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Adaptive E-File Method: A Two-Phase Technique for Controlled E-File Removal of Artificial Nail Coatings

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Abstract

The article examines the features of controlled electric-file removal of artificial nail coatings within the author's Adaptive E-File Method (AEM). Based on an analysis of dermatological literature and a synthesis of professional practice, the technical principles of step-by-step coating removal are described, taking into account drill bit movement, contact with the material, positioning of the client's finger, and mechanical exposure. The aim of the study is to systematize the two-phase technique of electric-file removal of artificial nail coatings and substantiate criteria for performing technical operations. A distinction is proposed between active removal of the bulk material and final smoothing of the residual layer, with the conditions for transitioning between phases identified. The sequence of treating five nail zones is systematized, and the mirroring of working movements for right- and left-handed technicians is examined. Particular attention is paid to the technician's non-working hand in positioning the client's finger and providing access to the lateral areas of the coating. The functional differences between active material removal and subsequent smoothing are described in relation to the drill bit's working surface, movement direction, and intensity of mechanical contact. A reverse smoothing movement that maintains the established direction of instrument rotation is examined separately. Based on the systematization, a functional diagram of the two-phase technique and a technical decision-making algorithm have been developed, defining the treatment sequence, transition conditions, and need for local correction. A system of control criteria is proposed to assess coating condition, uniformity of material removal, correspondence between working movements and the technical task, and conditions for terminating additional abrasive exposure. The rationale for avoiding repeated filing of the natural nail plate is substantiated when the surface is sufficiently prepared for the selected coating system. Comparison with existing professional approaches clarifies the distinctive features of AEM, associated with differentiating the functions of working passes and consistently controlling mechanical exposure. The findings expand the methodological foundations for standardizing electric-file removal of artificial nail coatings and may be used in developing educational materials, improving the professional training of nail technicians, and assessing the reproducibility of technical procedures.

Keywords: *Artificial Nail Coating Removal, E-File Manicure, Final Smoothing, Mechanical Exposure, Natural Nail Plate.*

INTRODUCTION

The improvement of e-file manicure technologies is accompanied by an expansion of the options available to technicians when selecting methods for treating artificial nail coatings and, simultaneously, by increasing requirements for the precision of professional procedures. Particular attention during material removal is paid to preserving the structure of the natural nail plate, since the rotating drill bit acts directly on the coating surface, whose thickness and density may vary across a single nail. Insufficient control over drill bit positioning and movement direction increases the likelihood of localized surface depressions, repeated treatment of individual areas, and unintended contact between the cutting edges and the natural nail plate. Consequently, the outcome of the procedure depends on the coordination of the technician's actions, the characteristics of the instrument used, and the initial condition of the nail coating.

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In dermatological literature, mechanical trauma is considered one of the main factors contributing to damage to the nail apparatus during cosmetic procedures. In particular, Rieder and Tosti (2016) described changes in the nail plate associated with various manicure techniques, including repeated abrasive treatment. Similar issues were addressed by Dinani and George (2019), who examined the dermatological consequences of using cosmetic materials and mechanical nail treatment methods. Particular attention should also be paid to the clinical observation reported by Wu, Morrison, and Tosti (2015), in which the development of worn-down nail syndrome was associated with filing the upper layer of the nail during acrylic coating removal.

At the same time, it should be noted that the development of instrumental methods for examining the nail plate has made it possible to supplement clinical observations with objective characteristics of its surface condition. For example, Batory et al. (2019) used scanning electron microscopy to identify structural changes in nails following different decorative treatment and material removal methods. Zdrada et al. (2022) proposed the use of three-dimensional scanning for the quantitative assessment of changes in nail plate surface relief after manicure procedures. Taken together, the findings of these researchers indicate the relevance of improving technical methods aimed at reducing repeated mechanical stress on the nail plate.

At the same time, the precision of e-file nail coating removal depends on the execution of individual movements, which technicians often develop directly during professional training and consolidate through practical experience. It should be noted that the use of a rotating drill bit requires several conditions to be considered simultaneously: (1) the position of its working surface relative to the material, (2) the direction and speed of movement, (3) the contact angle, (4) pressure, and (5) accessibility of the treatment area. Changes in any of these parameters may affect how the instrument acts on the nail coating. Accordingly, improving professional techniques requires coordination between the sequence of actions followed by the nail technician and the criteria used to decide whether to continue or stop removing the artificial coating from a given area.

