ORIGINAL ARTICLE

Comparison of Winograd VS Sleeve Technique in The Treatment of Ingrown Toenail - A Randomized Clinical Trial in Tertiary Care Setting Islamabad

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ABSTRACT

Objective: To compare the recurrence rate following Sleeve and Winograd surgery for ingrown toenails.

Study Design: Randomized clinical trial.

Place and Duration of Study: This study was conducted at the Department of General Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan, from June 2024 to September 2025.

Methods: Patients between 12 and 75 years old and with clinically diagnosed IGTN were enrolled. The included patients exhibited at least two clinical signs such as discomfort, swelling, redness, or tissue overgrowth. Patients with diabetes, vascular disease, cancer, or low immunity were excluded. The patients were randomly divided into two groups: Group A (Winograd) and Group B (Sleeve). The study involved 312 nails (156 nails per group). Surgeries were performed according to standardized protocols, and recurrence was assessed within 30 days using predefined criteria. Data were collected on a prescribed proforma and analyzed using SPSS v25. Stratification was done among various confounding variables for the recurrence and compared for both groups, and a *P*-value ≤0.05 was considered statistically significant.

Results: The mean age of patients was 43.33±19.48 years, with male predominance. The mean duration of symptoms was 46.71±24.32 days. Recurrence was significantly higher in the Sleeve group (23.1%) than the Winograd group (14.1%) (*P*=0.042). Subgroup analysis showed significantly greater recurrence with Sleeve among males (*P*=0.009), obese individuals (*P*=0.007), and those without hyperhidrosis (*P*=0.023). Other demographic and clinical variables showed no significant effect.

Conclusion: The Winograd technique showed a much lower recurrence rate than the Sleeve method, especially in males and obese patients, thereby justifying its use as a more definitive surgical procedure in IGTN.

Keywords: *Hyperhidrosis, Ingrown Toenails, Pain, Recurrence, Surgical Procedure.*

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Introduction

An ingrown toenail, scientifically known as onychocryptosis, is a prevalent and frequently painful nail disorder. The condition arises from the encroachment of the periungual dermis by the adjacent nail plate, frequently leading to inflammatory, infectious, and reparative processes that may become chronic and cyclical.[1] The prevalence of onychocryptosis in the general population varies from 2.5% to 5%. Individuals with diabetes and those with compromised arterial circulation and diminished feeling may exhibit more serious conditions, such as secondary infections or gangrene, and the prevalence among these patients ranges from 13% to 32%.[2,3]

Ingrown nails are thought to exhibit a bimodal presentation, occurring between the first and third decades of life and thereafter in the elderly. In extreme instances, onychocryptosis can be incapacitating and negatively impact daily activities.[4] Onychocryptosis of the feet predominantly affects the great toe (70%), perhaps due to increased

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trauma during ambulation. This idea aligns with the observation that ingrown nails frequently develop near the distal-lateral margin of the nail, which typically endures significant weight-bearing pressure. There is minimal inclination for either the left or right foot. Other unclear etiological factors may encompass anatomical anomalies, inappropriate nail trimming, and ill-fitting footwear. Endogenous variables, including genetic predispositions and metabolic problems, are also potential contributors.[5,6] Basic interventions, including the application of soaks and appropriate trimming techniques, may alleviate symptoms and halt the progression of the pathology.[7] Nevertheless, more conclusive treatments is frequently necessary. Although both non-surgical and surgical therapies are available, conservative approaches are associated with an elevated risk of recurrence.[8] Numerous surgical techniques have been examined in the literature, highlighting their advantages and disadvantages. The sleeve technique involves inserting a short plastic or silicone tube beneath the nail edge to detach it from the skin, thereby facilitating optimal nail growth. The Winograd technique is a surgical procedure that excises a segment of the nail matrix and adjacent tissue to permanently rectify recurrent ingrown toenails. The sleeve technique is conservative and non-invasive, but the Winograd technique is more definitive and generally employed for recurrent or severe instances.[1,9]

