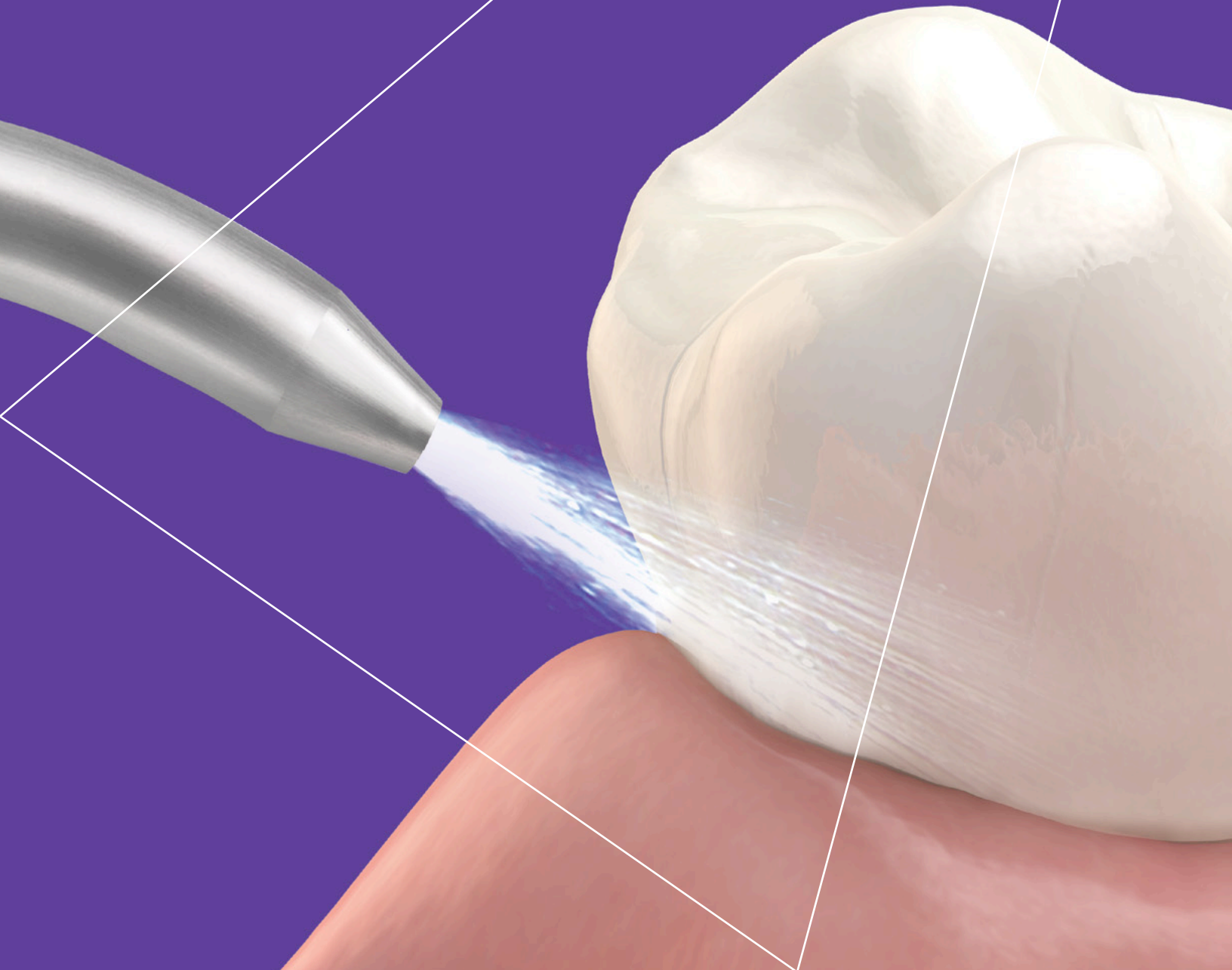


**3M** Science.  
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# Clinpro™ Glycine Prophy Powder

Technical Product Profile



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# Introduction

Air polishing has been used as a supplement or alternative to debridement using hand instruments or oscillating scalers for professional tooth cleaning for more than half a century.<sup>2,3,12</sup> It contains an air, powder and water mixture to remove surface deposits like plaque biofilm and stains. Air polishing allows a fast and easy cleaning procedure, especially for areas difficult to reach with prophy paste.

