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NAIL PLATE RESTORATION AFTER AGGRESSIVE NAIL PROCEDURES

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Abstract
Aggressive nail procedures (intensive filing/grinding, frequent removal of durable coatings, prolonged exposure to solvents, trauma to the cuticle and nail folds) can lead to a decrease in the thickness and strength of the nail plate, splitting (onychoschisis), longitudinal fragility (onychorrhexis), onycholysis, and chronic inflammation of the periungual tissues. Nail restoration is determined by the physiology of growth from the matrix and the reversibility of structural changes in keratin; clinically, reducing re-trauma, normalizing hydration, and using products that improve the mechanical properties of the nail plate are important. This article summarizes the mechanisms of nail damage during cosmetic procedures and presents practical restoration measures based on clinical reviews and studies on nail barrier properties and the treatment of fragility.

Key words: Nail plate, brittle nails, onychoschisis, onychorrhexis, onycholysis, acetone, nail hydration, biotin, hydroxypropyl chitosan.

Introduction

The scientific novelty of the article lies in the comprehensive analysis of the mechanisms of damage to the nail plate during aggressive nail procedures and their linkage with a physiologically based recovery algorithm that takes into account nail growth, water balance, and barrier properties of the nail plate.
The nail plate is a specialized keratinized structure formed by a matrix and possessing pronounced barrier and mechanical properties. Modern reviews emphasize that the nail is a "formidal barrier" with a dense microstructure and specific composition, and its transport and mechanical properties are significantly dependent on the physicochemical parameters of the environment, primarily water content [1]. In practical terms, this means that any influences that alter the

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thickness of the nail plate and its hydration (intensive filing/ buffing, frequent removal of coatings, contact with solvents) can lead to a clinically significant decrease in strength, increased fragility, and delamination.

Aesthetic nail procedures are a common source of exogenous damage to the nail apparatus. A dermatological review of cosmetically induced nail diseases describes complications associated with both manicure technique (excessive buffing, trauma to periungual tissues) and the processes of applying/removing coatings and the materials used [2]. Clinically, phenotypes of nail fragility (onychoschisis, onychorrhexis, " worn-down" nails "), as well as onycholysis and inflammation of the periungual folds, which can reduce the quality of life and limit the further use of cosmetic coatings.

A key physiological factor determining both the development and reversibility of these disorders is water balance in the nail. Experimental data on equilibrium water sorption demonstrate that the physical and transport properties of keratinized tissues are closely linked to hydration levels; the nail is characterized by significant changes in water content with changes in relative humidity, which is consistent with the observed clinical dependence of fragility on "wetting-drying" cycles [3]. Therefore, nail plate restoration after aggressive exposure should be considered as a process that includes cessation of re-trauma, normalization of hydration and operating conditions of the nail, and maintenance of the mechanical properties of the growing plate.

With the growing popularity of durable nail polishes and the frequency of procedures, the need for evidence-based approaches to nail rehabilitation is increasing. This study aims to summarize the mechanisms of nail plate damage during aggressive nail procedures and systematize restoration measures based on data on the barrier properties of the nail and clinical guidelines for the management of brittle nails and cosmetically induced lesions.

"Aggressive" nail procedures are defined as cosmetic interventions involving repeated mechanical, chemical, or physical stress that exceeds the adaptive capacity of the nail apparatus. These include excessive filing and buffing of the nail plate, frequent removal of durable coatings using acetone-containing solvents (including under occlusion), regular trauma to the cuticle and proximal nail fold,

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and prolonged wear of artificial coatings with repeated application-removal cycles without a recovery period. Clinical reviews of cosmetically induced nail diseases emphasize that it is the combination of technique and frequency of procedures that determines the risk of damage, not a single exposure [2].

The danger of such procedures stems from the anatomical and physiological characteristics of the nail. Excessive filing leads to thinning of the nail plate and a decrease in its mechanical strength, which clinically manifests as brittleness and delamination (onychoschisis , onychorrhexis). Prolonged contact with solvents and dehydration disrupt the nail's water balance, depriving it of its main "plasticizer"-water- which further reduces elasticity and resistance to stress [4]. Traumatization of the cuticle and periungual folds disrupts the barrier function and promotes inflammation and secondary infections, which can indirectly impair the quality of the regrowing nail plate [5].

Thus, aggressive nail procedures are dangerous because they cause cumulative damage to the nail plate and surrounding tissues, and restoration is possible only as a new, structurally intact part of the nail grows back, provided that repeated injury ceases.