In this respect, distinguishing the main stages of artificial material removal is particularly important, since working with a relatively thick coating requires a gradual reduction in its volume, whereas, once a thin residual layer has been reached, the intensity of mechanical treatment must be adjusted to the task at hand. As practice shows, continuing active removal at the same intensity increases the number of passes over an already treated surface. At the same time, transitioning to final smoothing requires changes in instrument positioning and its contact with the material, which deserves a formalized description in the form of a professional protocol.

Contemporary dermatological research also addresses the consequences of repeated mechanical treatment during artificial nail coating removal. Tyagi and Singal (2024) note that removing gel coatings through repeated buffing may contribute to nail plate thinning. These findings emphasize the importance of examining the mechanics of working movements, criteria for changing the technical task, and conditions for terminating treatment. Particular attention should therefore be paid to the reproducibility of professional techniques when using different instruments and working with coatings of varying thickness.

One possible solution to the identified problem is the Adaptive E-File Method (AEM), an original e-file manicure technique developed by the author on the basis of professional and teaching practice. Within AEM, treatment follows a defined sequence, taking into account the position of the client's finger, the working surface of the drill bit, and the required level of mechanical contact with the artificial coating. As will be discussed below, particular attention is given to distinguishing active removal of the bulk artificial coating from subsequent smoothing of the residual layer through controlled changes in the drill bit's contact with the artificial coating. In turn, the need to formalize and scientifically substantiate the author's AEM technique determined the aim, subject, and scope of the present study.

The aim of the study is to describe the technical foundations of two-phase e-file removal of artificial coatings within AEM, systematize the sequence of professional actions, and substantiate the criteria for transitioning between phases, taking into account the effects of mechanical treatment on both the artificial coating and the natural nail plate.

MATERIALS AND METHODS

The study is based on an analysis of scientific literature addressing the mechanical effects associated with cosmetic nail procedures and on the systematization of the author's technical description of AEM, developed between 2021 and 2026. The technique took shape through professional activity and teaching e-file manicure, initially in Russia and, since 2024, in the United States. As practical experience accumulated, the author refined the zonal coating removal scheme, the principles for selecting the instrument's working surface, and the execution of finishing movements. A separate outcome of this work was the distinction between two functionally different treatment phases and the identification of conditions for transitioning between them.

Thus, the technical analysis is based on considering each working pass of the drill bit as a sequence of controlled actions, in which the treatment area, instrument position,

characteristics of contact between its working surface and the material, direction of movement, and required intensity of exposure are determined for each movement. These parameters are examined in relation to the initial coating thickness and the task of a particular stage, since the same direction of movement may produce different degrees of material removal depending on the drill bit position and the portion of its cutting edges being used.

In the author's AEM protocol, the primary instrument for e-file removal is a cone-shaped carbide drill bit with a blunt tip and a relatively flat lateral working surface. Its geometric characteristics allow the lateral portion to be used for treating relatively wide areas of artificial coating, distributing the drill bit's contact over the surface. The cutting ability of the instrument is selected according to the density and thickness of the material. In the author's professional practice, drill bits with red and purple markings are predominantly used, with the choice determined by the coating characteristics and the condition of the working surface.

The primary removal of hard artificial material within AEM is usually performed at a rotational speed of approximately 30,000–35,000 rpm. At the same time, the technical parameters of the procedure are determined by the combined characteristics of the instrument, its movement speed, contact angle, and the pressure applied by the technician. One of the principles of the technique is the use of the minimum necessary pressure; when the cutting ability of the instrument decreases, its condition, positioning, and suitability for the task are reassessed.

The preliminary stage involves assessing the coating condition, the presence of lifting, the presumed material system used, and the need for complete removal. With a stable coating and no significant lifting, part of the artificial layer may be preserved if this is consistent with the requirements of the subsequent procedure. When the material system is unknown, a coating replacement is necessary, or substantial lifting is present, the extent of removal is determined separately. If a soak-off base layer has been used, the residual material may be removed using methods prescribed for the corresponding system.

To systematize AEM, the main treatment zones, functional differences between active removal and smoothing, and completion criteria for each stage were identified. Movements for right- and left-handed technicians were examined separately, since the direction of rotation and orientation of the cutting edges determine the characteristics of contact between the drill bit and the coating. The resulting characteristics formed the basis for the comparative diagram of the two phases and the technical decision-making algorithm for transitioning from material removal to final surface smoothing.

