

## Mechanical Nail Abrasion Uses beyond the Nail Plate

Alejandra Ávila Álvarez<sup>1\*</sup>, María Camila Vélez Pelaez<sup>2</sup> and Luz Marina Gómez Vargas<sup>3</sup>

<sup>1</sup>Phillip Frost Department of Dermatology & Cutaneous Surgery University of Miami Miller School of Medicine Miami, FL, USA

<sup>2</sup>Dermatology Department, Faculty of Health Science, Universidad Pontificia Bolivariana, Medellín, Colombia

<sup>3</sup>Soma Clinic. Private Practice.

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### ABSTRACT

Mechanical abrasion is a technique used in the treatment of nail diseases, mainly onychomycosis. The utility of this tool on nail bed diseases has not been widely described. In this brief review, we report our technique and its benefit based on the tissue response to the mechanical forces and heat generated during this procedure.

**Keywords:** Nail diseases, Dermatology, Hand dermatoses

### INTRODUCTION

Mechanical nail abrasion has classically been described as a procedure that involves sanding down the nail plate to reduce its thickness or destroy it completely [1]. Typically, this technique has been used to reduce the width of the nail and create vertical holes in its surface [1]. Its use has been focused mainly on the treatment of onychomycosis, a condition in which it acts as an adjuvant tool by reducing the fungal load and increasing the permeability to topical antifungals [2]. In this context, it has also been used in a localized way, to obtain samples for fungal test in the closest region of the nail plate where there is a greater amount of active fungus [3].

Its use in non-infectious conditions has been described few times for the drainage of subungual hematomas [1], the treatment of ingrown toenails [2], and more recently in a case of onychodystrophy [5]; however, its functionality in these indications is also limited to the nail plate.

In this review, we propose the use of this technique in the nail bed based on our clinical experience for the management of nail deformities in which the nail bed has disappeared due to chronic onycholysis and other disorders associated with nail bed damaged.

### REVIEW

Onycholysis is when the nail plate separates from the nail bed. A fungal nail infection, nail injury, reaction to chemicals (like nail polish), and nail psoriasis are some possible causes [6]. Its prolonged presence can lead to a condition described since 2005 as a disappearing nail bed (DNB), in which this separation leads to abnormal

keratinization of the nail bed with the appearance of dermatoglyphics [7].

DNB is an entity difficult to manage, a recent review of the literature describes conservative therapies such as the use of adhesive tape, cosmetic camouflage, or the use of wide shoes and more invasive surgical methods such as serial excisions and hard palate flaps [8].

As we described in a previous publication, the nail bed is a highly dynamic tissue that responds to the forces applied to it, and its integrity directly affects the morphology of the nail plate and the shape of the fingertip [9]. Based on our clinical experience (**Figure 1**), we describe below our technique for mechanical abrasion on the nail bed and its mechanism of action.

**Corresponding author:** Alejandra Maria Avila-Alvarez, Dr. Phillip Frost Department of Dermatology & Cutaneous Surgery University of Miami Miller School of Medicine 3880 Bird Road, 31146 Miami, FL, USA, Tel: 786 860 0127; E-mail: alejavila1402@gmail.com

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**Figure 1.** Improvement after Treatment with Mechanical Abrasion in Two Patients. A-B Patient One. C-D Patient Two. A: Before picture of the first patient shows a dystrophic nail, DNB, and hyperkeratotic nail bed; B: Improvement 6 months after treatment; C: Before picture of the second patient shows toenail with parrot beak nail dystrophy; D: Improvement 6 months after treatment.