In 2001, Clinpro™ Glycine Prophy Powder, invented by 3M, revolutionized air polishing by offering a new type of powder next to the more abrasive classic powders like sodium bicarbonate and calcium carbonate. This new powder was glycine based—an amino acid gentle enough to allow an efficient supra- and subgingival cleaning. This resulted in the first subgingival polishing method in professional tooth cleaning and the possibility of a completely new periodontal treatment for periodontitis and peri-implant diseases. In addition, patient comfort was enhanced by the pleasant taste of glycine and no gingival erosion. Air polishing also solved the challenges of cleaning orthodontic brackets by reaching all hidden areas in an easy and comfortable way, without affecting orthodontic appliances.

Clinpro™ Glycine Prophy Powder can be used in commercially available air-polishing devices (APDs).

Clinpro™ Glycine Prophy Powder allows safe, easy and patient-friendly removal of supra- and subgingival plaque/biofilm. Due to its unique formulation based on the water-soluble amino acid glycine, it does not cause clinically relevant loss of root substance—usually determined after curette or scaler usage. Moreover, treatment with Clinpro™ Glycine Prophy Powder is more efficient in lowering bacterial load in periodontal pockets than conventional instrumentation. Plus, the removal of supragingival plaque with Clinpro™ Glycine Prophy Powder eliminates the need for further surface finishing with polishing pastes in many cases.

# Product Description

Features and benefits of Clinpro™ Glycine Prophy Powder:

- Easy and fast removal of plaque biofilm
- Supra- AND subgingival use for deep cleaning, particularly helpful for periodontitis and peri-implant therapy
- Comfortable for patient
- Pleasant taste

# Product Indications

- Professional cleaning of teeth: Removal of subgingival and supragingival plaque biofilm and stains
- Can also be used in the presence of fixed orthodontic devices (brackets), restorative and prosthetic materials and implants
- For maintenance in periodontitis therapy after completion of initial treatment—when using standard devices—for gingival pockets up to 5 mm in depth
- For maintenance in peri-implantitis therapy after completion of initial treatment—when using standard devices—for gingival pockets up to 5 mm in depth

# Materials Overview

## Clinpro™ Glycine Prophy Powder

Traditional air-polishing powders are mainly composed of sodium bicarbonate ( $\text{NaHCO}_3$ ), while Clinpro™ Glycine Prophy Powder consists of more than 99% glycine. Glycine is a naturally occurring amino acid. It is water soluble and has a non-salty, pleasant, sweet taste.

Traditional sodium bicarbonate particles (Fig. 1) are bigger in size than glycine particles (Fig. 2). Additionally, sodium bicarbonate is harder than glycine, at 2.5 versus 2.0 on the Mohs hardness scale. These two factors make Clinpro™ Glycine Prophy Powder a desirable choice for both supra- and subgingival cleaning.

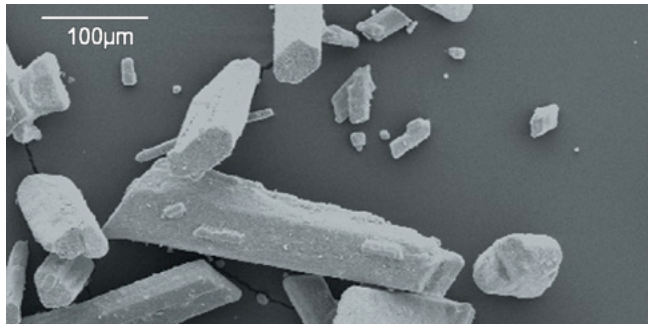


Figure 1: SEM (x200; scale bar: 100  $\mu\text{m}$ ) of conventional sodium bicarbonate powder.