Despite their extensive local and global applications, a consensus between sleeve and Winograd approaches regarding which yields superior long-term outcomes, especially with respect to recurrence, remains elusive. The majority of existing literature is either obsolete or derived from disparate healthcare environments, which may lack generalizability to our community owing to variations in surgical proficiency, patient adherence, and postoperative management.[1] Considering the prevalence of these procedures in modern clinical practice and the necessity for customized, context-specific data, it is essential to assess and contrast the recurrence rates linked to these two treatments. This study aims to inform local practices, enhance patient outcomes, and potentially create a standardized method for addressing ingrown toenails.

Methods

This randomized clinical trial was conducted at the Department of General Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan, from June 2024 to September 2025, following the formal approval from the hospital Ethics Research Review Board, vide letter no: FMTI ERRB/06/01, dated: 15 March, 2022. Trial was also registered with clinicaltrials.gov identifier: NCT07547241. The sample size was 312 nails (156 in each treatment arm), calculated with a 10% significance level, 80% power, an anticipated population proportion I of 10.34%, and an anticipated population proportion II of 20.5%.[10,11]

Patients of both genders with clinically diagnosed ingrown toenails, aged 12 to 75 years, were enrolled in this study. Diagnostic criteria were the presence of two or more clinical characteristics, including nail-edge discomfort, erythema/edema, discharge, or granulation tissue. The patients with diabetes, peripheral vascular disease, immunodeficiency, coagulopathy, malignancy with chemotherapy, recurrent abscess, IGTN, or delayed post-surgical complications were excluded.

Demographic and clinical information was collected using a pretested proforma after obtaining informed consent. Selection bias was minimized, and the two groups had similar baseline characteristics due to randomization. The participants who qualified were randomly divided into two groups: Group A (Winograd) and Group B (Sleeve). The patient allocation sequence was designed using a table of random numbers generated by an independent researcher not involved in recruiting patients or assessing patient outcomes. Concealment of allocations was achieved using sequentially numbered, opaque, sealed envelopes that were opened only after participants had been recruited. After allocation, patients underwent the assigned surgical procedure according to the study protocol.

Group A was subjected to the Winograd procedure, which included longitudinal nail incision, removal of the lateral nail matrix and granulation tissue to the periosteum, and suture of the nail fold. Group B was subjected to the sleeve (gutter) procedure, where the growing portion of the preceding nail and a thin strip of unchanged nail were excised, and a flexible tube was inserted in the groove for 10-14 days. The

granulation tissue was cauterized. The surgeries were performed by trained residents under the supervision of a consultant surgeon, in accordance with standardized procedures. Postoperative administration of analgesics and antibiotics did not differ between the groups. Patients in both groups were followed up after every week to examine the healing process, and recurrence was recorded as per the operational definition. Gathered observations were recorded and statistically analyzed using SPSS version 25.0 software. Mean ± SD was used to summarize quantitative variables, whereas frequencies and percentages were used to summarize categorical variables. Quantitative variables were further categorized into different groups for stratification purposes. Demographic and clinical stratification were performed, and post-stratification Chi-Square tests were conducted, with $P \leq 0.05$ considered significant.

Results

Data analysis showed that the mean age of the patients in both groups was comparable: 42.95±19.63 years in the Sleeve group and 43.72±19.39 years in the Winograd group. BMI values were similar in both groups: 27.51±6.19 kg/m2 and 28.22±5.93 kg/m2 in the Sleeve and Winograd groups, respectively. The mean duration of symptom onset was slightly longer in the Winograd group, at 48.63±24.28 days, compared with the Sleeve group, 44.79±24.28 days (Table 1).