## PROCEDURE

### Tools

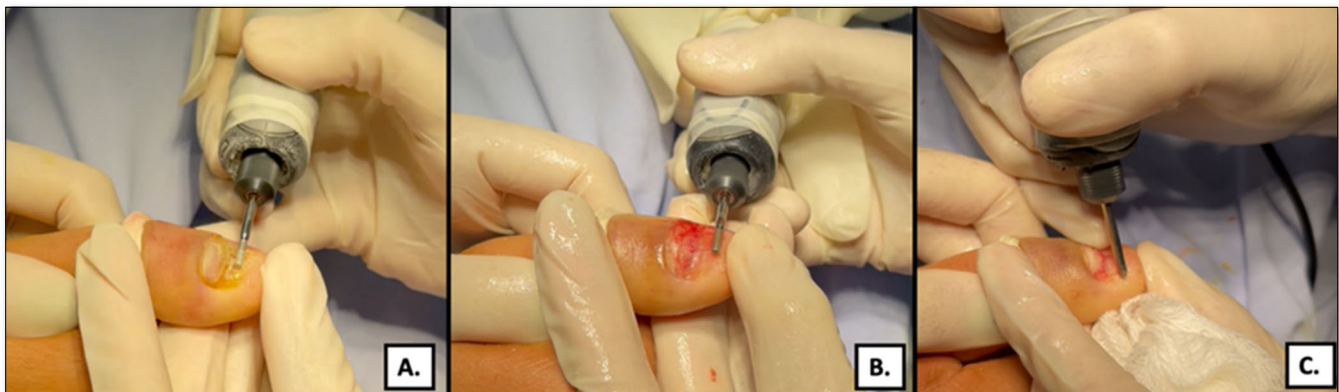
We use a drill with adjustable speed that could be modified according to each indication or condition, from 5000 to a maximum of 22,000 revolutions per minute (rpm). We use granite, diamond, and tungsten tips, with several shapes and diameters, to remove the impaired portion of the nail plate and reach the affected nail bed.

### Technique

Previous reports have described good tolerance to nail abrasion without anesthesia [2]; however, since in our

technique we affect the nail bed, hyponychium, and nail folds, which are highly sensitive structures, we prefer to perform it under local anesthesia with digital block and/or sedation, which allows a comfortable and safe procedure for both, the patient and physician.

We use cylindrical tips to remove the affected nail plate and the nail bed hyperkeratosis (**Figure 2A**), the treatment endpoint is to achieve punctate bleeding at this level (**Figure 2B**). If the periungual folds are also altered, we treat them with a triangular tip (**Figure 2C**).



**Figure 2.** Mechanical Dermabrasion of The Nail Bed Was Performed in Patient Number One.

If the nail bed is deformed or displaced to one side, we can use part of the excess nail plate as a splint or a wooden splint

covered with Vaseline gauze dress, this allows the nail bed to remain flattened and not retract. (**Figures 3A-B**).



**Figure 3.** Postoperative Care of Patient 2.

*A: Splint with a Piece of Wood Covered by Gauze with White Petrolatum; B: Appearance of the Bed in the First Postoperative Check-Up, 48 h After the Procedure; C: Taping on the Hyponychium and Lateral Folds.*

During the procedure, alcohol is used to keep the treated area clean and wet and to control the temperature generated by the procedure.

#### Post Procedure Care

After the procedure, the area is covered with a Vaseline gauze dress, which is removed after 48 h (**Figure 3B**). Subsequently, according to the inflammation and pain, once the patient tolerates it, complementary techniques, such as taping, are started. Taping on the nail folds allows adequate growth of the nail plate over the treated nail bed (**Figure 3C**). This therapy is maintained until the nail completes its growth.

- A. Removal of nail bed hyperkeratosis with a cylindrical tip.
- B. Pinpoint bleeding from the nail bed, treatment includes the area of the nail bed that has disappeared.
- C. Remodeling of the nail folds using a triangular tip.

#### Biosecurity

There are not many studies that evaluate the biosecurity of this procedure in terms of exposure to debris generated during its performance. A study carried out in 1984 studied the effects of the aerosols generated during this procedure in podiatrists chronically exposed to them, and found symptoms of rhinitis, conjunctivitis, and cough, among others [10].

A more recent study evaluated fungal viability by collecting nail dust from gloves and masks used in 9 patients with onychomycosis who underwent this procedure. They found hyaline hyphae; however, they were morphologically deformed and there was no growth of any fungus in cultures in the Mycosel medium [11].

With current evidence, no cutaneous or systemic mycoses associated with exposure to these aerosols have been demonstrated. However, the use of gloves, protective

glasses, and a mask, ideally N95, is recommended during procedure [11].

#### MECHANISM OF ACTION

##### Mechanical Forces

Mechanical dermabrasion allows removing hyperkeratosis from the nail bed so that it becomes flattened; The advantage of this change lies in the fact that there are stem cells mainly in the most proximal portion of the nail bed and it has been shown that under normal conditions the cells that make up the nail bed move distally towards the hyponychium [12]. The rectification of the bed that is achieved with dermabrasion could restore this normal migration of the nail bed.

In addition to this, the nail plate that slides longitudinally “pushes” and continues flattening the nail bed to fit its corresponding space, supporting the adhesion and prolongation of the new plate.

