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A Comparison of the Chemical Matricectomy with Sodium Hydroxide and Winograd Method in the Operative Treatment of Ingrown Nail: A Case Control Study

Tırnak Batması Cerrahi Tedavisinde Sodyum Hidroksit ile Kimyasal Matrisektomi ve Winograd Yönteminin Karşılaştırılması: Bir Olgu Kontrol Çalışması

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ABSTRACT Objective: There is no consensus on the operative method for ingrown nail treatment. The aim of this study was to compare the Winograd method and chemical matricectomy with sodium hydroxide in the treatment of ingrown big toenails. **Material and Methods:** 31 patients with chemical matricectomy with sodium hydroxide and 29 patients with the Winograd method were analyzed retrospectively. The two groups were compared in terms of intraoperative pain, the need for local anesthesia, patient satisfaction, Dermatology Life Quality Index, recurrence, and complication rates. **Results:** The mean intraoperative pain scores in groups chemical matricectomy and Winograd were 0.54±0.96 and 3.86±1.43, respectively (p=0.001). The recurrence rates were similar between the two groups (p=1.000). The number of satisfied and very satisfied patients at the last follow-up was respectively 31 (100%), in chemical matricectomy and 26 (89.65%) in Winograd group. The chemical matricectomy had a significantly rapid return time to school or work (day) (p<0.001). A statistically significantly negative correlation was found between preoperative Dermatological Quality of Life Index (DLQI) and post-operative satisfaction level (r=-0.312, p=0.024). **Conclusion:** Chemical matricectomy with sodium hydroxide and Winograd methods are both effective and reliable treatment methods in the treatment of ingrown toenails. Less intraoperative pain, the use of anesthetic agents, and rapid return time to school or work (day) may be an advantage of chemical matricectomy with sodium hydroxide. DLQI score before the procedures may give a clue for predicting satisfaction levels after ingrown nail procedures.

Keywords: Heifetz; ingrown toenail; matricectomy; sodium hydroxide; Winograd

ÖZET Amaç: Tırnak batması tedavisinde ameliyat yöntemi konusunda fikir birliği yoktur. Bu çalışmanın amacı, tırnak batması tedavisinde Winograd yöntemi ve sodyum hidroksit ile kimyasal matrisektomiyi karşılaştırmaktır. **Gereç ve Yöntemler:** Sodyum hidroksit ile kimyasal matrisektomi yapılan 31 hasta ve Winograd yöntemi uygulanan 29 hasta retrospektif olarak incelendi. İki grup intraoperatif ağrı, lokal anestezi ihtiyacı, hasta memnuniyeti, Dermatolojik Yaşam Kalite İndeksi (DYKİ), nüks ve komplikasyon oranları açısından karşılaştırıldı. **Bulgular:** Kimyasal matrisektomi ve Winograd grubunda ortalama intraoperatif ağrı skorları sırasıyla 0,54±0,96 ve 3,86±1,43 idi (p=0,001). Nüks oranları iki grup arasında benzerdi (p=1,000). Son takipteki memnun ve çok memnun hasta sayısı sırasıyla kimyasal matrisektomide 31 (%100), Winograd grubunda 26 (%89,65) idi. Kimyasal matrisektominin okula veya işe dönüş süresi (gün) anlamlı derecede hızlıydı (p<0,01). Ameliyat öncesi DYKİ ile ameliyat sonrası memnuniyet düzeyi arasında istatistiksel olarak anlamlı negatif korelasyon bulundu (r=-0,312, p=0,024). **Sonuç:** Tırnak batması tedavisinde sodyum hidroksit ile kimyasal matrisektomi ve Winograd yöntemleri hem etkili hem de güvenilir tedavi yöntemleridir. Daha az intraoperatif ağrı, anestetik ajanların kullanımı ve hızlı okula veya işe dönüş süresi (gün) sodyum hidroksit ile kimyasal matrisektominin avantajları olabilir. İşlemlerden önceki DYKİ skoru, tırnak batması işlemlerinden sonraki memnuniyet düzeylerini tahmin etmede ipucu verebilir.