Table 1: Distribution of Quantitative Variables by Surgical Group

Variable	Study Group	Mean	N	Std. Deviation (±)
Age (years)	Sleeve	42.95	156	19.63
	Winograd	43.72	156	19.39
	Total	43.33	312	19.48
BMI (kg/m²)	Sleeve	27.51	156	6.19
	Winograd	28.22	156	5.93
	Total	27.86	312	6.06
Duration of symptoms (days)	Sleeve	44.79	156	24.28
	Winograd	48.63	156	24.28
	Total	46.71	312	24.32

Table 2: Frequency Distribution of Patients' Characteristics by Surgical Group

Variable	Category	Sleeve N (%)	Winograd N (%)	Total N (%)
Gender	Female	61 (39.1%)	73 (46.8%)	134 (42.9%)
	Male	95 (60.9%)	83 (53.2%)	178 (57.1%)
Age Groups	12–30 years	55 (35.3%)	48 (30.8%)	103 (33.0%)
	31–75 years	101 (64.7%)	108 (69.2%)	209 (67.0%)
Duration Groups	>30 days	103 (66.0%)	113 (72.4%)	216 (69.2%)
	≤30 days	53 (34.0%)	43 (27.6%)	96 (30.8%)
BMI Groups	<25 (Normal)	66 (42.3%)	51 (32.7%)	117 (37.5%)
	25–29.9 (Overweight)	31 (19.9%)	40 (25.6%)	71 (22.8%)
	≥30 (Obese)	59 (37.8%)	65 (41.7%)	124 (39.7%)
Incorrect Nail Clipping	No	75 (48.1%)	63 (40.4%)	138 (44.2%)
	Yes	81 (51.9%)	93 (59.6%)	174 (55.8%)
Tight Shoe Use	No	73 (46.8%)	81 (51.9%)	154 (49.4%)
	Yes	83 (53.2%)	75 (48.1%)	158 (50.6%)
Hyperhidrosis	No	130 (83.3%)	123 (78.8%)	253 (81.1%)
	Yes	26 (16.7%)	33 (21.2%)	59 (18.9%)
Residential Status	Rural	54 (34.6%)	55 (35.3%)	109 (34.9%)
	Urban	102 (65.4%)	101 (64.7%)	203 (65.1%)
Job Nature	Labor	31 (19.9%)	41 (26.3%)	72 (23.1%)
	Office Work	39 (25.0%)	34 (21.8%)	73 (23.4%)
	Sedentary	48 (30.8%)	44 (28.2%)	92 (29.5%)
	Technical	38 (24.4%)	37 (23.7%)	75 (24.0%)

Our study was male-dominated in both groups, and most patients were aged 31-75 years. BMI Stratification indicated that the Winograd group had a higher proportion of obese patients (41.7%). Among the etiologies, we noticed that incorrect nail clipping was most common, particularly in the Winograd group (59.6%). Similarly, other etiologies, such as tight shoe hyperhidrosis, were also common in this group. Analysis of the data showed that both groups were comparable clinically and demographically; details are illustrated in Table 2.

