–3 weeks. Patients in both groups were advised not to cut their nails for 2 months after surgery, to cut their nails straight across, and to avoid wearing tight-fitting shoes.

All patients were called for control on the first postoperative day and were instructed to cover this site using a dressing made with povidone-iodine solution. Antibiotics and analgesics were prescribed to patients. The patients were followed up at the 1st, 3rd, and 8th weeks, as well as the 12th month postoperatively.

The statistical significance of mean values was ana-

lyzed using SPSS (SPSS Inc., Chicago, IL, USA) statistical software. One-way analysis of variance and Tukey's post hoc test were used to compare surgical time, relapse rate, number of required additional surgeries, and amount of local anesthetic used between the groups. P values of <0.05 were considered statistically significant.

Results

Patients were followed up for 13 months (range: 10–20 months). In Group 1, which included 45 nails of 35 patients (19 male, 16 female), the knot technique was applied. Of these, 26 patients had stage 2, and 19 had stage 3 ingrown nails; 18 of the ingrown nails were in the left foot, and 27 were in the right foot. A total of 23 patients had previously undergone surgery for ingrown nails. Bacterial infections were treated before surgery in 17 patients. Etiological factors were incorrect clipping of nails in 18 patients, wearing of tight-fitting shoes in 9 patients, obesity in 6 patients, and hyperhidrosis in 2 patients. The median age of Group 1 patients was 32 years (range: 16–51 years).

In Group 2, which included 45 nails of 40 patients (22 male, 18 female), the Winograd technique was applied. Of these, 28 had stage 2, and 17 had stage 3 ingrown nails; 21 of the ingrown nails were in the left foot, and 24 were in the right foot. A total of 12 patients had previously undergone surgery for ingrown nails. Fourteen patients with bacterial infection were treated before surgery. Etiological factors were incorrect clipping of nails in 21 patients, wearing of tight-fitting shoes in 10 patients, obesity in 6 patients, and hyperhidrosis in 3 patients. The median age of Group 2 patients was 38 years (range: 17–56 years).

In Group 1, local anesthesia was performed using a mean of 1 cc (range: 0.5–1.3 cc) prilocaine. The mean local anesthetic used was 2 cc (range: 1.4–2.5 cc) in Group 2. The median surgical time was 6 minutes (range: 4–8 minutes) in Group 1 and 13 minutes (range: 11–15 minutes) in Group 2.

Relapse was observed in 1 patient in Group 1 (2.2%), and recovery was achieved through conservative treatment. In Group 2, relapse was observed in 8 patients (17.7%), and 5 patients (11.1%) required additional surgery. No infection, hematoma, or nail deformity was observed in either group.

The mean surgical time, relapse rate, number of additional surgeries required, and amount of local anesthetic were significantly greater ($p < 0.05$) in Group 2 than in Group 1. The mean nail diameter was significantly decreased, with a mean of 3 mm (range: 2–4

mm) ($p < 0.05$) in Group 2. No statistically significant differences were found between the groups in terms of incidence of infection, intraoperative pain, hematoma, or nail deformity. Moreover, no statistically significant differences were found between recurrence and incorrect clipping of nails, wearing of tight-fitting shoes, obesity, or hyperhidrosis. No statistically significant differences were found between the groups according to relapse in patients who had previously undergone operation.

Discussion

This comparative study demonstrated that the knot technique, in which a wedge excision of the ingrown nail without touching the upper and lower soft *tissue* of the nail is performed before permanent suturing, can be successfully performed with low rates of recurrence. It was statistically demonstrated that the knot technique for the treatment of ingrown nails is a simple technique with low complication rate and short surgical time. Despite administering a lower amount of local anesthetic in the knot technique, there was no statistically significant difference in reported pain during the operation. The median surgical time was significantly longer in Group 2 than Group 1. We believe that the knot technique resulted in a shorter surgical time because it was applied to a smaller area than the Winograd technique.

In the knot technique, the success of the surgery is affected by wedge excision accompanied by primary suturing, sufficient excision of granulation *tissue*, and suturing of the proximal portion of the ingrown nail. Patients should follow a standard protocol for protection against infection, avoid wearing tight-fitting shoes, and not cut their nails for 2 months.