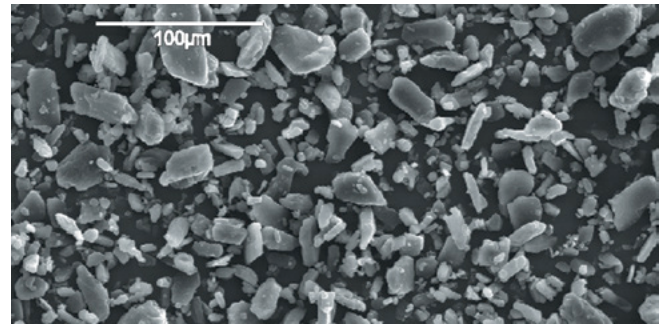


Figure 2: Scanning Electron Microscopic image (SEM) (x300; scale bar: 100  $\mu\text{m}$ ) of Clinpro™ Glycine Prophy Powder.

Air polishing with sodium bicarbonate is more abrasive to dentin surfaces (Fig. 3) and is therefore indicated for supragingival cleaning only. However, Clinpro™ Glycine Prophy Powder, which exerts minimal abrasiveness on dentin surfaces, allows for safe supra- and subgingival use (Fig. 4).

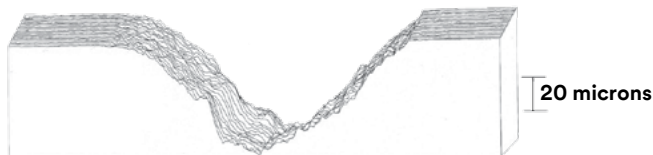


Figure 3: Dentin wear and surface roughness of human dentin after air polishing with a conventional sodium bicarbonate-based powder (scale 20  $\mu\text{m}$ ).



Figure 4: Dentin wear and surface roughness of human dentin after air polishing with Clinpro™ Glycine Prophy Powder (scale 2  $\mu\text{m}$ ).

# Air-Polishing Technology

Air polishing is an alternative method of removing plaque from dental surfaces. Air polishing removes stain and plaque biofilm from tooth surfaces using pressurized air, water and particles of various abrasiveness. The most common abrasive agent used with air-polishing technology is a sodium bicarbonate powder. Water flow acts as a carrier for the types of powder used in an APD. Compared to conventional instrumentation, prophy powders allow more efficient and effective removal of plaque and extrinsic discolorations. Due to their high abrasiveness when used with APD, however, their application is restricted to the supragingival parts of the tooth. Usage of APD with conventional prophy powders (such as sodium bicarbonate, calcium carbonate, phosphosilicate, etc.) on root surfaces will lead to significant loss of root substance, causing clinical effects.<sup>4</sup> Therefore, it is strictly contraindicated.

The aim of developing Clinpro™ Glycine Prophy Powder was to broaden the use of traditional air-polishing powders from supragingival to both supra- and subgingival application. A prerequisite for this was to balance the abrasiveness of the powder in such a way as to allow efficient removal of both supra- and subgingival plaque and not harm root substances. Air-polishing treatment with Clinpro™ Glycine Prophy Powder efficiently reduces bacterial load in subgingival pockets. Patient comfort is a key feature of Clinpro™ Glycine Prophy Powder, as it exerts minimal abrasiveness and therefore can safely be applied subgingivally during supportive periodontitis and peri-implant treatments. Clinpro™ Glycine Prophy Powder can be used in a safe way on root surfaces and has shown to be very gentle to all kinds of restorative materials, implants and orthodontic appliances.<sup>6,9,10,11</sup>

## Air-polishing device setting recommendations

Clinicians should make adjustments according to particular equipment used and the individual patient situation.