The main outcome, i.e., recurrence, was higher in the

Table 3: Main Outcome and Full Stratified Analysis of Recurrence

Variable/Subgroup		Sleeve (N, %)	Winograd (N, %)	*Chi-Square* value/ **Fisher's exact* test	*P*- value
Overall recurrence		36/156 (23.1%)	22/156 (14.1%)	4.135	0.042
Gender	Female	11/61 (18.0%)	13/73 (17.8%)	0.001	0.973
	Male	25/95 (26.3%)	9/83 (10.8%)	6.823	0.009
Age groups	12–30 yrs	17/55 (30.9%)	8/48 (16.7%)	2.822	0.093
	31–75 yrs	19/101 (18.8%)	14/108 (13.0%)	1.340	0.247
Duration of symptoms	>30 days	24/103 (23.3%)	15/113 (13.3%)	3.652	0.056
	≤30 days	12/53 (22.6%)	7/43 (16.3%)	0.604	0.437
BMI groups	<25 (Normal)	8/66 (12.1%)	8/51 (15.7%)	0.309	0.578
	25–29.9 (Overweight)	9/31 (29.0%)	6/40 (15.0%)	2.062	0.151
	≥30 (Obese)	19/59 (32.2%)	8/65 (12.3%)	7.273	0.007
Residential status	Rural	14/54 (25.9%)	8/55 (14.5%)	2.189	0.139
	Urban	22/102 (21.6%)	14/101 (13.9%)	2.062	0.151
Job nature	Labor	8/31 (25.8%)	6/41 (14.6%)	1.404	0.236
	Office work	7/39 (17.9%)	4/34 (11.8%)	0.543*	0.461
	Sedentary	11/48 (22.9%)	7/44 (15.9%)	0.717	0.397
	Technical	10/38 (26.3%)	5/37 (13.5%)	1.919	0.166
Incorrect clipping	No	19/75 (25.3%)	9/63 (14.3%)	2.583	0.108
	Yes	17/81 (21.0%)	13/93 (14.0%)	1.491	0.222
Tight shoe use	No	16/73 (21.9%)	11/81 (13.6%)	1.848	0.174
	Yes	20/83 (24.1%)	11/75 (14.7%)	2.223	0.136
Hyperhidrosis	No	34/130 (26.2%)	18/123 (14.6%)	5.169	0.023
	Yes	2/26 (7.7%)	4/33 (12.1%)	0.313*	0.576

Sleeve group (23.1%) compared with Winograd (14.1%), and this difference was statistically significant (*P* value 0.042). We also performed the stratification analysis for all the effect modifiers. For this purpose, quantitative variables were categorized into different groups, and a Chi-Square test was applied to all confounding variables. Stratification analysis revealed statistically significant differences among male patients (*P*=0.009), obese patients (*P*=0.007), and patients without hyperhidrosis (*P*=0.023). However, we noticed that the duration of symptom onset>30 days also showed a borderline significant difference in recurrence rate between the two study groups (*P*=0.056). While all the other variables didn't show any significant difference, i.e., *P*-value >0.05. Detailed analysis of overall outcomes and stratification analysis is illuminated in Table 3.

Discussion

This study compared the clinical outcomes of the Sleeve and Winograd technique for ingrown toenail in terms of recurrence, and overall study findings demonstrated that the Winograd method was associated with a low recurrence rate in comparison with the Sleeve method, and this difference was statistically significant, which supports the superiority of the Winograd technique in achieving sustainable resolution or treatment outcomes. Although the two groups were similar in age, BMI, symptom duration, gender, and other baseline

factors, recurrence was significantly higher in the Sleeve group (23.1 percent) than in the Winograd group (14.1 percent). This is in line with the available literature indicating that a more focused surgical technique, such as the Winograd, could achieve better removal of pathological tissue and better reshaping of the nail matrix, which could also decrease the risk of complications that might arise during regrowth.

In a recent study, Khan AA and Kumar S reported a recurrence rate of 10.34% among all treated patients with ingrown toenails, and 6.89% of patients developed an infection following the procedure.[10] On the other hand, Gupta and colleagues in their study reported that 20.5% of patients showed recurrence following treatment with the sleeve technique.[11] Our study findings are consistent with numerous reviews and meta-analyses that prefer to consider Winograd or matrix-removal surgeries as definitive, with less recurrence than the less extensive procedures that involve avulsion of the matrix, especially without standardized adjunctive matrix ablation.[8,12,13] In comparison, a randomized trial (N = 100) by Peyvandi et al. also showed comparable recurrence following Winograd and sleeve/gutter (12% vs 10%); however, the operative time was shorter and recovery faster with the sleeve technique, indicating that the choice of technique might be affected by trade-offs between recurrence risk and early recovery.[14]