Considering the pathophysiology of ingrown nails, this process tends to be chronic, and therefore surgery must be more aggressive. Ingrown nails often form in the distal and lateral sides of the nail. When cutting a nail, soft *tissue* comes into contact with the sharp edges of the nail, which causes inflammation due to foreign body reaction. The ingrown nail subsequently becomes vulnerable to infection. Granulation *tissue* develops later during the infection. This process continues with secondary bacterial colonization and recurrent infections; thus, pathology beginning at the distal portion eventually reaches the proximal nail;^[2,5,7,8] this process may continue until the nail is completely covered with soft *tissue*.^[3]

The causes of ingrown nails are varied and include incorrect clipping of nails, wearing of tight-fitting shoes, obesity, trauma to the toes and/or nails, hyperhidrosis, fungal infection, and differential growth of nails and toes during puberty.^[2,3,6] In our study, etiological factors in the

majority of patients in both groups were incorrect clipping of nails and wearing of tight-fitting shoes. The other factors were obesity and hyperhidrosis. The relationship between nail and soft *tissue* was deteriorated in all these occurrences. All surgical techniques attempt to repair this relationship. Many techniques interfere with the nail and nail matrix, and some interfere with the soft *tissue*.

Recurrence rate was reported as 0.6–9.6% in 1 of these techniques, which was based on chemical destruction of the nail matrix for the treatment of the ingrown nail.^[9] In a different technique which did not interfere with nail matrix, the authors fixed the flexible tube to the nail by suture, and the recurrence rate was reported as 11.7%.^[10] Relapse following the Winograd procedure, 1 of the most commonly used surgical ingrown nail treatments, is reported between 1.7–27%.^[1,2,8,9–17] In our study, the percentage of patients requiring additional surgery following the Winograd technique was 11.1%, which is consistent with the literature.

When the Winograd and knot techniques were compared, there was no narrowing at the width of the nail in the knot technique because there was no nail excision. The nails remained wide and aesthetically natural in appearance. In Group 2, the nail width narrowed by an average of 3 mm because the ingrown nail was excised from the lateral nail.

In the knot technique, local anesthesia was applied to the area to be excised without requiring digital blocks since only soft *tissue* was excised. Thus, the amount of local anesthetic and number of injections performed were lower. The amount of local anesthetic administered was more than doubled using the Winograd technique. In Group 1, the surgical time was shorter than in Group 2, as the knot technique does not involve operation on the nail.

In the knot technique, patients are required to follow care recommendations and be informed about conservative methods. This technique can lead to relapse in non-compliant patients. On the other hand, causes of recurrence following the Winograd technique are mostly surgical in nature. In this technique, relapse occurs if the germinal matrix is not sufficiently damaged or the matrix is inadequately excised.^[6] In the knot technique, which is performed only on soft *tissues*, recurrence is unlikely because no germinal matrix damage or matrix excision is required.

The knot procedure is not appropriate for patients who do not want a suture on their nail during the 3–5 weeks of recovery.^[7] However, this limitation is not applicable to the Winograd technique.

While the knot technique used in this study targets soft *tissue*, the Winograd technique extensively involves the nail matrix. If the cause of ingrown nail is nail deformation, such as a result of trauma, the Winograd procedure may be used. However, the knot technique can be used in cases where the nail shape is not altered.

The knot technique has several advantages: there is no need for specific chemicals or surgical tools, no narrowing of the nail, and no damage to the nail matrix. In addition, we observed shorter surgical time, lower amount of required local anesthetic, and decreased recurrence risk with the knot technique. Although it can provide wound healing without operating on the nail, a period of 2 months is needed for the nail to grow beyond the knot. During this period, recurrence can be seen if the patient cuts the nail in a curved manner. This procedure is not applicable for patients who do not want a suture knot on their nail during the 3–5 weeks of recovery. Other techniques such as the Winograd procedure may be more appropriate for these patients.

In conclusion, this study demonstrated that the knot technique, consisting of wedge excision of soft *tissue* without affecting the nail itself, is a simple technique to treat ingrown nails with a lower complication rate and shorter surgical time. Although the exact etiology of ingrown nails, whether due to involvement of the nail or soft *tissue*, could not be determined in the study, considering our results, we believe that successful treatment of ingrown nails may depend only on excision of soft *tissue*, with no need to operate on the nail bed.

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Conflicts of Interest: No conflicts declared.

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