Anahtar Kelimeler: Heifetz; tırnak batması; matrisektomi; sodyum hidroksit; Winograd

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Ingrown toenail is a common nail disorder that can be seen in all age groups and most commonly affects the big toe.[1,2] If the process that starts with pain is not treated, it progresses as inflammation, granulation tissue and infection due to secondary bacterial colonization and negatively affects the quality of life of the person.[3-5]

Conservative treatments are recommended for moderate and mild lesions whereas operative treatments are recommended for resistant to conservative treatments and terminal lesions.[6,7] In addition to measures such as wide shoe preference, correct nail cutting, and foot baths, conservative treatments include methods such as banding, packing with cotton or dental thread, nail wires, and nail braces that aim to keep the nail fold away from each other.[3,4,7,8]

As for operative treatment, besides partial or total nail extraction, wedge resection, partial matrix resection, Zadik procedure, terminal Syme operations, and chemical matricectomy have been reported in the literature.[3,4,9] The Winograd method, which is the wedge resection of the affected nail margin and germinal matrix, is accepted as an effective and reliable method of operative treatment with good clinical results and low complication rates.[10] Chemical matricectomy is performed with phenol, sodium hydroxide or trichloracetic acid, and successful results of chemical matricectomy with sodium hydroxide have been reported.[1,11,12]

There is no consensus on the choice of the operative method in the literature, and this choice may vary depending on the specialty of the professional performing the treatment.[4] In our hospital, chemical matricectomy (with sodium hydroxide) is performed in the department of dermatology and venereology clinic and Winograd method is performed in the orthopedics and traumatology clinic for the treatment of ingrown toenails. There are few studies in the literature comparing chemical matricectomy with sodium hydroxide and Winograd method in the treatment of ingrown toenails.[11,13] In this study, it was aimed to compare chemical matricectomy with sodium hydroxide and Winograd method in terms of intraoperative pain, need for local anesthesia, patient satisfaction rates, Dermatological Quality of Life Index (DLQI), recurrence, and complication rates.

MATERIAL AND METHODS

A retrospective analysis of prospectively collected data of patients who underwent operative treatment for ingrown toenails in our hospital between October 2018 and March 2019 was conducted. Uşak University Faculty of Medicine Clinical Research Ethics Committee approved the study protocol in accordance with the Declaration of Helsinki on July 22, 2020 (no: 11-05-13). Written informed consent was obtained from all patients for human subject research. Patients with Stage III and Stage I and II ingrown toenails who did not respond to conservative treatment were included in the study according to Heifetz classification.[14] Patients younger than 18 years of age and patients who had previously undergone operative treatment for ingrown toenail, had a vascular or neurological disease, diabetes mellitus, traumatic nail deformity, and fungal infection were excluded from the study. Sixteen patients out of 81 patients who underwent operative treatment during the study period were excluded due to exclusion criteria. The patients were divided into two groups according to the treatment method. Among the 65 patients included in the study, there were 33 patients in Group A who underwent chemical matricectomy with sodium hydroxide by the first author in the dermatology and venereology clinic. On the other hand, there were 32 patients in Group B who underwent the Winograd method by the second author in the orthopedics and traumatology clinic.

All operative procedures in Group A were performed under local anesthesia with a combination of 20 mg/mL lidocaine hydrochloride and 0.0125 mg/mL epinephrine after surface cleaning with 10% povidone iodide. The distal nerve block technique was applied with a maximum of 1.5 cc of anesthetic agent in unilateral part of the nail. The finger tourniquet was not used. After the hypertrophic granulation tissue extending to the nail plate was excised, the ingrown lateral part of the nail was released from the nail bed, proximal and lateral nail fold with the help of a clamp. The released nail plate was removed by cutting from the distal end to the bottom of the prox-

imal nail fold with operative nail scissors. Afterwards, a chemical matricectomy was performed with 10% sodium hydroxide solution with the help of a sterile cotton swab for 2 minutes. When the current application was completed, neutralization was performed with 10% acetic acid.