Extensive syntheses of randomized trials and observational studies have established that chemical matricectomy (e.g., phenolization) is associated with substantial recurrence reduction following partial nail avulsion and that much of the inconsistency in results across studies lies in the lack of uniformity in technique, combined preoperative and postoperative measures, surgeon experience, and follow-up period.[12,15] Similar reports and recent reviews also indicate that modified sleeve/gutter procedures can yield good cosmetic and functional outcomes in selected patients but may be associated with increased recurrence in unfavorable host factors (e.g., male sex, obesity, or chronic inflammation), which are consistent with our subgroup outcomes.[13,16] Modern clinical practices and literature reviews hence encourage the individualization of operative practice to patient attributes and, in cases where recurrence prevention is paramount, support surgery involving matrix ablation (surgical or chemical), such as Winograd or partial matricectomy with phenolization.[1,17]

Our research contributes to this literature by finding that male gender and obesity are subgroups with especially high recurrence rates between techniques, which justifies selective procedures according to these risk factors and prospective studies according to them. Recurrence was also higher in males who had received the Sleeve technique, which is highly likely because the more curved and thicker male toenail architecture is more prone to poor correction with less aggressive procedures in our study. Obesity also proved to be a sensitive confounder, and obese patients proved to have a significantly higher recurrence in the Sleeve group than in the Winograd. Higher and sustained plantar pressure, deep folds of about nail growth.[18,19] These observations underscore the importance of patient-specific variables in the decision-making process of surgery and indicate that the Winograd technique might be more consistently beneficial to overweight or obese people

Patients with prolonged symptom duration (>30 days) showed a borderline trend toward lower recurrence with the Winograd method, although results did not reach statistical significance. Chronic inflammation and repeated minor infections may alter soft tissue resilience and increase the need for more definitive procedures, which could explain this observable trend.[20] On the other hand, variables such as age, residential status, job nature, incorrect nail-trimming habits, and tight-shoe use did not significantly influence differences between the two techniques. This suggests that while patient behaviors and occupational exposure may contribute to the development of ingrown toenails, their impact on surgical success appears technique independent. Interestingly, the absence of hyperhidrosis was associated with a much higher recurrence rate with the Sleeve technique than with the Winograd technique, but the subgroup with hyperhidrosis showed no significant difference. Hyperhidrosis only causes the periungual tissue to become soft, which may theoretically affect healing dynamics, but the outcomes in this subgroup were inconclusive.[21]

This research has various limitations that ought to be

taken into account when interpreting this research. First, the surgeons' experience and technical differences were not measured or controlled; differences in the surgeon-operator's skill might affect recurrence rates. Second, there is no report of a follow-up period and follow-up completion here, as short or random follow-up may underestimate late recurrences. Third, there were many subgroup comparisons, but no correction was made for multiple testing, exposing some stratified results to the risk of type I error. Fourth, the analysis did not consider key potential confounders (e.g., smoking status, presence of coexisting foot deformities, prior treatment, or perioperative antibiotics), which could have affected the results. Sixth, the study population may not generalize externally to other settings because it was based on a single center or a specific demographic group; the same results may not be achieved elsewhere. Lastly, recurrence was measured as a dichotomous clinical event, not as patient-reported outcomes (pain, function, satisfaction) or standardized photographic verification, to avoid a more subtle evaluation of clinical benefit. These shortcomings highlight the necessity of prospective, randomized, multicenter studies with standardized surgical practices, prolonged follow-up, and comprehensive covariate adjustment to verify and extend these results.

Conclusion

The Winograd technique demonstrated a much lower recurrence rate than the Sleeve method, especially among male and obese patients. Both procedures were clinically similar, though Winograd provided longer-lasting results. These results confirm its preferential use in patients at increased risk of recurrence and underscore the need for technique-specific surgical planning.

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Author Contributions

AH: Revising, editing, supervising for intellectual content, and approving for final submission

SHW: Conception, design of the work, manuscript writing for methodology design, investigation, and approval for final submission

FK: Data acquisition, curation, statistical analysis, and approval for final submission

MAI: Validation of data, interpretation, write-up of results, and approval for final submission

MFA: Writing the original draft, proofreading, and approval for final submission

SHW is the nominated guarantor and takes full responsibility for the overall content and integrity of the work