## Precautionary Measures

- Calculus and tartar cannot be removed with Clinpro™ Glycine Prophy Powder.
- Caution should be exercised when using Clinpro™ Glycine Prophy Powder for treatment of patients suffering from chronic bronchitis or asthma because the fine spray of air and powder can cause respiratory problems.
- When using an air-polishing device, both operator and patient must wear protective eyewear during use. Powder accidentally sprayed into the eyes can cause severe eye injury. The fine powder dust can cause irritation if it gets under contact lenses. Patients wearing eyeglasses should wear protective eyewear over their eyeglasses to avoid getting them soiled during treatment.
- You may wear a mask as protection from dust particles (e.g., when filling the device).
- Do not aim the nozzle directly at the gum tissue during treatment. Proper positioning of the nozzle is described under “Treating the Patient.” As with all prophy powders, there is a risk of provoking a subcutaneous emphysema when compressed air is used intraorally.
- Please pay attention to possible restrictions when treating high-risk patients (general weakened immunity, endocarditis), because bacteremia may occur when treating deep periodontal pockets.
- Always use a suction device during treatment.
- Never use the air-polishing device without water as this makes it more difficult to suction the air-powder mixture, causing injuries in the area to be treated.

# Importance of Plaque Removal in Cariology

Dental plaque consists of bacteria, bacterial products, proteins and other molecules that originate from saliva and nutrition. This biofilm allows bacteria to adhere to the tooth surface, preventing it from being swallowed. Through the bacterial metabolic activity, nutrient carbohydrates are converted into acids. These acids, mainly lactic acid, are present in the plaque fluid and have intimate and persisting contact to the tooth surface. The effect of the resulting lower pH level leads to the demineralization and softening of enamel, which in turn allows bacteria to penetrate the tooth. At the same time, incorporation of minerals from both saliva and teeth into the plaque results in the conversion into calculus, further accelerating tooth demineralization. Therefore, removal of these deposits has long been recognized as an important step in the prevention of caries disease progress.

# Importance of Plaque Removal in Periodontology

Persisting supragingival plaque, along with the inflammation of marginal gingiva, will result in the formation of subgingival deposits and infection with periopathogenic bacteria. The developing inflammatory process will cause marginal epithelium to develop into pocket epithelium. This process is accompanied by reduced adherence of the marginal gingiva to the tooth surface. The resultant gingival pocket facilitates plaque formation and bacterial growth in even deeper areas. In the next step, degradation of the tooth-supporting fiber apparatus and the alveolar bone will follow, both eventually causing tooth loss. The primary goal in periodontal treatment is the reduction of gingival pocket depth. The accomplishment is causally linked to the successful lowering of bacterial load and decrease of inflammation. Hence, in the initial therapeutic phase, plaque and calculus are removed mechanically from supra- and subgingival dental surfaces by scaling and root planing with hand instruments or mechanical devices (e.g. curettes, ultrasonic scalers). Additionally, patients are instructed to improve oral hygiene. Due to the fact that recolonization of periodontal pockets by periopathogenic bacteria occurs within a couple of weeks to months after the initial phase, continuous removal of supra- and subgingival plaque is mandatory.<sup>12</sup> Professional cleaning, accompanied by oral hygiene instruction, is done at 3- to 6-month intervals during the following supportive periodontal therapy.

However, treatment of root surfaces with instruments (hand scalers and curettes, sonic and ultrasonic scalers) is considered unpleasant by patients. Moreover, as a consequence of repeated use of these instruments, root substance is significantly reduced. This may lead to hypersensitivity, weakening of the respective roots or even root fracture.<sup>5</sup> This translates into a limited frequency of application in the clinical practice.

# Importance of Plaque Removal in Orthodontics

There are three phases during orthodontic treatment where removal of plaque and stain is of major interest. First, during the preparation of tooth surfaces for cementation of brackets. Second, during ongoing therapy with brackets fixed to maintain oral health. And third, after removal of brackets. A study by Gerbo et al<sup>1</sup> has shown that cleaning of the tooth surface by APDs prior to bracket cementation has no negative effect on bonding strength. Moreover, APDs have been found to be the most effective method of plaque removal for orthodontic patients without causing breakage of elastics and wires or loss of zinc phosphate and composite material. Clinpro™ Glycine Prophy Powder can be applied safely and effectively during all three phases of orthodontic treatment.

## Clinical Background

In common dental and periodontal disease treatment, much effort is actually put into preventing, controlling and arresting these diseases. In caries disease, the underlying chemical and bacteriological processes are located at the tooth-plaque interface and depend on diet, several host factors, the exposure time to acids and microbial plaque composition. Marginal periodontal disease is caused by infection with bacterial periopathogens that are located in subgingival plaque. During the disease progress, both host and pathogen reactions contribute to the degradation of the tooth-supporting fiber apparatus and the alveolar bone. Therefore, plaque removal is one of the most important preventive measures for both caries and periodontal diseases.

