



Comparison of phenol applications of different durations for the cauterization of the germinal matrix: an efficacy and safety study

Germinal matriks koterizasyonunda farklı fenol uygulama sürelerinin etkinlik ve güvenlik açısından karşılaştırılması

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Amaç: Tırnak batması tedavisinde en sık kullanılan yöntemlerden biri kısmi tırnak çekimi ile birlikte uygulanan fenol matriksektomidir. Bu çalışmada farklı fenol uygulama sürelerinin etkinlik ve güvenliği karşılaştırıldı.

Çalışma planı: Çalışmada evre 2-3 tırnak batması bulunan 110 hastanın (54 erkek, 56 kadın) 148 tırnağı incelendi. Hastalar, batan tırnakların cerrahi eksizyonundan sonra, germinal matriksin 1, 2 ve 3 dakikalık fenol koterizasyonu için rastgele seçimle üç gruba ayrıldı. Hastalar cerrahi sonrası 2, 10, 16, 24 ve 30. günlerde ağrı, drenaj ve doku hasarı açısından değerlendirildi ve 24 ay süreyle nüks açısından izlendi.

Sonuçlar: Ağrı, drenaj ve doku hasarının zaman içinde iyileşmesi her üç grupta da anlamlı bulundu ($p<0.001$). Tam iyileşme, drenaj ve doku hasarı süreleri, bir dakikalık fenol uygulanan grupta anlamlı derece daha kısa bulundu ($p<0.001$). Daha uzun süreli fenol uygulamaları arasında bu parametreler açısından fark bulunmadı. Ortalama ağrı süresi gruplar arasında farklılık göstermedi. Gruplar arasında ağrı ve doku hasarı sıklığı yönünden farklılık bulunmazken, 16. günde yapılan kontrolde birinci grupta belirgin oranda daha az kişide drenaj gözlemlendi ($p<0.001$). Uzun dönem takiplerde tüm nükslerin altıncı ayda ortaya çıktığı görüldü ve bu açıdan gruplar arasında anlamlı fark yoktu.

Çıkarımlar: Bulgularımız, tırnak batması tedavisinde germinal matriks koterizasyonu için fenolün bir dakika süreyle uygulanmasının, iki ya da üç dakika süreyle uygulanmasından daha güvenli olduğunu göstermektedir.

Anahtar sözcükler: Tırnak batması/cerrahi; fenol/terapötik kullanım; tedavi sonucu.

Objectives: Partial nail avulsion with phenol matricectomy is one of the most widely performed procedures for the treatment of ingrowing nails. We compared phenol applications of different durations with respect to efficacy and safety.

Methods: The study included 148 ingrowing nails (grade 2-3) of 110 patients (54 males, 56 females). The patients were randomized to three groups for 1-, 2-, and 3-minute applications of phenol cauterization of the germinal matrix following surgical removal of ingrowing nails. Postoperative evaluations were made on days 2, 10, 16, 24, and 30 for pain, drainage, and tissue damage. Recurrences were recorded during a follow-up of 24 months.

Results: Improvements in pain, drainage, and tissue damage in each group were significant ($p<0.001$). Time to complete healing and durations of drainage and tissue damage were significantly shorter in patients receiving 1-minute phenol application ($p<0.001$), and the remaining groups did not differ in this respect. The mean duration of pain was similar in three groups. While the frequencies of pain and tissue damage were similar in three phenol groups, the number of patients having drainage on day 16 was significantly lower with 1-minute phenol application ($p<0.001$). All recurrences appeared in the sixth month and there was no significant difference between the three groups with respect to the recurrence rate.

Conclusion: Our findings suggest that 1-minute phenol cauterization of the germinal matrix has a better safety profile than prolonged applications in the treatment of ingrown nails.

Key words: Nails, ingrown/surgery; phenol/therapeutic use; treatment outcome.

Ingrowing nail is a common health problem affecting generally young adults and result in a significant morbidity.^[1] The disease is classified into three grades according to the presence of pain, erythema, infection, drainage and granulation tissue, and the treatment of the disease is determined according to the grade.^[2] In grade 3 almost always, and in grade 2 mostly surgical treatment is required.^[2,3]

In daily practice, partial nail avulsion with phenol matricectomy is one of the most common used treatment modality.^[1-6] Phenol application to germinal matrix, after the removal of the nail, is an effective treatment with low recurrence rates.^[7,8] However, there is no consensus on duration times of phenol applications and the effectiveness and safety of these duration times.^[1-6]

With this study, by comparing different durations of phenol applications in terms of postoperative complications and recurrence rates, we aimed to determine the optimal duration times for phenol applications, of which the effectiveness is well known.

Patients and Method

General features of patients

110 patients (54 male, 56 female), of which the informed consent was taken, with grade 2 or grade 3 ingrowing nail in 148 nails included in the study. Patients were randomized into three different treatment groups (Table 1). Patients did not have a history of hematologic, vascular, neurologic problem or allergic reaction to local anesthetic agents. The nails which are diagnosed as infected at the time of examination were treated with systemic and topical antibiotics.

