

## Medical Treatment of Ingrown Toenails by Chemical Matricectomy Using Phenol

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### Abstract

**Background:** Ingrown toenails can be treated using a variety of surgical and non-surgical techniques. The present study determined the efficacy of phenol application for the induction of chemical matricectomy using phenol over the course of a one-year follow-up.

**Material and Methods:** A total of 70 patients underwent 99 phenol-induced toenail ablations for the treatment of stage 2-3 ingrown toenails. Patients were observed on a weekly basis until wound healing was complete and followed at regular intervals over the subsequent year to evaluate the long-term effects of phenol treatment.

**Results:** Surgical healing time ranged from 2 weeks to one month. Recurrence was observed in only 3 cases (at 3, 5, and 10 months, respectively) over the one year period of observation. Remarkable cosmetic results were achieved and the rate of success was 96.9%.

**Conclusion:** Ingrown toenails can be effectively resolved by phenol cauterization, a simple procedure which is associated with a high success rate and low morbidity. It is technically simple and associated with low morbidity and a high success rate.

### Introduction

Onychocryptosis, or ingrowth of the toenail, is a common dermatologic condition occurring with greatest frequency among adolescents and young adults. While all digits are susceptible, ingrown toenails occur most commonly in the large toe [1]. Changes in the fit of the nail plate within the lateral nail groove result in the ingrowth of the nail.

A variety of causes of ingrown nails have been proposed, including improperly trimmed nails, anatomic abnormalities, repetitive trauma, and poorly fitting shoes. Restricted activity and discomfort are associated with

ingrown toenails [2]. Toenail ingrowth in infants may occur as a result of congenital malalignment [3].

Ingrown toenails are evaluated using a staging system. Pain and edema occur in stage 1 ingrowths, while in stage 2, infection and drainage are also present. Lateral wall hypertrophy is seen in stage 3. Many chemical and surgical techniques have been established for the treatment of this condition [1, 4].

Ingrown toenails can be treated using a variety of surgical and non-surgical techniques. Conventional approaches include proper nail-



**Figure 1.** Phenol chemical matricectomy. (a) Prior to surgery, (b) Extraction of the lateral nail plate, and (c) Phenol application using a cotton tip

trimming techniques, use of topical or oral antibiotics, soaking of the foot in warm water, cauterization of granulation tissue with silver nitrate, elevation of the nail using a plastic gutter or gauze, and notching the central third of thick nails, and overall improvement of foot hygiene [2, 5, 6, 7].

### Materials and Methods

The researcher performed phenol ablation 99 times in 70 patients with stage 2-3 toenail ingrowths from October 2010 to April 2013. Criteria for exclusion from the study included the presence of vascular disease. Infections existing prior to the procedure were treated with topical and/or oral antibiotics and submersion in dilute povidone-iodine solution. The surgical procedure was initiated only once the skin fold and nail had completely dried.

**Surgical Technique:** Povidone-iodine solution was used to prepare the toe (**Figure 1a**). Anesthesia (2% prilocaine without epinephrine) was supplied using a standard digital block. A sterile tourniquet was fixed around the toe base to achieve a dry operative field after anesthesia was achieved. Lateral nail strips released from the overlying proximal nail matrix, nail fold, and nail bed using a septum elevator. Along the entire length of the lateral nail fold, a 2-3 mm nail segment was cut (**Figure 1b**) and removed using a hemostat to provide lateral matrix horn access. Debridement of the hypertrophied granulation tissue conducted prior to the application of 88% liquid phenol using stripped cotton applicators to vigorously massage the nail matrix (**Figure 1c**). Measures were taken to avoid contact of the phenol with the surrounding tissue. During the 3 minute phenol application, the cotton applicator was refreshed twice. Subsequently,

isopropyl alcohol was applied to the affected area to neutralize any residual phenol. Following removal of the tourniquet, antibiotic ointment was applied while dressing the wound with circumferential and longitudinally wrapped gauze and the dressing was secured with adhesive tape. The procedure was completed within 20 minutes.