Damage to the nail plate after aggressive nail treatments is cumulative and caused by a combination of mechanical, chemical, and barrier factors. Understanding the pathophysiological mechanisms allows us to develop a rational restoration strategy focused not on "repairing" already damaged keratin, but on creating conditions for the formation of a high-quality new nail plate .

Mechanical damage and thinning of keratin. The nail plate consists of tightly organized keratin layers with limited self-healing capacity. Excessive filing and grinding lead to a decrease in plate thickness and disruption of its microstructure, which reduces mechanical strength and increases susceptibility to splitting and longitudinal fragility. Clinical reviews of brittle nail syndrome emphasize that repeated mechanical trauma is a leading factor in the development of onychoschisis and onychorrhexis [5].

Water imbalance and dehydration. Water is a key physiological component of the nail plate and acts as a "plasticizer," ensuring its elasticity. Experimental studies have shown that the water content of the nail significantly affects its mechanical

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properties, and dehydration leads to increased fragility [4]. Frequent use of acetone solvents and "occlusion-evaporation" cycles when removing coatings increase water loss, creating a functionally weakened nail.

Inflammation and secondary effects of periungual tissues. Although the nail plate itself is a strong barrier, damage to the cuticle and proximal nail fold disrupts the matrix's protection. Chronic microinflammation in this area can indirectly impair the quality of the newly formed nail plate, as has been described in cosmetically induced nail lesions [4].

Given these mechanisms, nail plate restoration should be viewed as a physiological process of regrowth, not repair of already damaged keratin. Key principles include: preventing re-injury, normalizing water balance, protecting against chemical and mechanical stress, and maintaining the mechanical properties of the nail during growth. This approach is consistent with current clinical guidelines for the management of brittle nails.

Table 1 - Pathophysiological mechanisms of nail damage and the logic of restoration

Damage mechanism	**Pathophysiological basis**	**Clinical manifestation**	**Recovery logic**
Excessive sawing	Thinning of keratin layers	Brittleness, delamination	A break from aggressive procedures, protection of the plate
Dehydration	Loss of water – the nail's "plasticizer"	Fragility, cracks	Maintaining hydration, reducing solvents
Chemical irritation	Damage to keratin and skin properties	Dryness, sensitivity	Minimize contact with acetone
Cuticle injury	Barrier insufficiency	Inflammation, slow growth	Gentle treatment, barrier restoration
Cumulative impact	Chronic structural weakening	Persistent fragility	Long-term rehabilitation taking into account nail growth

Nail plate restoration after aggressive nail procedures should be based on the physiology of nail growth and proven damage mechanisms. Since already formed keratin in the nail plate lacks the ability to repair itself, any restorative measures

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are aimed at creating optimal conditions for the regrowth of a new, structurally sound plate and temporarily improving its mechanical properties.

The most significant and proven factor in recovery is eliminating the causative agent. Clinical reviews of cosmetically induced nail lesions emphasize that without a break from aggressive procedures (excessive filing, frequent removal of coatings, cuticle trauma), any care or treatment measures have limited effectiveness [3]. Gentle manicure techniques and temporary abstinence from durable coatings allow the matrix to form a higher-quality nail.

Experimental data show that water is a key "plasticizer" of the nail and determines its elasticity and resistance to stress [6]. Therefore, measures aimed at stabilizing the water balance (regular use of emollients , reducing contact with solvents, protection from frequent "wetting-drying" cycles) are considered a physiologically sound basis for restoration.

Medical varnishes that form a protective film on the nail surface can temporarily improve the mechanical properties of the nail plate and reduce the clinical manifestations of fragility. Randomized trials have demonstrated the effectiveness of hydroxypropyl chitosan- based varnishes in brittle nail syndrome, including cosmetically induced forms [7]. These products do not "restore" keratin, but they do reduce further damage during the growth period.

Biotin has traditionally been used for brittle nails; several studies and reviews have noted improvement in clinical signs at doses of approximately 2.5 mg/ day [8]. However, the evidence base remains limited, and current authors emphasize that biotin should be considered a complement, not an alternative, to addressing the injury and adequate care.

Thus, a truly effective approach to nail plate restoration is comprehensive and based on a combination of eliminating damaging factors, protecting and supporting the physiological properties of the nail during its regrowth.