# Clinical Studies: Supra- and Subgingival Plaque Biofilm and Stain Removal

Cleaning Efficiency

Gingival Erosion

Abrasion on Human Dentin

Abrasion on Bovine Dentin

Surface Abrasion of Dentin and Enamel

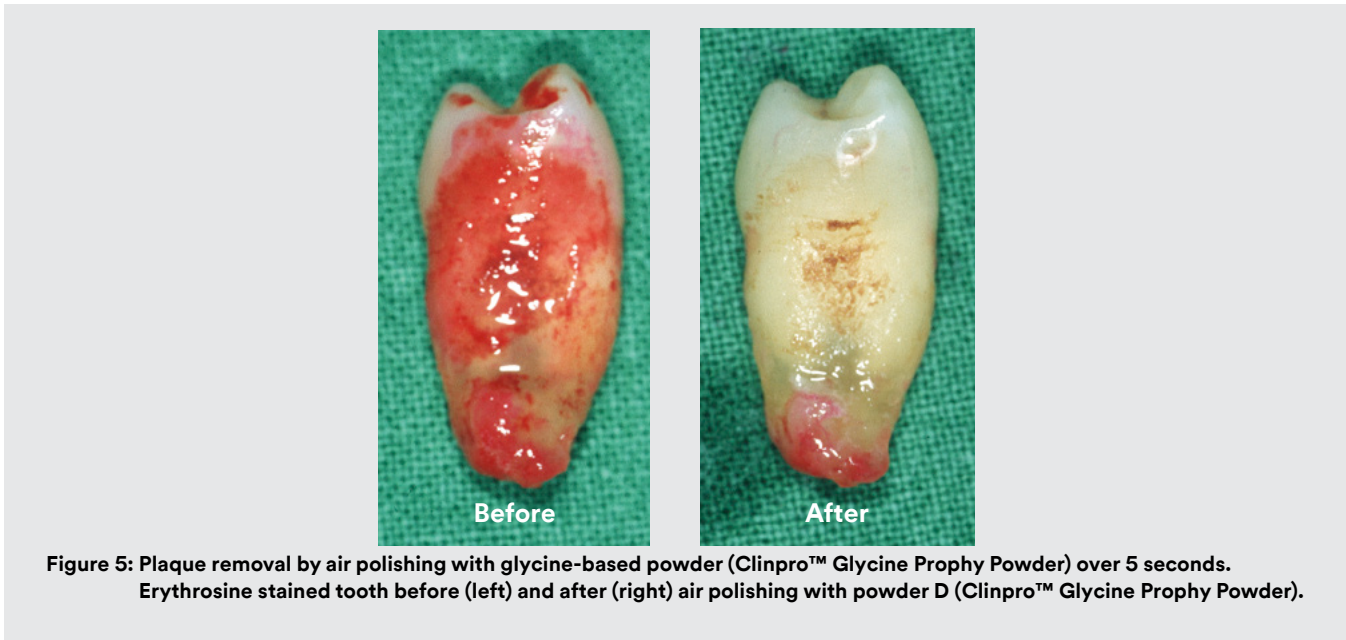
## Clinical Study: Cleaning Efficiency

# In vitro evaluation of novel low abrasive air polishing powder.

Petersilka, G.J. et al. (2003b). *Journal Clinical Periodontology*, 30, 9–13.

### Aim of the study:

In vitro evaluation of the safety and efficacy of novel low abrasive air polishing powder and determination of transport characteristics in the AIR-FLOW S1 (EMS, Switzerland)



### Conclusion:

Clinpro™ Glycine Prophy Powder offers low abrasiveness while being effective in removing dental plaque. Thus, it may be useful for safe and efficient plaque removal on exposed root surfaces.