In Group B, all operative procedures were performed under local anesthesia and finger tourniquet with 20 mg/mL prilocaine hydrochloride after surface cleaning with 10% povidone iodide. A vertical incision was made using a no 15-scalpel along the nail edge, approximately 3 mm proximal from the nail border. The nail bed and matrix were resected along with the nail edge. Hypertrophic granulation tissue was excised, and curettage was performed. Fixation was achieved with 2/0 prolene suture.

In the presence of infection at preoperative, oral antibiotic therapy was applied for one week in both groups. Compression bandages were applied to all patients postoperative, and elevation was recommended. Oral non-steroidal anti-inflammatory and antibiotic treatment was given to all patients for one week postoperative. Intraoperative, 0.8-1.5 cc local anesthetic was applied first in both groups. Afterwards, this amount was increased according to the patient's need intraoperative and the total amount used was recorded. Intraoperative pain was assessed using the visual analogue scale (VAS) pain score (range 0-10).

Patients were called for follow-up in the first week, second week, first month, sixth month and first year postoperative. Until the first week, the patients were advised not to wear tight shoes, but at the first week control, it was suggested that they could wear the shoes they used in the preoperative period. In addition, patients were encouraged to return to work or school as soon as possible. Patients who did not work or did not attend school were advised to start their daily activities preoperative as soon as they could tolerate by wearing shoes.

Age, gender, body mass index, nail ingrown stage according to Heifetz classification and preoperative DLQI data of the patients were recorded. DLQI consists of ten questions in total and is scored between 0 and 30 as a result.[14,15] The score obtained according to DLQI is inversely proportional to the quality of life. The time to return to school or work and the time to start wearing shoes were questioned in the second week and first-month follow-up. Patients were evaluated with satisfaction rates and DLQI at the last postoperative follow-up. Patient satisfaction was evaluated by VAS (between 0-10) and in order to classify it, VAS>7 was determined as very satisfied, 6 or 7 as satisfied, and <5 as dissatisfied. Data on recurrence, complications, and time from operative to recurrence were also collected.

STATISTICAL ANALYSIS

IBM® SPSS Statistics 25.0.x, based in the USA, was used for the analysis of the data. The compliance of continuous variables to normal distribution was checked with Kolmogorov-Smirnov and Shapiro-Wilk tests and histograms. Categorical variables between groups were analyzed by chi-square test or Fisher exact test. Comparisons between groups were made using Student's t test for data conforming to normal distribution; and Mann-Whitney U test for data not conforming to normal distribution. In addition, the linear relationship between the two numerical measurements was investigated by Pearson or Spearmen correlation analysis according to the normal distribution state. In statistical analysis, $p<0.05$ condition was accepted as significant.

RESULTS

Two patients in Group A and three patients in Group B were out of follow-up, so the results of 31 patients in Group A and 29 patients in Group B were included in the study. The mean age was 27.29±9.55 years in Group A and 28.10±9.82 years in Group B. In Group A, 12 (38.70%) patients were male and 19 (61.30%) patients were female, while in Group B, 11 (37.94%) patients were male and 18 (62.06%) patients were female. No significant difference was found between the two groups in terms of age, gender, and body mass index ($p>0.546$) (Table 1). According to the Heifetz classification, the number of patients with Stage I, II, and III ingrown toenails was 4 (12.90%), 12 (38.70%), and 15 (48.38%) in Group A, respectively, and 4 (13.79%), 11 (37.93%) and 14 (48.27%) in Group B, respectively. There was no significant

TABLE 1: Preoperative characteristics of the patients.