Surgical methods

Partial nail avulsions were performed according to the general guidelines.^[1,4] The operation area was cleaned by povidone-iodine solution, ring block digital anesthesia was provided by using 2 ml of 1% lidocaine without epinephrine. By a tourniquet applied to the digit, a clean and bloodless area was achieved. The ingrowing edge of the nail was cut longitudinally 3-4 cm apart from the affected side of the nail and removed as one-piece. The matrix, the nail bed and if there was, the granulation tissue were curetted with a sterile metal curette and the area was controlled if there was nail spicules left. The surrounding area was protected from phenol

by bacitracin pomade application. The nail matrix was cauterized with 88% phenol for one, two and three minutes in the first, second and third groups, respectively. Solution was applied to nail matrix for 1 minute with a cotton-tipped applicator. Two and three minute procedures were also performed by one-minute applications. In each one-minute application, the applicator was changed and the operation area was cleaned by a sterile gauze between the applications. After phenol application, the operation area was washed with 70% alcohol for the dilution of residual phenol. The tourniquet was removed and the operation area was bandaged with sterile gauze after the application of topical antibiotic. Patients were instructed to use povidone-iodine solution and topical antibiotics for wound care.

Clinical Assessment and Follow-up

Complete healing was defined as the complete reepithelization of the nail bed and the cessation of drainage. Patients were examined on alternate days until the complete healing was achieved. Pain, drainage and tissue damage was assessed on the 2nd, 10th, 16th, 24th and 30th days of follow up and recorded as "present" or "absent".

Recurrence was defined as the formation of a new nail particule and the presence of any sign related with the reingrowth of the operated nail such as pain, erythema or spicule formation. Patients were followed up at six month intervals for 24 months.

Statistical method

During the study, the data was assessed in two different varieties as patient-related and nail-related. For the descriptive assessment of data, the number and percentage, the mean and the standard deviation values were used.

Ki-square analysis were used to examine whether there was difference between different phenol groups in terms of patient number, nail number, gender, stage of nail, pain, drainage, tissue damage and recurrence. One-sided variant analysis was used to assess the difference between groups in terms of age and mean disease duration, drainage, tissue damage and complete healing times. The groups that make the difference in one-sided variant analysis were determined with Tukey paired comparison method. Time course of pain, drainage and tissue damage in different phenol groups were assessed with Cochran

Table 1. General features of patients

	Group 1			Group 2			Group 3			<i>p</i>
	Number	%	Mean.±SD	Number	%	Mean.±SD	Number	%	Mean.±SD	
Patients	37	33.6		36	32.7		37	33.6		0.991
Female patient	17	30.4		20	35.7		19	33.9		0.712
Male patient	20	37.0		16	29.6		18	33.3		
Age			31.9±7.9			31.6±10.2			32.7±9.6	0.879
Disease duration (months)			5.8±2.7			6.5±3.2			7.0±2.4	0.185
Nails	48	32.4		52	35.1		48	32.4		0.898
Nail avulsion	7	29.2		11	45.8		6	25.0		0.290
Stage 2 (n=65)	23	35.4		22	33.8		20	30.8		0.792
Stage 3 (n=83)	25	30.1		30	36.1		28	33.7		0.289

Phenol applications were 1, 2, and 3 minutes in patient groups 1, 2, and 3, respectively.

Q test and the groups that make the difference were determined with Bonferroni corrected Mc-Nemar test. SPSS Version 15.0 was used statistical comparisons and statistical significance was accepted as $p < 0.05$.

Results

Patient groups were similar in terms of age, gender, disease duration, grade of disease and the presence of previous nail avulsion (Table 1).

Mean complete healing time, mean duration of drainage and duration of tissue damage was found to be significantly shorter in the first group than second and the third group ($p < 0.001$; Table 2). However, second and third groups did not differ in terms of these parameters. The mean duration of pain did not differ among groups ($p = 0.527$; Table 2).

When the pain, drainage and tissue damage on control days compared, although there was no difference in terms of pain and tissue damage among groups, on 16th day, the number of patients having drainage in first group was lower the other two groups ($p < 0.001$; Table 3). There was no drainage and tissue damage in any patient on the 30th day of control.

The improvement in pain, drainage and tissue damage over time was statistically significant for all three groups ($p < 0.001$).

During long term follow up, all the recurrences occurred on sixth month and there was no difference among groups in terms of recurrence (Table 3).

Discussion

A surgical procedure in the treatment of ingrowing nail must be cost effective, technically simple and appropriate to be applied in a short duration of time with local anesthesia.

