



# The Mozena Classification System and Treatment Algorithm for Ingrown Hallux Nails

John D. Mozena, DPM\*

Infected ingrown toenails raise the question of how much nail should be removed and what amount of nail fold reduction should occur. Often, the unguis labia folds are found to be hypertrophic, forcing the nail to push into the flesh and start a foreign body reaction. A simplified approach to this problem is proposed on the basis of the measurement of 100 normal nail folds and 25 infected nail folds. The results of this study show that the treatment goal should be to achieve an unguis labia fold of less than 3 mm, concluding that there is a correlation between the depth of the unguis labia fold and the severity of the infected ingrown toenail. (*J Am Podiatr Med Assoc* 92(3): 131-135, 2002)

Ingrown toenails have multiple causes, including faulty nail trimming, excessive sweating, tight footwear, poor hygiene, excessive weight, inherited factors, and trauma. Two anatomical causes include abnormally shaped nail plates and hypertrophic unguis labia folds. The external factors can be treated conservatively, but the anatomical causes may require surgical intervention.<sup>1</sup>

Onychocryptosis has been associated with the abnormally shaped nail itself. However, studies have shown that nail shape is not the primary cause of ingrown toenails, which leaves the hypertrophic unguis labia fold as a chief cause of the malady. In fact, nail fold involvement has been indicated in 72% to 84% of cases. In the author's practice, more than 5,000 ingrown toenail procedures have been performed, including simple avulsion, phenolization, sharp dissection matrixectomy, and laser matrixectomy. Empiric observation has also indicated that matrixectomy alone often requires excessive nail removal if the hypertrophic unguis labia folds are not removed.<sup>1,3</sup>

The objective of this study was to identify the normal and pathological depths of unguis labia fold, since an abnormal fold can lead to an infected ingrown toenail. The information gained about abnor-

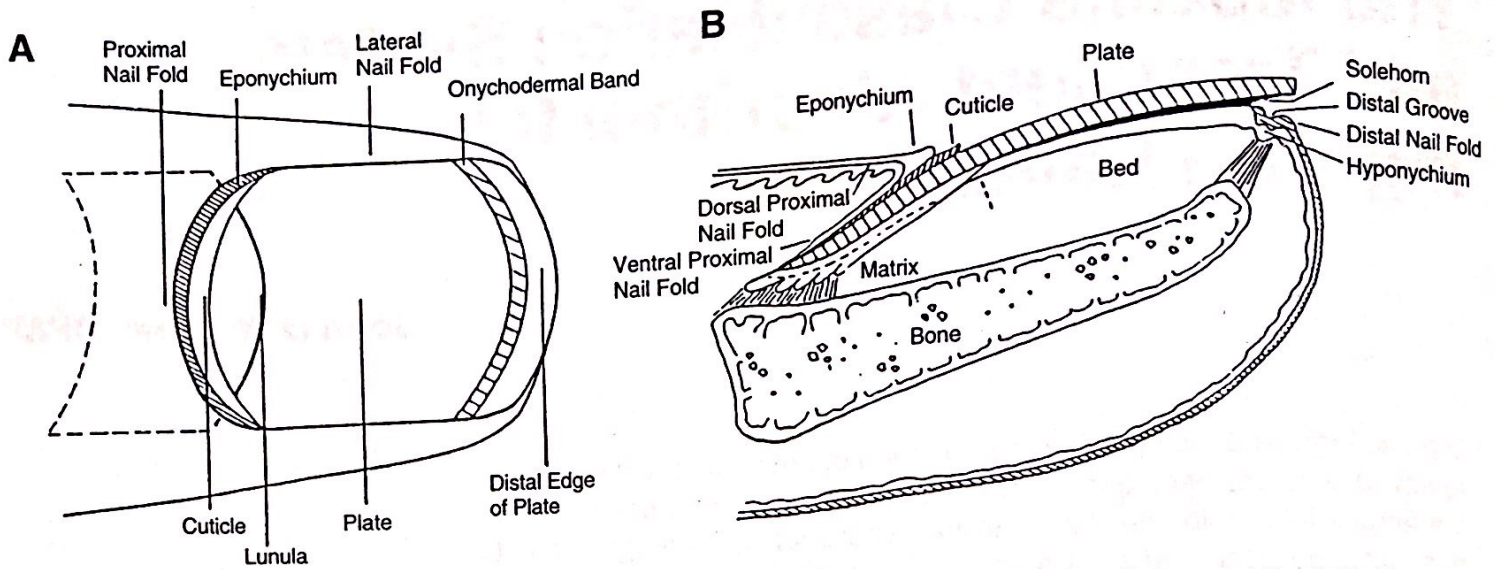
mal nail fold depth can assist in creating a treatment regimen.