Characteristics	A group (n=31)	B group (n=29)	p value
Age (year)	27.29±9.55	28.10±9.82	0.998
Gender			
Male	12 (38.70%)	11 (37.94%)	1.000
Female	19 (61.30%)	18 (62.06%)	
Body mass index (kg/m^2)	26.80±2.41	27.20±2.62	0.546
Heifetz staging			
I	4 (12.90%)	4 (13.79%)	0.994
II	12 (38.70%)	11 (37.93%)	
III	15 (48.38%)	14 (48.27%)	
Preoperative DLQI	11.69±3.08	13.79±2.85	0.055
Follow-up time (month)	12.67±1.58	12.89±1.41	0.698

DLQI: Dermatological Life Quality Index; A group: The chemical matricectomy group; B group: Winograd method group.

difference between groups A and B in terms of the degree of the ingrown toenail (p=0.994). The mean preoperative DLQI was 13.19±3.08 in Group A and 13.79±2.85 in Group B, without any significant difference between the two groups (p=0.415). Follow-up time was 12.67±1.58 and 12.89±1.41 months in groups A and B, respectively, and the two groups were similar (p=0.698).[14]

There was no significant difference between the two groups in terms of the time to return to school or work, the time to start wearing shoes, and DLQI at the last follow-up (Table 2). The mean intraoperative pain scores in groups A and B were 0.54±0.96 and 3.86±1.43 respectively, and a statistically significant difference was found between the two groups (p=0.001). The amount of local anesthetic used during surgery was 1.11±0.33 and 2.24±0.50 cc in groups A and B, respectively, and a statistically significant difference was found between the two groups (p=0.001). Recurrence was observed in two patients in both groups, and recurrence rates were similar between the two groups (p=1.000). The mean time of recurrence was 12.48 months in Group A and 11.51 months in Group B. No complications, including infection, were observed in any patient in either group.

According to the level of satisfaction, the number of very satisfied, satisfied, and dissatisfied patients at the last follow-up was respectively 27 (87.09%), 4 (12.91%), and 0 (0%) in Group A. In Group B, it was 15 (51.72%), 11 (37.93%), and 3 (10.35%), respectively (p=0.001; Table 3). The mean degree of satisfaction was 9.21±1.10 in Group A and 7.55±2.03 in Group B (p<0.001). In addition, a statistically significantly negative correlation was found between preoperative DLQI and satisfaction level (r=-0.312, p=0.024).

TABLE 2: Comparison of intraoperative and postoperative data between the two groups.

Data	A group (n=31)	B group (n=29)	p value
Intraoperative pain score	0.54±0.96	3.86±1.43	0.001
The amount of local anesthesia (cc)	1.11±0.33	2.24±0.50	0.001
Return time to school or work (day)	4.36±3.85	11.79±3.07	<0.001
Time to start wearing shoes (day)	9.19±7.14	10.21±2.12	0.480
Postoperative DLQI	0.87±1.24	0.93±1.32	0.855
Recurrence	2 (6.45%)	2 (6.89%)	1.000

DLQI: Dermatological Life Quality Index; A group: The chemical matricectomy group; B group: Winograd method group.

TABLE 3: Patient satisfaction scores between the chemical matricectomy and Winograd method groups.

Satisfaction score	A group (n=31)	B group (n=29)	p value
Very satisfied (range, 8-10)	27 (87.09%)	15 (51.72%)	0.001
Satisfied (6 and 7)	4 (12.91%)	11 (37.93%)	
Dissatisfied (<5)	0 (0%)	3 (10.35%)	

A group: The chemical matricectomy group; B group: Winograd method group.

