

# A Case of Median Nail Dystrophy Treated with Poly Urea-Urethane Solution

Sergey Petrosian, BS,\* Shane Meehan, MD,\*\* Stephanie Lasky, DO,\*\* Peter Saitta, DO\*\*\*

\*Medical Student, 4<sup>th</sup> year, New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY

\*\*Dermatology Resident, 2<sup>nd</sup> year, St. John Episcopal Hospital, Far Rockaway, NY

\*\*\*Dermatologist and Clinical Instructor, Ronald O. Perelman Department of Dermatology, New York University School of Medicine, New York, NY

## Abstract

We present a case of median canaliform nail dystrophy (MND) cured with poly-ureaurethane 16% solution (Nuvail®, Innocutis Holdings LLC, Charleston, South Carolina). **Case:** A 59-year-old Caucasian male with a six-year history of a disfigured right thumb nail and no other co-morbidities or relevant history presented to the clinic. Physical examination showed a midline fissure in the right thumbnail that ran from the lunula to the distal nail fold, accompanied by transverse fissuring. The remainder of the fingernails were normal. The history and physical examination lead to a diagnosis of median nail dystrophy. **Management and Outcome:** There is no standard therapy for MND. The patient was started on poly-ureaurethane 16% solution applied once a day. Follow-up visits were scheduled at one-month intervals. The patient's nail showed a gradual improvement and the condition was cured in three months' time. **Discussion:** A mechanism of action for the poly-ureaurethane 16% solution used to treat the patient is proposed. **Conclusion:** We believe the mechanism was two fold. First, the solution allowed a protective physical barrier for the nail to prevent micro and macro trauma. Second, the properties of the ureaurethane helped promote the growth of new healthy nail.

## Introduction

Median canaliform nail dystrophy (MND) is also known as dystrophia unguium mediana canaliformis and median canaliform dystrophy of Heller.<sup>1</sup> It is an unusual condition that typically affects the thumb, but can affect other fingers or toes. It is characterized by a median longitudinal canal or splitting of the nail. It is accompanied by small lateral cracks or fissures that project from the central canal toward the nail edge. These findings give the typical fir-tree pattern appearance.<sup>2</sup> The diagnosis is confirmed solely on clinical findings. Onset is usually in adulthood. Typically, patients will have had the problem for a long time and have no explanation as to why the issue is present. It is thought that the condition may be related to repetitive trauma such as picking or pushing of the cuticle. Habit-tic deformity is another nail condition with a similar presentation to MND and is also thought to be caused by repetitive unnoticed external trauma to the nail.<sup>3</sup> It is very difficult to distinguish the two, but if there is an inverted fir-tree pattern, this is more suggestive of MND. However, it is sometimes thought that the two are variants of the same disease process.<sup>3</sup>

Nail deformities frequently have unknown etiologies and can present on their own, as manifestations of cutaneous or systemic diseases or as side effects from certain drugs. The pathophysiology of MND is unclear and speculative, and there are no definitive diagnostic tests. There is also no standard therapy for treatment. All of these factors make the management of patients with median nail dystrophy difficult. Our findings are unique because it is the first time that a case of MND has been treated with poly-ureaurethane 16% nail solution and a complete cure has been documented.

## Case Report

A 59-year-old Caucasian male presented to our clinic complaining of a disfigured right thumb nail for a duration of six years. He stated that the nail initially cracked down the center and then progressively worsened. The patient also

mentioned that there were times where he believed it was getting better, but then would regress. There was no associated trauma, nor were there any complaints of pain, weakness, or numbness. The patient had no relevant medical, surgical, social or family history, and a review of systems was non-contributory.

Physical examination demonstrated a midline fissure in the right thumbnail that ran from the lunula to the distal nail fold, accompanied by transverse fissuring. There was also a yellow discoloration (**Figure 1**). The remainder of the fingernails were normal. There was no clubbing, cyanosis, or edema present, and strength and sensation were within normal limits. Based on the clinical examination, the lack of underlying systemic disease, and the absence of reported trauma, we diagnosed the patient with median canaliform nail dystrophy.

## Management and Outcome

Our patient was treated with poly-ureaurethane 16% solution applied to the affected nail one time a day for a duration of three months. During that span, the nail showed a gradual improvement, with the median nail dystrophy eventually resolving completely (**Figure 2**). The patient began using the medication within five days of the initial visit. Follow-up appointments were made at one-month intervals. After the first month, there was some improvement in the nail, the midline fissure was less pronounced and the nail base near the lunula seemed to be growing normal, healthy nail. The second visit showed significant improvement in the nail. The majority of the right thumb nail looked normal, with only the distal fourth of the nail still showing the pathology. At the third and final visit, the nail looked completely normal, with no trace of any fissures. During the treatment period, the patient had no complaints and noted no side effects from the medication.