Nails function to protect and to perform sensory discrimination. The nail plate acts as a buttress that opposes pressure on the finger or toe, increasing the discrimination ability of the acral pulp and skin when the object is felt. Without the nail, the skin around the digit would deform, and fine proprioception would not be possible.<sup>4</sup>

The proximal nail fold (Fig. 1) is known as the eponychial area. This is where nail growth begins, and the growth cells extend out to the distal end of the lunula. The nail itself consists of three layers: the dorsal, the intermediate, and the ventral. The dorsal layer is the horny zone, which consists of hard keratin. The ventral nail plate layer is held to the nail bed by a specialized onychodermal band known as the solehorn. Distally, the nail separates from the solehorn at the hyponychium. The medial and lateral unguis labia fold enclose the nail and complete the nail unit.<sup>4,5</sup>

The first excision of the ingrown nail and cautery of its granulation tissue was described by Abu-al-Qusin around 1000 AD. These procedures changed very little until a chiropodist, Lewis Durlaber, reviewed and tried to modify the savage practices used to remove the ingrown nail in the early 1800s. In 1853, Gosselin first proposed a procedure that dealt

\*Diplomate, American Board of Podiatric Surgery; Fellow, American College of Foot and Ankle Surgeons; private practice, 8305 SE Monterey, Suite 101, Portland, OR 97266.



**Figure 1.** Nail anatomy. A, Sagittal view of the nail unit (reprinted with permission from Scher and Daniel<sup>5</sup>); B, cross-section view.

with the nail fold by removing an elliptical, wedge-shaped piece of nail. In 1899, Foote appeared to be the first to be concerned with the functional and cosmetic result of what he described as a "barbarous operation." His procedure was very similar to that of the modern-day Winograd.<sup>6</sup>

DuVries was the first to recognize the importance of the hypertrophic unguis labia fold by removing the nail fold and sewing the edge directly into the nail bed. Later, aggressive operations included the terminal Syme's amputation, which was described in 1951 by Thompson and Terwilliger. A less aggressive procedure was advocated by Ross; it used liquefied phenol, also known as carbolic acid, to denature the matrix tissue. This simplified procedure provided a more conservative approach, and when it was performed by an experienced physician, it killed only matrix tissue. The latest innovation in nail surgery is the CO<sub>2</sub> laser, which can ablate both matrix and soft-tissue nail fold with its precision cuts. This technique has resulted in considerably less postoperative discomfort than surgical excision.<sup>3, 5, 7</sup>

## Classification

### Classification According to Severity

Heifetz<sup>8</sup> and Mogensen<sup>9</sup> proposed a simplified system for classifying the severity of ingrown toenails according to their signs and symptoms. Zuber and Pfenninger<sup>10</sup> added treatment options for the different stages of the classification system.