DISCUSSION

Inappropriate nail cutting and tight shoe preference are considered as etiological factors for big toe ingrown toenails, and conservative treatments including precautions for these reasons are recommended in cases of early-stage ingrown toenail.[3,7] In our study, we applied operative treatment in stages I and II in the settings of no benefit from conservative treatment. Operative treatment to be applied should be simple, effective, inexpensive and have acceptable cosmetic results, as well as provide early return to daily activities.[13] Recurrence rate after ingrown toenail treatment is one of the most important factors determining the success of the treatment, and there is no consensus in the literature about which is the most ideal method.[11,13] Matricectomy can be performed chemically or mechanically in the form of wedge resection, also known as the Winograd method and successful results of these two methods have been reported in ingrown toenails.[1,6,11-13,16] In our study, chemical matricectomy with sodium hydroxide and Winograd method as mechanical matricectomy method were compared. In the literature, recurrence rates after ingrown toenail treatment with Winograd method were found to be 6% by Acar, 6.5% by Aydin et al., 9.4% by Guler et al., and 12% by Peyvandi et al. and 13.2% by Kose et al.[6,8,17-19] In the present study, the recurrence rate in the Winograd method group was 6.89%, and it was found to be consistent with the literature. Regarding chemical matricectomy with sodium hydroxide, Akkus et al. reported a recurrence rate of 5.4%, Grover et al. 4.3% and Bostanci et al. reported a recurrence rate of 4.9%.[11,20,21] In the present study, the recurrence rate in the chemical matricectomy group with sodium hydroxide was 6.45%, and it seems to be consistent with the literature. In our study, sodium hydroxide with chemical matricectomy and Winograd technique applied for ingrown toenail surgery were found to be similar in terms of recurrence rates in the short term. However, the need for intraoperative local anesthesia and intraoperative pain were statistically significantly higher in the Winograd technique compared to chemical matrixectomy with sodium hydroxide.

Chemical matricectomy with phenol is also known as a frequently used and effective method in the treatment of ingrown toenails.[22] Although sodium hydroxide can be neutralized with acetic acid, the tissue damage caused by phenol is not predictable since phenol cannot be neutralized.[11] As a matter of fact, Bostanci et al., in their study comparing phenol and sodium hydroxide as chemical matricectomy agents, found that the success rates of both groups were similar, but they stated that less postoperative morbidity and faster recovery in the sodium hydroxide group.[21] Similarly, Grover et al. reported that while sodium hydroxide and phenol had similar efficacy, tissue healing was faster with sodium hydroxide than with phenol.[20] The time of administration of sodium hydroxide also affects postoperative results. Kocyigit et al. compared the 30-second, one-minute and two-minute application periods of sodium hydroxide and reported that the 30-second application had a significantly lower success rate than the one-minute and two-minute application.[23] In the same study, while the success rates of one-minute and two-minutes applications were similar, it was shown as a disadvantage of using two-minutes to prolong the recovery period. In another study, one-minute and two-minutes applications were found to be similar in terms of recurrence rates in the long term.[12]

The time to return to work or recovery time with the Winograd method was reported as 13.9 days by Guler et al., 15.8 days by Uygur et al., and 15.7 by Pérez-Rey et al.[8,13,24] With sodium hydroxide, it was reported as an average of 17.3 days by Akkus et al. and 14 days by Pérez-Rey et al.[11,13] In our study, Winograd method group, the mean time to return to work or school was 11.79 days and slightly faster than the pieces of literatures. However, the mean time to return to work or school was significantly faster in the chemical matricectomy group (4.36±3.85 days) and when compared to the Winograd method group (11.79±3.07 days). The pre-operative high levels of DLQI in the surgery group and suture-related conditions may explain the longer time to return to work or school in the surgery group. This result was similar to the study performed by Pérez-Rey et al. in which they found the recovery time was significantly shorter in the sodium hydroxide group than in the Winograd

method.[13] Difference from our study, in the study of Pérez-Rey et al chemical matricectomy with sodium hydroxide was applied to patients with Stage I and II ingrown toenails, while the Winograd method was applied to Stage III patients. Likewise, Akkus et al. reported that the recovery time was significantly lower in the sodium hydroxide group compared to the Winograd group.[11,13] In the aforementioned study, this period was 17,3 days in the sodium hydroxide group and 28.9 days in the Winograd group, and the authors stated that the Winograd group was not consistent with the literature.