##### Heating and Tissue Debridement

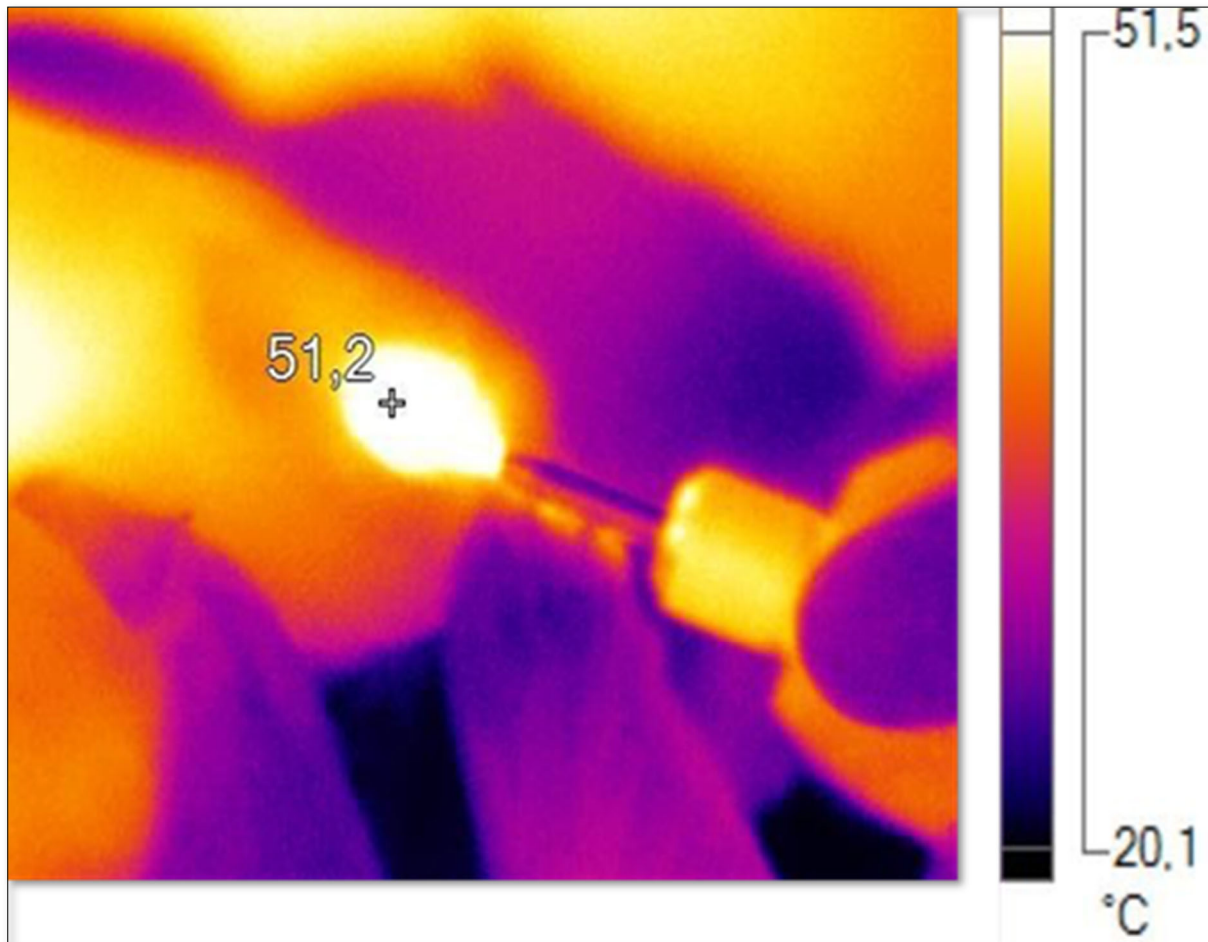
During our procedures, we have made thermographic readings to evaluate the temperatures reached during its realization (**Figure 4**). Depending on the speed of the drills and the material of the tip (granite, diamond, and tungsten), the device and consequently the tissue can reach high temperatures between 40 and 55 degrees Celsius (104- and 131 degrees Fahrenheit).

The Heating makes easy the abrasion of the hyperkeratosis, the debridement of biofilms (in cases of onychomycosis) [13,14] and the receding of the DNB, inducing slight bleeding.

#### CONCLUSION

The use of mechanical dermabrasion in the nail unit should not be limited solely to the control of diseases confined to the nail plate. The nail bed is a dynamic tissue; its

manipulation through this procedure can allow the management of entities such as the DNB.



**Figure 4.** Thermographic image during mechanical dermabrasion. A temperature of 51 degrees celsius is registered.

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