RESULTS AND DISCUSSION

The systematization carried out made it possible to identify interrelated technical actions that determine the sequence of e-file artificial coating removal within AEM. The first phase is based on zonal treatment, during which the technician gradually reduces the volume of material according to its distribution over the nail surface. Unlike moving the instrument freely between areas, a predefined scheme allows the required order of working passes to be maintained and the condition of previously treated zones to be assessed promptly. The author's technique identifies five main areas:

1. The central zone is treated first. The bulk artificial coating is removed by longitudinal passes from the proximal part toward the free edge. The lateral working surface of the drill bit is positioned relative to the material to ensure a uniform reduction in coating thickness.

2. As the technician moves toward the lateral areas, the client's finger is repositioned with the non-working hand, providing access to the side zones while maintaining a controlled instrument angle.

3. The next area involves a diagonal transition from the lateral part toward the free edge. Its treatment requires the direction of movement to be coordinated with the changing geometry of the coating.

4. The technician then moves to the opposite lateral zone, maintaining the functional distinction between working movements.

5. The final area of the first phase is the proximal arc, whose treatment requires increased attention to material thickness and visual control of instrument positioning.

The technician's non-working hand plays a separate role in AEM. Its use involves stabilizing and repositioning the client's finger, retracting the lateral nail folds, and providing convenient access to the artificial coating. This allows the position of the drill bit's working surface to be coordinated with the geometry of the treatment zone and reduces the need for excessive instrument tilting. This approach is also useful when working with coatings of uneven thickness, since the finger position can be adjusted as the technician moves between areas.

The zonal scheme provides for mirrored reproduction of movements for right- and left-handed technicians. When working with the right hand and a standard right-cutting drill bit, Forward mode is used. For the left hand, the sequence of actions is mirrored, taking into account the direction of rotation and the characteristics of the instrument used. At the same time, the distinction between the active working movement, intended to remove material, and the return pass, intended to smooth the remaining material, is maintained. The sequence of five zones, directions of movement, and positions of the working areas are presented in Figure 1.