Ingrown toenails make it difficult for the individual to wear shoes, especially in advanced stages, and may cause changes in shoe preferences. In addition, it causes contamination in the socks due to the drainage and negatively affects the quality of life of the person.[3] For this reason, DLQI can be an effective method to determine the success of treatment. As a matter of fact, Akkus et al. used DLQI in their studies to determine patient satisfaction and found significant improvement in DLQI according to preoperative values after both chemical matricectomy with sodium hydroxide and Winograd method.[11,13] In our study, a significant improvement was observed in both groups according to DLQI and the two groups were found to be similar in this regard. The level of satisfaction was also investigated in our study. The rates of very satisfied and satisfied patients after treatment with sodium hydroxide and Winograd method were found to be 100% and 89.65%, respectively. Although the recurrence rates are similar in two groups, the difference in the degree of satisfaction may be related to the conditions that low intraoperative pain and the rapid return to school/work in the chemical matricectomy group. Interestingly, a weak negative correlation was found between preoperative DLQI and satisfaction levels ($r=-0.312$, $p=0.024$). In other words, the level of satisfaction after treatment was less in patients whose quality of life was affected more by nail ingrown before the treatment. In this context, it can be concluded that the DLQI score before the procedures of ingrown toenails may be an important predicting factor for the satisfaction levels of the post-procedures.

In the present study, intraoperative pain and the need for local anesthesia were found to be significantly lower in the sodium hydroxide with chemical matricectomy group compared to the Winograd method group. The reason for this condition could be the fact that chemical matricectomy with sodium hydroxide is a less invasive method and it may be due to the local anesthetic agent used. Lidocaine with epinephrine was used in the chemical matricectomy group. It has recently been considered a myth that there is a risk of necrosis with the use of local anesthetics containing epinephrine in the tip areas such as fingers and should not be used in these areas. Local anesthetic agents with epinephrine have been shown to reduce the amount of anesthetic agent when used with appropriate technique in suitable patients and provide better pain control during the procedure.[25] In addition, according to our study, the use of tourniquets can be reduced with the use of lidocaine with epinephrine.

LIMITATIONS

Our study has some limitations. First, although our study collected data prospectively, it is not a randomized controlled study and perhaps due to its retrospective design, five patients who were excluded from follow-up were not evaluated. Second, the sample size and follow-up time in the study were small. Lastly, performing the procedures by different physicians may make the objective evaluation of the procedures difficult.

CONCLUSION

In conclusion, both chemical matricectomy with sodium hydroxide and Winograd method are effective and reliable treatment methods in the treatment of big toe ingrown toenail. There is no difference between the two operative methods in terms of postoperative recurrence rates in the short term. Less intraoperative pain, the use of anesthetic agents, and rapid return time to school or work (day) may be an advantage of chemical matricectomy. DLQI score before the procedures may give a clue for predicting of satisfaction levels after ingrown nail procedures.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Ömer Kutlu;* ***Design:*** *Ömer Kutlu, Enes Uluyardımcı;* ***Control/Supervision:*** *Ömer Kutlu, Enes Uluyardımcı;* ***Data Collection and/or Processing:*** *Ömer Kutlu, Enes Uluyardımcı;* ***Analysis and/or Interpretation:*** *Ömer Kutlu;* ***Literature Review:*** *Ömer Kutlu, Enes Uluyardımcı;* ***Writing the Article:*** *Ömer Kutlu, Enes Uluyardımcı;* ***Critical Review:*** *Ömer Kutlu, Enes Uluyardımcı;* ***References and Fundings:*** *Ömer Kutlu, Enes Uluyardımcı.*

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