## Discussion

The pathophysiology of MND is unknown. However it is theorized that it is the result

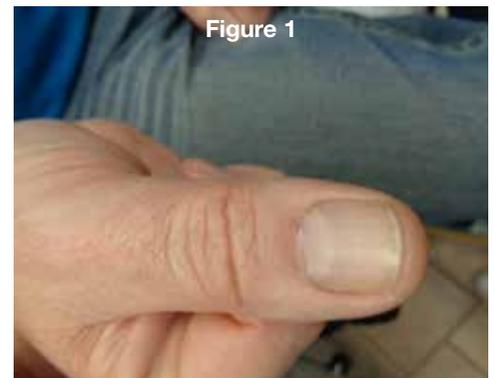


Figure 1



Figure 2

of a temporary defect in the nail matrix after dyskeratinization, hindering normal nail formation. MND has been shown to be associated with self-inflicted or job-related trauma to the nail.<sup>4</sup> Familial cases have been reported as well.<sup>5</sup>

MND development has also been reported in patients treated for acne with isotretinoin.<sup>6</sup>

MND has no standard treatment because no therapy has consistently worked and because

it often will resolve on its own without intervention.<sup>1</sup> If a medication or other offending agent is the presumed cause, removing the agent will usually result in resolution of the MND.<sup>6</sup> Possible treatments include triamcinolone acetonide injections into the nail fold and topical 0.1% tacrolimus ointment.<sup>4,7</sup> In our literature search, we were unable to find any reports of poly-ureaurethane solutions being used as a treatment for nail disorders.

We successfully treated our patient with a once-a-day application of poly-ureaurethane 16% nail solution. We believe the etiology for our patient's MND was continuous, unnoticed micro-trauma. Poly-ureaurethane 16% nail solution coats and sticks to the nail surface, providing a protective layer that prevents direct injury and scraping. Nails are somewhat permeable and allow the solution to infiltrate intercellular spaces and bind to keratin. This creates a strong water-resistant shield, while also providing mechanical support to the nail. It has been shown that poly-ureaurethane can act like scaffolding in normal tissue and binds proteins like albumin, hemoglobin, thrombin, fibrinogen, fibronectin, complement components, and immunoglobulins.<sup>8</sup> In the nail, we postulate that the poly-ureaurethane absorbs and adheres to keratin, improving the integrity of the nail and thereby preventing unnoticed trauma to the nail plate.

The functionality of the polyurethane in different applications depends on the chemistry of the polymer. Manufacturers can alter the chemistry of poly-ureaurethanes for different purposes. In experiments done with polyurethanes and vascular grafts, hydrophobic polyurethane urea grafts were found to possess superior cellular-migration characteristics versus their hydrophilic counterparts.<sup>10,11</sup> The polyurethane urea solution we used is also hydrophobic in nature.<sup>8</sup> We believe that a similar mechanism takes place in the nail, whereby the nail solution promotes cellular migration from the nail matrix to the nail plate, augmenting the formation of new, healthy nail.

## Conclusion

In conclusion, we believe the mechanism of poly-ureaurethane 16% nail solution in the MND was twofold. First, it provided physical reinforcement and a barrier for the nail. Second, it promoted the formation and growth of new healthy nail.

## References

1. Scher R, Daniel III C. Nails: Diagnosis, Therapy, Surgery. 3rd ed. Philadelphia: Saunders; 2005. p. 252-253.
2. Tosti A, Piraccini BM. Nail disorders. In: Bologna JL, Jorizzo JL, Rapini RP, editors. Dermatology. 2nd edition. St. Louis, Mo, USA: Mosby Elsevier; 2008. p. 1031.
3. Griego RD, Orengo IF, Scher RK. Median nail dystrophy and habit tic deformity: are they different forms of the same disorder? *Int J Dermatol.* 1995;34:799-800.
4. Kim BY, Jin SP, Won CH, Cho S. Treatment of median canaliform nail dystrophy with topical 0.1% tacrolimus ointment. *J Dermatol.* 2010;37(6):573-4.
5. Sweeney SA, Cohen PR, Schulze KE, Nelson BR. Familial median canaliform nail dystrophy. *Cutis.* 2005;75(3):161-5.
6. Bottomley WW, Cunliffe WJ. Median nail dystrophy associated with isotretinoin therapy. *Brit J Dermatol.* 1992;127(4):447-8.
7. Grover C, Bansal S, Nanda S, Reddy BS. Efficacy of triamcinolone acetonide in various acquired nail dystrophies. *J Dermatol.* 2005;32(12):963-8.
8. Nuvail-rx.com. Understanding Nail Dystrophy. Nuvail [Internet]. 2015 [cited 2015 Aug 8]. Available from: <http://nuvail-rx.com/understanding-nail-dystrophy/>.
9. Biocompatibility of Polyurethanes. Madame Curie Bioscience Database [Internet]. Austin, TX: Landes Bioscience; 2000. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK6422/>
10. Guidoin R, Sigot M, King M. et al. Biocompatibility of the Vascugraft®: Evaluation of a novel polyester urethane vascular substitute by an organotypic culture technique. *Biomaterials.* 1992;13:281-8.
11. Sigot-Luizard MF, Sigot M, Guidoin R. et al. A novel microporous polyurethane blood conduit: Biocompatibility by assessment of the UTA arterial prosthesis by an organo-typic culture technique. *J Invest Surg.* 1993;6:251-71.

**Correspondence:** Sergey Petrosian;  
Spetrosi@nyit.edu