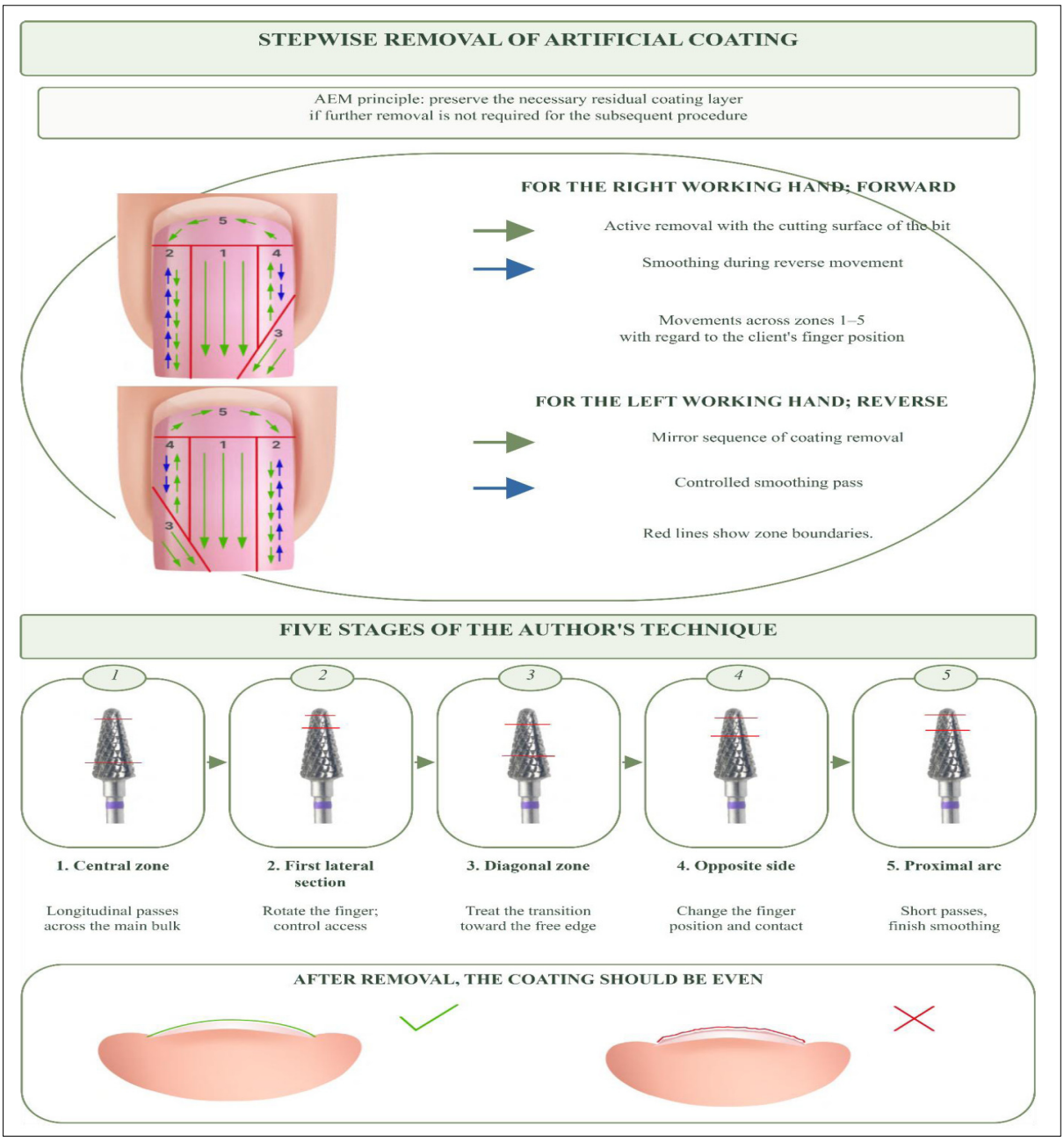


Figure 1. Zonal sequence of e-file artificial coating removal within AEM for right- and left-handed technicians

The presented sequence primarily reflects the order of coating treatment. However, the number of passes in each area depends on the actual thickness of the artificial material and its surface condition. Once the required result has been achieved, further active removal in the corresponding area is terminated. Accordingly, zonal organization of the procedure provides conditions for monitoring the completion of the nail technician's specific technical task.

A fundamental feature of AEM is the division of e-file artificial coating removal into two functionally different phases: (1) the initial stage focuses on removing the bulk material, while (2) the subsequent stage involves smoothing the thin residual layer and levelling the surface. This distinction reflects a change in the technical task as the coating becomes thinner, requiring a gradual reduction in the intensity of material removal.

In the first phase, the primary working element is the cutting lateral surface of the cone-shaped carbide drill bit. The technician gradually treats the designated zones while controlling the instrument position and the volume of material removed. Working movements are aimed at a uniform reduction in coating thickness, while repositioning the client's finger provides access to the lateral areas while maintaining the required contact. Treatment of the proximal arc deserves particular attention, since the artificial material in this area is often thinner than in the central part.

The transition to the second phase takes place once the bulk coating has been removed and further treatment must address the task of levelling the residual layer. In the AEM technique, this moment is determined through visual assessment of the surface. In particular, when working with hard gel, the underlying natural nail plate may become visible

through the thin remaining layer of artificial material. This is used as a reference point together with an assessment of coating uniformity, its condition in the lateral areas, and the required extent of subsequent preparation.

The finishing phase involves a change in the mechanics of contact between the instrument and the material. In the right-handed version of AEM, when using Forward mode, the active working pass in the corresponding lateral zone is performed from right to left. During the subsequent return movement from left to right, the drill bit remains in Forward mode, while the technician adjusts the orientation of its working surface and the intensity of contact with the material. The instrument is positioned more parallel to the surface, and pressure is reduced to the minimum required for the smoothing movement.

With this working method, primary removal and final smoothing are treated as two independent technical operations performed with the same instrument within the selected rotational mode. The result of the return pass is determined by the characteristics of contact between the cutting edges and the material, the contact area, and the drill bit position. Consequently, the technician controls treatment intensity by coordinating several parameters, while maintaining the sequence of movements and monitoring the condition of the residual layer (see Figure 2).