In Stage I, there is evidence of slight edema and erythema in the nail fold, and mild pressure on the

nail fold can elicit mild pain. The treatment for the virgin nail infection in Stage I is conservative. Conservative care includes soaking, proper shoe fit, topical antibiotics, and lateral fold protection such as cotton wadding. Nail avulsions have been used with poor success, with a recurrence rate for nail avulsion approaching 80%.<sup>10-15</sup>

Stage II exhibits Stage I signs and symptoms, but drainage and infection are also noted. This stage can be managed conservatively or surgically. In Stage III, the signs and symptoms of Stage II are magnified. The surgical management of Stages II and III can be confusing in terms of whether the nail fold should be addressed or not, as there appears to be no guiding principle for when to address unguis labia fold hypertrophy.<sup>12</sup>

### The Mozena Classification System

The previous classification systems lack any reference to the importance of the unguis labia folds. To rectify this significant omission, the Mozena Classification System was proposed (Table 1). In Stage I, the unguis labia fold is less than 3 mm, and the ingrown nail is treated conservatively. At Stage II, the Mozena Classification System begins to differ from previous classification systems in that it is divided into Stages IIa and IIb. Stage IIa requires conservative care and/or a matrixectomy. In Stage IIa, the nail fold is less than 3 mm, whereas in Stage IIb the nail fold is 3 mm or greater. The treatment in Stage IIb should include a matrixectomy and nail fold reduction.<sup>12</sup>

The final stage is a more severe hallux ingrown toenail. Stage III exhibits the signs and symptoms of

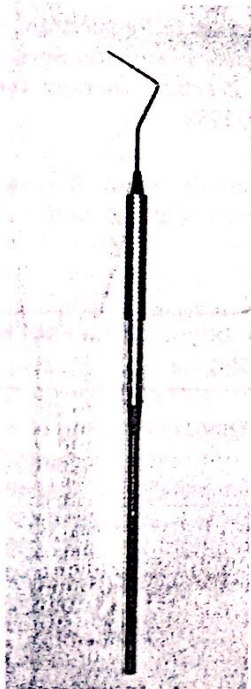
**Table 1. The Mozena Classification System for Treatment of Ingrown Nails**

Stage	Signs and Symptoms	Treatment
I	Erythema, slight edema, and pain when pressure is applied to the lateral fold	Conservative
IIa	Increased Stage I symptoms, drainage and infection, nail fold less than 3 mm	Conservative and/or matrixectomy with hypertrophic unguis labia fold reduction
IIb	Increased Stage I symptoms, drainage and infection, nail fold 3 mm or greater	Same as Stage IIa
III	Magnified Stage II symptoms, presence of granulation tissue and nail fold hypertrophy	Matrixectomy with hypertrophic unguis labia fold

Stage II, but they are magnified. The toe in this stage is marked by granulation tissue and an enlarged unguis labia fold. Stage III treatment should focus on reducing the hypertrophic nail fold and permanently reducing nail width.

## Materials and Methods

This clinical study retrospectively reviewed 100 patients with no history of ingrown nails. To standardize measurements, only the central portion of the medial nail fold on the right hallux was measured. The measurement was accomplished by means of a periodontal probe, which was graduated in 1-mm increments (Fig. 2). The measurement results of the 100 patients