A treatment period, which the patient could start daily activities in a short time and which has lower postoperative complication and recurrence rates and acceptable cosmetic results should be provided.^[2,3]

Surgical procedures used in the treatment of grade 2 and 3 ingrowing nail includes complete or partial nail avulsion, chemical matricectomies applied with complete or partial nail avulsions, surgical matricectomies, electrocauterization, laser and cryotherapy applications, wedge excision of nail and radical excisions.^[2,9]

Table 2. Postoperative complications and complete cure times (days)

	Group 1	Group 2	Group 3	P values between groups		
				1-2	1-3	2-3
Pain	1.4±1.4	1.1±1.2	1.3±1.3		0.527	
Drainage	12.6±4.0	16.4±4.0	16.1±3.5	<0.001	<0.001	0.888
Tissue damage	11.2±3.5	14.6±3.0	14.8±2.5	<0.001	<0.001	0.943
Complete cure	13.5±3.9	17.5±2.8	17.1±2.6	<0.001	<0.001	0.853

Phenol applications were 1, 2, and 3 minutes in patient groups 1, 2, and 3, respectively.

Table 3. Distribution of pain, drainage, tissue damage and recurrence rates during follow-up

	Group 1		Group 2		Group 3		<i>p</i>
	Number	%	Number	%	Number	%	
Pain							
2nd day	19	51.4	16	44.4	19	51.4	0.846
Drainage							
2nd day	48	100.0	52	100.0	48	100.0	0.898
10th day	40	83.3	52	100.0	48	100.0	0.449
16th day	6	12.5	34	65.4	27	56.3	<0.001
24th day	2	4.2	1	1.9	1	2.1	0.779
Tissue damage							
2nd day	48	100.0	52	100.0	48	100.0	0.898
10th day	40	83.3	52	100.0	48	100.0	0.449
16th day	2	4.2	9	17.3	6	12.5	0.113
24th day	2	4.2	1	1.9	1	2.1	0.779
Recurrences	6	12.5	2	3.9	1	2.1	0.092

Phenol applications were 1, 2, and 3 minutes in patient groups 1, 2, and 3, respectively.

After the removal of the ingrowing edge of the nail, the procedure should be combined with surgical or chemical matricectomies in order to avoid recurrences.^[2,3,6] The procedures, in which the germinal matrix is not destroyed, are associated with higher recurrence rates^[6]

Partial nail avulsion with chemical cauterization of the matrix with phenol is a successful and commonly used technique worldwide.^[1,6]

Although the phenol applications are associated with lower recurrence and postoperative pain rates, when compared to surgical treatments, the tissue damage is unpredictable and they result with longer drainage and healing times than sodium hydroxide.^[10-14]

Although there is no reported systemic side effect after phenol application for the treatment of ingrowing nail, phenol application results with chemical burn and intense inflammatory changes.^[5] The technique, duration and concentration of the application is important in determining the success of the agent in the treatment of ingrowing nail, however, there is no standardization in any of these issues.^[4]

During the procedure, achievement of homeostasis and the application of phenol, especially to the angles of matrix, are particularly important issues.^[1,4]

Phenol concentrations were reported to be between 80% and 89%, and the duration of applications were between 30 seconds and 6 minutes.^[4,5]

In most of the recent studies with extended number of patients, the duration of phenol applications were reported as three minutes.^[15-20] However, Espensen^[4] stated that two minutes of application is sufficient.

In order to observe the effects of different durations of applications on tissue, the excised nail matrices were treated with phenol for 30, 60, 90 and 120 seconds. While 30 seconds phenol

application resulted just with superficial damage and mild coagulation, 60 seconds phenol application resulted with full thickness necrosis of epithelium, complete damage of basal layer and shrinkage of dermal cells. 90 and 120 seconds phenol applications resulted with complete damage of basal layer and more intense dermal necrosis. In order to achieve complete damage of germinal matrix, phenol was reported to be applied at least for 1 minute.^[5]

It can be taken as the limitation of our study that, a control group which is treated with partial nail avulsion without phenol application was not included in the study in order to determine the relation between the duration of phenol applications and postoperative complications and recurrences.

In our study, when the absence of significant difference ($p=0.092$) between three durations of applications in terms of recurrences is considered, one minute application of phenol is suggested to be as effective as the other two, more commonly used durations. These observations are in accordance with the finding that,

in order to achieve germinal matrix damage, phenol must be applied at least one minute. The insignificant decrease in the recurrence rate with lengthening the duration of application may be related to the small number of our patients.

In this study, while the first group had better times than the other two groups in terms of mean complete healing, mean duration of drainage and tissue damage, the second and third groups did not differ in terms of postoperative complications.

Postoperative complications that occurred after one minute phenol application resolved in, and the complete healing was achieved in shorter time.

In conclusion, in the treatment of germinal matrix cauterization, one minute application of phenol is safer than two or three-minute applications. In order to compare the effectiveness of different durations of phenol applications, further studies with extended number of patients required.

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