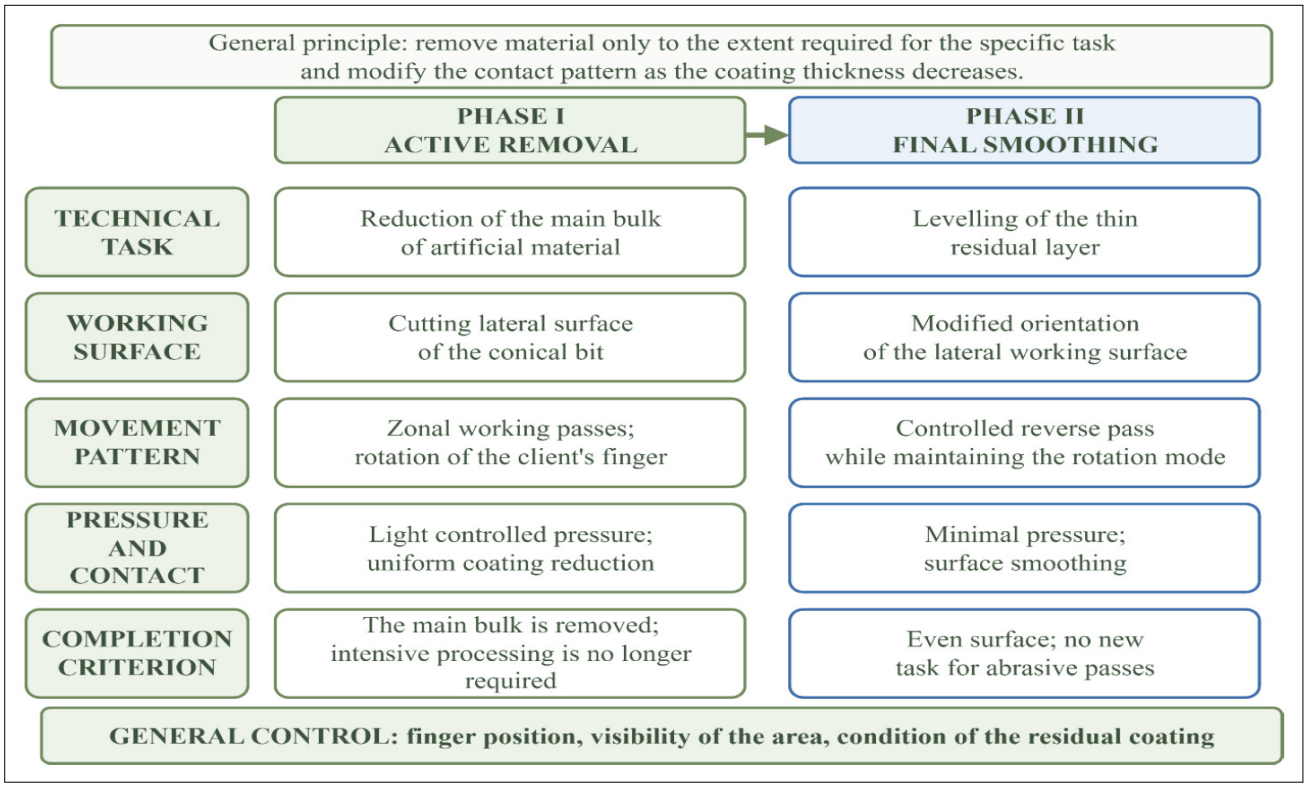


Figure 2. Functional distinction between active removal and final smoothing of artificial coating within AEM

The central principle of the proposed technique is to adjust the intensity of contact between the drill bit and the material according to the condition of the coating. As its thickness decreases, the purpose of the working movement changes, together with the drill bit position, contact intensity, and need for additional passes. In professional training, this distinction makes it possible to explain the sequence of actions through technical tasks and to develop the technician's understanding of the criteria for transitioning from active material removal to superficial levelling.

The proposed process of implementing the two-phase technique is based on identifying the signs by which the technician assesses the need to continue the procedure. Within AEM, the corresponding decision is made taking into account the condition of the artificial coating, accessibility of the treatment area, and the functional purpose of the next movement. Particular attention is paid to the moment when active removal should be terminated, since, after the bulk material has been reduced, further mechanical exposure must correspond to the task of final smoothing.

Rather than relying on a fixed number of passes, the technique provides for visual assessment of the residual coating thickness and the uniformity of its distribution. The material condition is assessed separately in the central, lateral, and proximal zones, since the treatment conditions differ between these areas. If a particular area still requires a further reduction in coating thickness, the technician performs a local correction, taking into account the material's location and the required direction of movement. Once the necessary surface condition has been achieved, active treatment of the corresponding zone is terminated.