**Figure 2.** Periodontal probe.

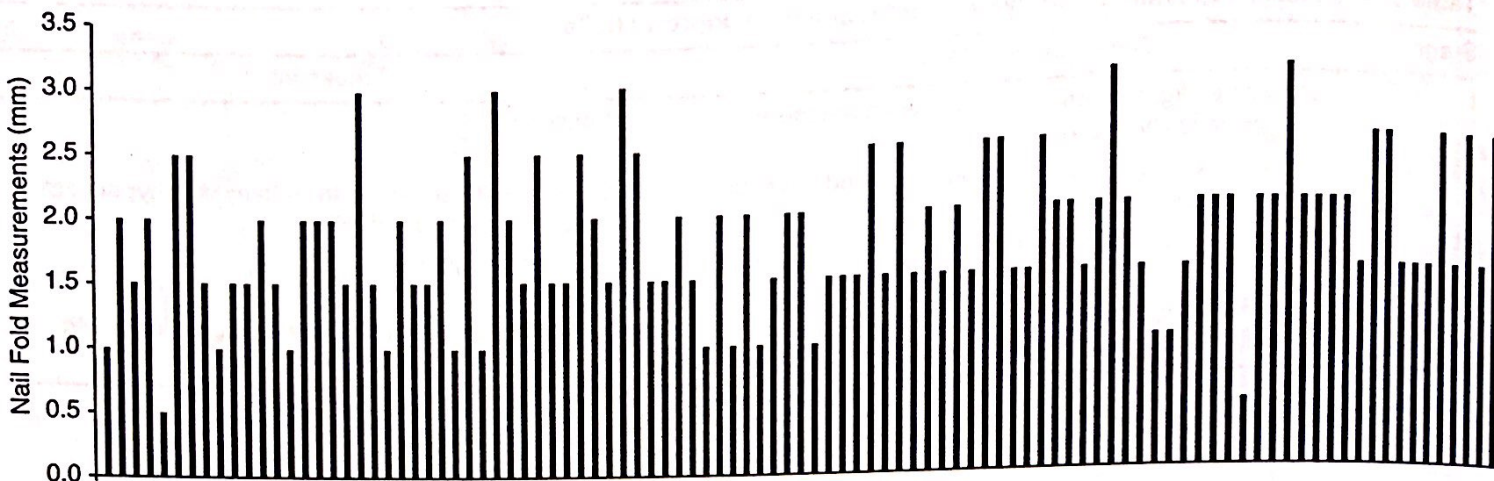
appear in Figure 3. Twenty-five Stage IIb and Stage III nails were also measured to prove that nail fold depth was greater in these stages (Fig. 4). The measured depths were averaged and standard deviations were calculated. Complete statistical analyses are presented in Tables 2 and 3.

## Results

The average nail fold measurement for the group of patients with no history of ingrown nails was 1.8 mm (Fig. 3), with a range from 0.5 to 3 mm. From these measurements, it was determined that a normal unguis labia fold depth was less than 3 mm. The goal of treatment is for a normal fold depth to be achieved with matrixectomy and nail fold reduction (Figs. 5-8). Complete results of the normal and abnormal nail fold measurements can be found in Figures 3 and 4.

Until now, nail surgery has been a random attack on the matrix and nail fold. In many cases, extensive nail bed mutilation was necessary to counter the hypertrophic nail fold. Many physicians ignore the unguis labia fold area because they lack an understanding of its etiology. The guidelines presented here provide a more quantitative approach to dealing with ingrown toenails. A success rate of 80% to 95% can be predicted for Stage IIb and Stage III with reduction of the nail fold and matrix tissue. It has been found that cold steel reduction or laser surgery is effective for these stages.<sup>3</sup>

Conservative care for ingrown toenails is frequently associated with high recurrence rates and may be due to its inappropriate use in higher stage problems. Conservative care can also be used in medically complicated cases of Stage IIb and III, including serious problems such as fragile diabetes, vascular compromise, neuropathy, and other life-threatening diseases. More aggressive care may be indicated in such cases, but this should be done with extreme caution and good judgment.<sup>16</sup>



**Figure 3.** Normal unguis labia fold measurements of 100 patients with no history of ingrown toenails.

**Table 2. Normal Unguis Labia Fold Measurements (mm)**

N	100
Mean	1.805
SE	0.055457
Median	2
Mode	1.5
SD	0.554572
Sample Variance	0.307551
Kurtosis	-0.243426
Skewness	0.146745
Range	0.5-3
Sum	180.5

$P = .001; z = 21.5487.$

## Conclusion

This article has presented a new classification system that should allow the treating physician to better recognize the ingrown nail and to have a greater understanding of its pathology and etiology. This understanding should lead to more effective treatment of the ingrown nail and hypertrophic unguis labia fold.

