



## Original Research

# A new and simple suturing technique applied after surgery to correct ingrown toenails may improve clinical outcomes: A randomized controlled trial



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## HIGHLIGHTS

- New and traditional suturing techniques were compared.
- By using new suturing technique, recurrence cases would be diminished.

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## ABSTRACT

**Introduction:** In the present study, we investigated the efficacy of a new suturing technique applied after the Winograd procedure has been completed.

**Methods:** This study was prospective, randomized, and controlled. In total, 128 patients were recruited and divided into two groups. The outcomes of those treated with the new suturing technique (group I) were compared with those of patients treated with the traditional suturing technique (group II), both of which were applied after the Winograd procedure had been completed. The clinical outcomes and recurrence rates of the two groups were compared.

**Results:** Patients in group I required significantly more time to return to work or school than did those in group II ( $p = 0.015$ ). We found no significant difference between youths (age < 18 years,  $n = 55$ ) and adults (age  $\geq 19$  years,  $n = 69$ ) in this context ( $p = 0.161$ ). The recurrence rate was significantly higher in group II than in group I ( $p = 0.011$ ). The extent of satisfaction was significantly higher in group I ( $p = 0.042$ ).

**Conclusions:** Our new suturing technique is associated with lower recurrence and higher satisfaction rates. However, the times elapsing before shoes could be worn were similar in the two groups.

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## 1. Introduction

Ingrown toenails are encountered frequently in clinical orthopedic practice, mostly in young subjects, causing major losses of work and school time. Various conservative operative techniques have been described. Taping, packing, gutter insertion, and nail-brace fitting are well-known conservative methods [1]. The

Winograd technique has proven to be reliable since it was first described in 1929 [2–8]. Other operative techniques include nail avulsion, wedge resection, removal of the lateral nail folds, and chemical matrixectomy [3,6].

In 2014, the first author developed a new and simple suturing technique applied after the Winograd procedure has been completed [9]. In the present study, we explored whether the new technique afforded better clinical outcomes, especially in terms of recurrence and the time required for healing. We compared the new and traditional suturing techniques in terms of recurrence rate, the time taken to return to work or school, and the time that elapsed before shoes could be worn.

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## 2. Patients and methods

This prospective, randomized controlled study was approved by our institutional review board. In total, 128 patients were recruited and divided into two groups (Table 1). Written informed consent was obtained from all patients or their family members. A total of 124 patients completed all scheduled follow-up visits.

The exclusion criteria were onychomycosis, onycholysis, dystrophic nails, nails affected both medially and laterally, concomitant peripheral vascular disease, and/or diabetes mellitus. Bilateral (right and left big toes) cases were included and they were considered as separate cases. Heifetz staging (commonly used to evaluate ingrown toenails) was performed before surgery [10]. All evaluations were clinical in nature; no radiographic or microbiological test was performed.

The Winograd procedure was performed by the first two authors (i.e., one surgeon per patient; two surgeons in total involved in the trial) in all patients. Patients were assigned into groups by order of application and both surgeons treated members of both groups in a random manner. After treatment, patients were followed at 2 weeks (with suture removal), and then at 1 and 6 months. At first two visits, all patients were asked when they had been able to wear shoes and when they had returned to work or school. Patients who were not working were asked when they were able to go shopping while wearing their usual shoes. At month 6, many of the patients were examined to detect recurrence and others were telephoned to obtain final data. All patients were asked to report (by telephone) ingrown toenail recurrence during at least the first 12 months after surgery.

To eliminate any possible sex-based difference, we conducted sex-specific comparison of data from patients treated using the new and traditional suturing techniques. We also compared youths (12–18 years of age) and older patients ( $\geq 19$  years of age) between groups. We recorded the time taken to return to work or school, the time elapsing before shoes could be worn, recurrence, and patient satisfaction (rated as “low,” “moderate,” or “high”; Table 2).