It should be noted that the next technical decision concerns the transition to final smoothing. At this stage, the position

of the drill bit's working surface, the characteristics of its contact with the material, and the adequacy of visual control are assessed. When performed correctly, the technician changes the function of the movement while maintaining the established sequence of actions and limiting excessive mechanical exposure to the thin residual layer.

Completion of the procedure is associated with the condition of the surface after smoothing and the requirements of the subsequent coating application. If the artificial material has been treated uniformly and there is no independent technical need for additional filing, further abrasive passes are terminated. If local correction is required, the technician returns to the corresponding area after determining the necessary type of treatment.

The sequence of these decisions is formalized as an algorithm in Figure 3.

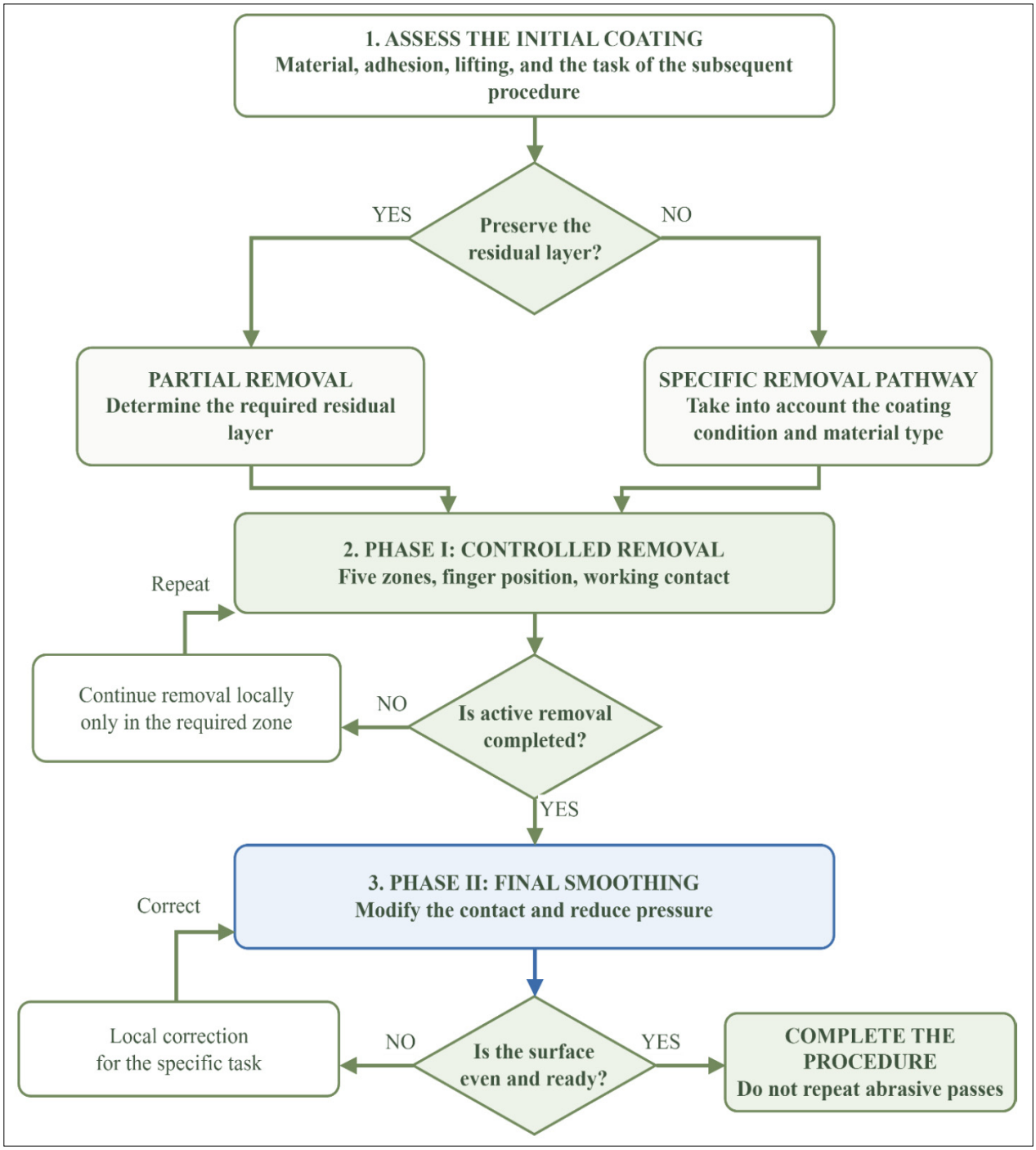


Figure 3. Technical decision-making algorithm for transitioning between the phases of e-file artificial coating removal according to AEM

Thus, the presented algorithm makes it possible to relate the sequence of the technician's actions to specific conditions for transitioning between stages. To clarify the criteria for performing AEM, the main control points that can be used in training and professional assessment of the technique were systematized (Table 1).