## References

1. LANGFORD DT, BURKE C, ROBERTSON C: Risk factors in onychocryptosis. *Br J Surg* 76: 45, 1989.
2. PEARSON HJ, BURG RN, WAPPLES J, ET AL: Ingrowing toenails: is there a nail abnormality? *J Bone Joint Surg Br* 69: 840, 1987.
3. SIEGLE RJ, STEWART R: Recalcitrant ingrowing nails: surgical approaches. *J Dermatol Surg Oncol* 18: 744, 1992.
4. FISHMAN HC: Practical therapy for ingrown toenails. *Cutis* 32: 159, 1983.

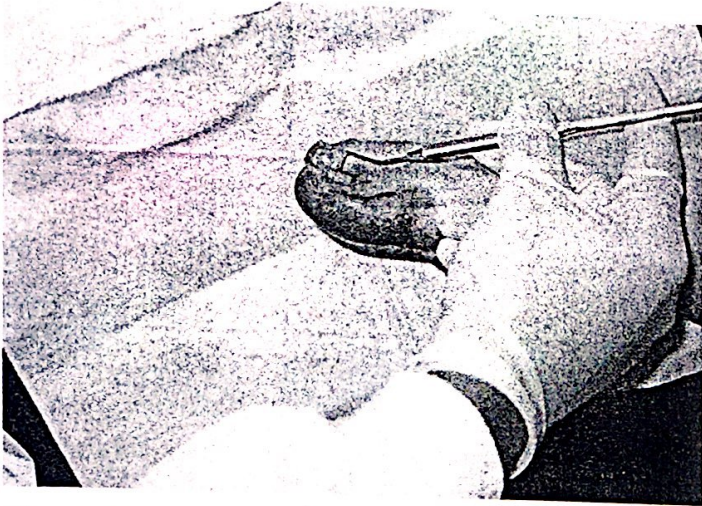


**Figure 4.** Abnormal unguis labia fold measurements of 25 patients with Stage IIb and Stage III ingrown toenails.

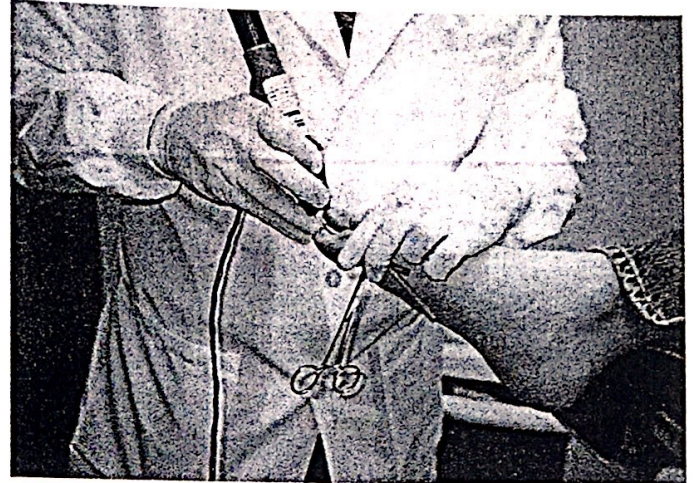
**Table 3. Abnormal Unguis Labia Fold Measurements (mm) for Stage IIb and Stage III**

N	25
Mean	4.7
SE	0.294392
Median	5
Mode	5
SD	1.47196
Sample Variance	2.166667
Kurtosis	0.529948
Skewness	0.967074
Range	3-8
Sum	117.5
Confidence Level (95%)	0.607595