### 2.1. Operative technique

To reduce inflammation, patients were preoperatively prescribed lateral nail-fold massage, bulky shoes and povidone/iodine footbaths. Although patients with Heifetz stage I and II nails were not prescribed antibiotics, patients with stage III nails were administered oral cefazolin (Sagent Pharmaceuticals, Schaumburg, IL, USA). When the complaints of the patients were not resolved, it was considered that conservative treatment had failed and operative treatment was advised to the patients. All operative interventions were performed in an operating theater under local, proximal, digital blocking anesthesia using 2% (w/v) prilocaine solution (Citanest; Zenica Medical, Paris, France). A single dose of cefazolin was given 30 min before surgery. An elastic tourniquet

was placed around the toe to ensure a clear and bloodless operative view.

A vertical incision was created along the border of the nail (Fig. 1a and b). On the ingrown side, 2–3 mm of the lateral nail was cut longitudinally with a no. 15 blade and removed together with a wedge-shaped ellipse of soft tissue including the infected granulation tissue and a small part of the nail. The incision was next lengthened 3–5 mm proximally. After the nail matrix had been excised, lateral part of the distal phalanx where the germinal matrix is most likely to remain was shaved by a curette. No chemical was applied and cautery was not used. In group I, the new suturing technique was used when closing the wound (Fig. 1c and d). In group II, the traditional suturing technique was employed (Fig. 2). All sutures were made with sharp, non-absorbable operative 3/0 monofilament (Fig. 1e).

A compression bandage was applied after surgery. The use of an anti-inflammatory agent and foot elevation were recommended to all patients. Cefazolin was given for 1 week after surgery to patients with Heifetz stage III nails. The stitches were removed 2 weeks after surgery.

All patients were encouraged to wear bulky shoes, and to walk and return to work or school as soon as possible.

### 2.2. Statistical analysis

All statistical analyses were performed using SPSS software (ver. 15.0; SPSS Inc., Chicago, IL, USA). We set the Cohen's *d* effect size to 0.5 and required 80% statistical power; the a priori sample size was thus 64 per group. Categorical variables are presented as numbers with percentages, and numerical variables are presented as means with standard deviations. As the numerical variables were not distributed normally, the Mann–Whitney *U* test was used to compare data from the two groups. The significance of between-group differences in categorical variables was tested using the chi-squared test. When incongruence was evident, we performed Monte Carlo simulation. *P* values  $< 0.05$  were considered to reflect statistical significance.

## 3. Results

Four patients moved to other cities during the follow-up period; we thus collected final data from 124 of the 128 patients. Demographic features were similar between the groups, except for the sex proportion; males were more predominant in study group ( $p < 0.001$ ; Table 1). The mean age of all patients was 22.8 (range, 12–48) years. The average follow-up time was 14.1 (range, 12–20) months. Group data are shown in Table 1.

Overall, 23% of patients had Heifetz stage I, 58% had stage II, and 18% had stage III conditions; these grade distributions did not differ between groups (Table 1). Group I patients returned to work/school significantly later than did group II patients ( $p = 0.015$ ). No significant difference was evident between youths (age  $< 18$  years) and adults (age  $\geq 19$  years) in this context ( $p = 0.161$ ; Table 2).

The recurrence rate was significantly higher in group II than in group I ( $p = 0.011$ ). The extent of satisfaction was significantly higher in group I ( $p = 0.042$ ). No significant difference was evident between youths and adults in terms of recurrence ( $p = 0.953$ ) or satisfaction ( $p = 0.887$ ; Table 2). No significant difference was evident between groups ( $p = 0.537$ ), or between youths and adults ( $p = 0.244$ ), in terms of the time elapsing before shoes could be worn (Table 2).

Table 3 lists details of recurrence in youths and adults; no significant between-group difference was evident.

**Table 1**  
Demographic features of the study group.

	Group I n = 64	Group II n = 60	p
Age (year) Mean $\pm$ SD	22.1 $\pm$ 8.4	23.9 $\pm$ 11.2	0.793
Youth	28 (43.8%)	27 (45.0%)	0.889
Elder	36 (56.3%)	33 (55.0%)	
Gender n (%)			<0.001
Male	33 (51.6%)	50 (83.3%)	
Female	31 (48.4%)	10 (16.7%)	
Heifetz n (%)			0.965
I	15 (23.4%)	13 (21.7%)	
II	37 (57.8%)	36 (60.0%)	
III	12 (18.8%)	11 (18.3%)	
Follow up time (month) Mean $\pm$ SD	14.5 $\pm$ 2.5	13.6 $\pm$ 2.4	0.132

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