Table 1. Control criteria for performing the two-phase AEM technique

Control point	Subject of assessment	Technical decision
Preliminary assessment	Coating condition, presence of lifting, material characteristics	Determination of the required extent of removal
Active removal	Uniformity of material reduction, drill bit position, accessibility of treatment zones	Continuation of treatment or local correction
Transition to smoothing	Condition of the residual coating, characteristics of instrument contact	Termination of intensive removal and change in the function of the movement
Final smoothing	Surface evenness, pressure, working part of the drill bit	Levelling of the residual layer
Completion of the procedure	Compliance of the surface condition with the subsequent technical task	Termination of additional abrasive treatment

A separate principle of AEM is the avoidance of mandatory repeated filing of the entire natural nail plate after completion of e-file removal. In other words, if the surface has already been prepared sufficiently for the subsequent application of the selected coating system, additional treatment with a hand file or sanding band is not always performed. The technician's further actions depend on the material condition and the technique of the procedure itself.

In professional practice, adherence to these criteria is particularly necessary when working with coatings of uneven thickness, since the need for more active removal may persist longer in certain areas. Consequently, the technician must coordinate the direction of movement and the working surface of the instrument with the actual task. Therefore, completion of treatment of the entire nail is based on an assessment of the condition of its individual zones.

Overall, the systematization of the two-phase technique made it possible to identify several features that determine its place among professional approaches to e-file artificial coating removal. First and foremost, this concerns distinguishing the main functions of the working movement within a unified treatment sequence, since removal of the bulk material and final smoothing are considered related technical tasks, each of which has its own conditions of execution and completion criteria.

Tyagi and Singal (2024) identify repeated mechanical treatment during gel coating removal as a potential cause of nail plate thinning. In relation to these findings, the distinctive feature of AEM lies in the functional differentiation of working movements within a unified treatment sequence. The technique establishes separate technical tasks for bulk material removal and final smoothing, including changes in drill bit contact during the return movement while maintaining the selected rotational mode. This distinction provides a basis for defining the conditions for transitioning between phases and completing the procedure.

From the perspective of the technical organization of the procedure, this distinction makes it possible to clarify the role of individual parameters, namely: (1) finger positioning determines the accessibility of the treatment area; (2) the working surface of the drill bit determines the characteristics of contact with the material; and (3) the direction of movement and pressure are coordinated with the task of removal or smoothing. Together, these characteristics establish a general sequence of actions that can be used in training nail technicians and assessing their professional technique.

In addition, a further direction of research is associated with instrumental assessment of the condition of the nail plate after different coating removal procedures. For example, the use of three-dimensional scanning, examined by Zdrada et al. (2022), may be of interest for quantitatively comparing changes in surface relief. In research on AEM, these measurements could be supplemented by an assessment of the number of passes, procedure duration, and characteristics of instrument use. This would allow the characteristics of technical actions to be related to the observed condition of the surface.

At the same time, the practical orientation of AEM is primarily determined by the opportunity to teach technical decision-making directly during the procedure. The technician assesses which area requires treatment, which working surface of the drill bit should be used, and under what conditions further mechanical exposure becomes excessive. As a result, professional training can rely on accessible criteria for performing the procedure and controlling actions, which supports consistent application of the author's technique when working with artificial coatings under different initial conditions.

CONCLUSIONS

Thus, as a result of the study, the two-phase technique of e-file artificial coating removal within the author's Adaptive E-File Method was systematized. The functional features of active removal of the bulk material and final smoothing of the residual layer were identified, the principles of controlling the drill bit's working contact were described, and the criteria for transitioning between stages were substantiated. Based on the author's technical description, a two-phase treatment scheme, a technical decision-making algorithm, and a system of control criteria for performing the procedure

were developed. These findings provide a basis for applying AEM in the professional training of nail technicians and for subsequently evaluating the consistency of the technique when performed by different specialists.

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