**Postoperative Care:** Paracetamol was administered following the procedure for pain control and the dressing was removed 48 h after the operation. The patient was started on daily submersion of the affected toe in dilute povidone-iodine solution for 15 minutes prior to the application of antibiotic ointment. Treatment continued until drainage ceased, approximately 2 weeks to one month. Weekly clinical examinations were conducted until full wound healing was achieved. The wound was evaluated at each visit and the severity of tissue destruction, drainage, and pain were recorded. At 3, 6, and 12 months postoperatively, the patients were examined for recurrence. Clinical signs of regrowth of the treated nail edge, discomfort, pain, drainage, or erythema were considered evidence of recurrence as was the presence of spicule formation, suggesting incomplete destruction of the germinal matrix.

### Results

In the 70 participating patients, a total of 99 ingrown toenails were treated (male, 38; female, 32). Average patient age was  $33.5 \pm 19.03$  years (**Table 1**). Conservative measures had been previously attempted on all patients, including 18 who had previously been treated with nail avulsion. We recorded no patient complaints regarding the cosmetic outcomes or the occurrence of any postoperative complications. Complete healing occur-

**Table 1.** Results of Patients (n)

Phenol chemical matricectomies	99
Patients	70
Male	38
Female	32
Bilateral ingrowing toenail	29
Monolateral ingrowing toenail	41
Age, mean $\pm$ standard deviation	33.5 $\pm$ 19.03

red within one month. Recurrence of nail ingrowth was observed on three separate occasions at 3, 5, and 10 months after matricectomy. A 96.9% surgical success rate was determined after one year of follow up.

### Discussion

Patients with stage 2-3 ingrowth of the toenail often undergo surgical treatment. Unacceptably high recurrence rates, poor cosmetic results, and significant postoperative pain have been associated with conventional surgical treatments [7, 8]. Published studies indicate that total nail avulsion is associated with a recurrence rate of 83% and simple nail edge removal has a recurrence rate of 39%, while soft tissue resection may cure as many as 60% of cases [7, 8, 9, 10, 11]. A 12-30% rate of recurrence has been reported following wedge resection [8, 12, 13]. Success rates of 95% are associated with excision of the proximolateral matrix segment. The technical difficulty of this procedure is a significant barrier, and overaggressive bone destruction can lead to complications including osseous infections [14]. Removal of the distal phalanx is cosmetically unacceptable. Cryotherapy is associated with a high rate of recurrence (36%) [15].

The use of liquid phenol for segmental matrix cauterization with liquefied phenol is an effective means of permanently eliminating the lateral matrix. Phenol (carbolic acid; C<sub>6</sub>H<sub>5</sub>OH) is a colorless crystal isolated from coal tar. In concentrated form, liquid phenol has anesthetic, antibacterial, and escharotic effects. A high concentration of 88% phenol is necessary for matricectomy. Phenol rapidly denatures the matrix and any other soft tissue it contacts [7, 16, 17].

The objective of therapy is the destruction of the lateral matrix horns and the inhibition of continued growth of the lateral nail plate within the nail fold. The technique was first applied in the 1950s and is widely used. Contraindications of chemical matricectomy include delayed wound healing, vascular disease, and allergic response [18, 19].

Surgical technique is critical in avoiding recurrence; the following method is recommended: [5, 20],

1. Remove a sufficient width of the nail (3 mm).
2. Avoid leaving nail spicules under the eponychium or in the sulcus or.
3. Sterile cotton-tipped applicators must be used to vigorously massage phenol into the matrix area for > 3 min.
4. Blood partially neutralizes the effects of the phenol; therefore, complete hemostasis must be obtained.

In the present study, phenol matricectomy was performed in accordance with these technical specifications. The recurrence rate was 3.1% after 10 months of follow-up. The patients with recurrence had previously undergone total nail extraction twice. Complications, such as spicule formation, infection, tissue necrosis, pain, exudative fluid leakage, and periostitis, have been reported in association with phenol matricectomy [7, 20, 21]. Aksakal et al. [21] reported a significant reduction in the exudative fluid leakage with the application of 20% ferric chloride followed by phenolization. The lack of spicule formation in all patients in the current study indicates that the technique is particularly important.

### Conclusion

We propose that phenol matricectomy should be the preferred for first-line management of ingrown toenails, because it offers low recurrence rates, the possibility of performing the procedure on an outpatient basis in approximately 20 minutes, and a return to daily activities within a couple of days.

### Conflict of Interest

No conflict of interest was declared by the authors.

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