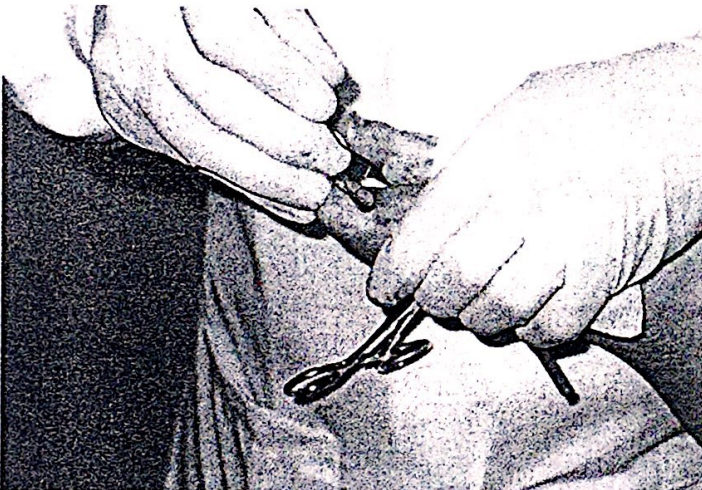
$P = .089; t = 1.20.$



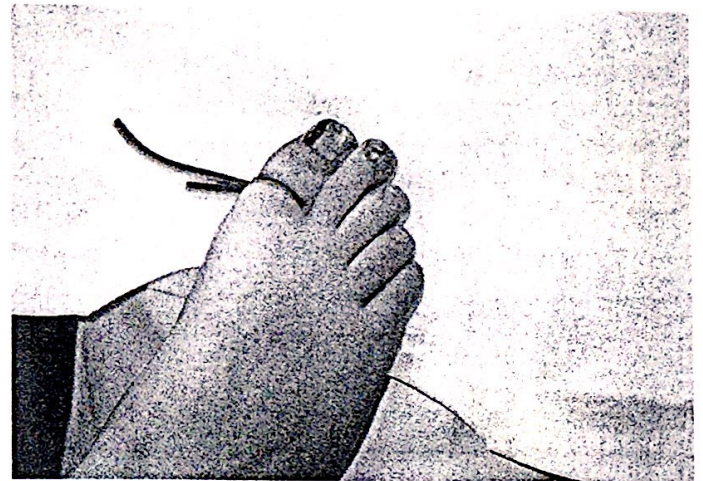
**Figure 5.** Preoperative nail fold measurement of the unguis labia fold.



**Figure 6.** Intraoperative matrixectomy and nail fold reduction with the laser.



**Figure 7.** Postoperative nail fold reduction management of the unguis labia fold.



**Figure 8.** Final result after laser matrixectomy and nail fold reduction.

5. SCHER RK, DANIEL CR: *Nails: Therapy, Diagnosis, Surgery*, p 13, WB Saunders, Philadelphia, 1990.
6. LAPIDUS P: "The Toenails," in *Disorders of the Foot*, ed by M Jahss, p 914, WB Saunders, Philadelphia, 1982.
7. HANKEKE E: Surgical treatment of ingrowing toenails. *Cutis* **37**: 251, 1986.
8. HEIFETZ CJ: Ingrown toe-nail. *Am J Surg* **38**: 298, 1937.
9. MOGENSEN P: Ingrowing toenail: follow-up on 64 patients treated by labiomatrixectomy. *Acta Orthop Scand* **42**: 94, 1971.
10. ZUBER TJ, PFENNINGER JL: Management of ingrown toenails. *Am Fam Physician* **52**: 181, 1995.

11. GOLDBERG DJ: Laser surgery of the skin. *Am Fam Physician* **40**: 109, 1989.
12. GREIG JD: Results of surgery for ingrowing toenails. *J Bone Joint Surg Br* **71**: 859, 1989.
13. GREIG JD, ANDERSON JL: The surgical treatment of ingrowing toenails. *J Bone Joint Surg Br* **73**: 131, 1991.
14. LATHROP RG: Ingrowing toenails: causes and treatment. *Cutis* **20**: 119, 1977.
15. HADLEY DL: The treatment of ingrowing and horny toenails. *Practitioner* **229**: 833, 1985.
16. REIJNEN JAM, GORIS RJA: Conservative treatment of ingrowing toenails. *Br J Surg* **76**: 955, 1989.