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Table 2 - Evidence-based measures for nail plate restoration

Recovery measure	**Physiological justification**	**Expected effect**
A break from aggressive procedures	Preventing re-injury to the matrix and plate	Gradually growing a stronger nail
Stabilization of hydration	Water as a key nail plasticizer	Increased elasticity, reduced brittleness
Protective gloves, solvent reduction	Prevention of dehydration and microdamage	Slowing down the progression of damage
Film-forming medicinal varnishes	Temporary enhancement of mechanical properties	Reduction of delamination and cracks
Biotin (optional)	Keratinization support	Moderate improvement in brittleness

Nail plate restoration after aggressive nail treatments should be viewed as a gradual physiological process directly related to the rate of nail growth and the conditions under which the new plate is formed. Since damaged keratin cannot be repaired, the clinical effect is achieved as a new, less damaged portion of the nail grows, provided that recurrent damaging factors are eliminated.

The average growth rate of hand nails is approximately 2.5–3.5 mm per month, which determines the minimum time frame for visible improvement. The first clinical signs of stabilization (reduced fragility, decreased splitting) are usually noted after 4–6 weeks, while complete renewal of the nail plate can take 4–6 months. These timeframes are consistent with data on nail physiology and clinical recommendations for the management of fragility and cosmetically induced nail lesions [5].

The practical restoration algorithm involves a sequential combination of eliminating aggressive factors, maintaining the nail's physiological properties, and dynamically assessing growth. Important factors include maintaining intervals between treatments and avoiding premature reversion to traumatic techniques, as this perpetuates the "vicious cycle" of damage [4].

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Table 3 - Practical algorithm for nail plate restoration and expected timeframes

Recovery stage	**Main events**	**Physiological justification**	**Expected dates**
I. Elimination of damage	A break from aggressive procedures, avoiding excessive filing and acetone removal	Preventing re-injury to the matrix and plate	Immediately
II. Stabilization of the condition	Gentle manicure, protection from water and chemicals, emollients	Reduces dehydration, maintains nail elasticity	2-4 weeks
III. Growth Support	Film-forming varnishes, barrier measures, optionally biotin	Improving mechanical properties during the growth period	4–8 weeks
IV. New plate growth	Regularly check the length and quality of your nails	Replacement of damaged keratin with new one	3–6 months
V. Return to procedures	Selecting gentle techniques and intervals	Prevention of recurrence of injuries	After restoration

Therefore, nail plate restoration after aggressive nail procedures is based on an understanding of the physiology of growth from the matrix and the water-dependent properties of the nail as a keratin barrier. The most important measures include preventing repeated trauma, reducing solvent exposure (especially prolonged acetone exposure), maintaining hydration, and using film-forming agents. Biotin can be considered as an adjunctive treatment for brittle nail syndrome. Evidence indicates that a lasting effect is achieved primarily by eliminating the underlying damage and gradually regrowth of a new, structurally intact portion of the nail.

References

1. Fleckman P., Allan C., Hennings H. Anatomy and physiology of the nail unit // Journal of Investigative Dermatology Symposium Proceedings. – 2013. – Vol. 17, No. 1. – P. 14–18.
2. Rieder EA, Tosti A. Cosmetically induced disorders of the nail with update on contemporary nail manicures // Journal of Clinical and Aesthetic Dermatology. – 2016. – Vol. 9, No. 4. – P. 39–44.

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3. De Berker DAR Nail biology and nail science // Clinical and Experimental Dermatology. – 2007. – Vol. 32, No. 5. – P. 509–515.
4. Baswan S., Kasting GB, Li SK, Wickett RR Understanding the formidable nail barrier: structure, composition, and permeability of the nail plate // Journal of Drugs in Dermatology. – 2017. – Vol. 16, No. 11. – P. 1081–1088.
5. Chessa MA, Rigopoulos D., Papini M., Piraccini BM Pathogenesis, clinical signs and treatment recommendations in brittle nails: a review // Dermatology and Therapy. – 2020. – Vol. 10, No. 1. – P. 15–27.
6. Gunt HB, Kasting GB Water sorption characteristics of the human nail plate // Journal of Pharmaceutical Sciences. – 2007. – Vol. 96, No. 12. – P. 3352–3362.
7. Chiavetta A., Serri R., Tosti A. Hydroxypropyl chitosan-based lacquer for brittle nail syndrome: a randomized assessor-blinded study // Dermatology. – 2019. – Vol. 235, No. 2. – P. 107–113.
8. Floersheim GL Treatment of brittle fingernails with biotin // Zeitschrift für Hautkrankheiten . – 1989. – Bd. 64, Nr. 1. – S. 41–48.