## Clinical Study: Gingival Erosion

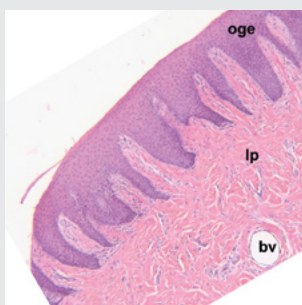
# Effect of glycine powder air polishing on the gingiva.

Petersilka, G.J. et al. (2008). *Journal of Clinical Periodontology*, 35(4), 324–332.

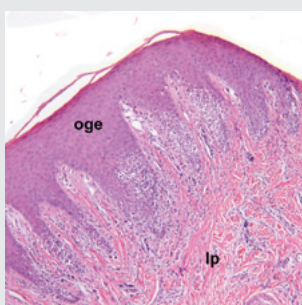
### Aim of the study:

Assess if Clinpro™ Glycine Prophy Powder results in less gingival erosion than sodium bicarbonate air-polishing powder and hand instrumentation.

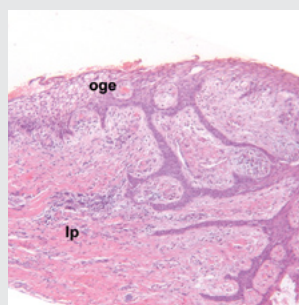
Figure 6: Light micrograph of oral gingival epithelium directly after these polishing techniques:



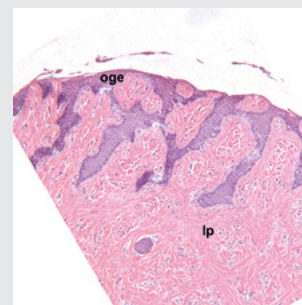
A) No treatment (negative control)—no lesion



B) Root debridement with glycine air-polishing powder—no lesion



C) Root debridement with sodium bicarbonate air-polishing powder—medium lesion



D) Root debridement with Gracey curette—severe lesion.

### Conclusion:

Clinpro™ Glycine Prophy Powder resulted in minor erosions of the gingiva (scores 1 and 2), sodium bicarbonate air-polishing powder and hand instrumentation displayed moderate to severe erosions (scores 2–4). These differences were significant ( $p < 0.05$ ). The results prove that Clinpro™ Glycine Prophy Powder leads to less gingival erosion in comparison to sodium bicarbonate air-polishing powder and hand instrumentation.

## Clinical Study: Abrasion on Human Dentin

# Determination of Dentin Wear Induced by a Conventional and a New Low-Abrasive Air-Polishing Powder

Degrange M. (2002). Department of Pediatric Dentistry, Faculte de Chirurgie Dentaire, Universite Rene Descartes-Paris V, Montrouge, France, unpublished data.

### Aim of the study:

In vitro evaluation and comparison of dentin wear after air polishing with a conventional sodium bicarbonate-based powder and a new, low-abrasive air-polishing powder (Clinpro™ Glycine Prophy Powder).

### Methodology:

Extracted human teeth were cut into slices, polished and fixated with dentin surface exposed (Fig. 7). A 2mm broad area was air polished under standardized conditions, reflecting the clinical situation (distance, pressure, spray angle, time). Surface topography was assessed quantitatively with a Mechanical Scanning Microscope (MSM; Akilog, Besançon, France). Visualization and measurement of abrasion-induced wear was compared to adjacent untreated and polished areas. The three-dimensional map of dentin air polished with  $\text{NaHCO}_3$  (Fig. 8) shows a deep, wedge-shaped groove that exceeds 50  $\mu\text{m}$  in depth. In contrast, usage of Clinpro™ Glycine Prophy Powder causes comparatively minor abrasion of dentin that reaches around 2  $\mu\text{m}$  at the utmost (notice the difference in scales in Fig. 9 and Fig. 10). Additionally, air polishing with Clinpro™ Glycine Prophy Powder creates a rather plain abrasion profile lacking deep incisions. Statistical analysis of abrasion data shows that usage of  $\text{NaHCO}_3$ -based powder results in  $47.6 \pm 24.7 \mu\text{m}$  average dentin loss, whereas Clinpro™ Glycine Prophy Powder leads to only  $5.3 \pm 3.0 \mu\text{m}$  wear.

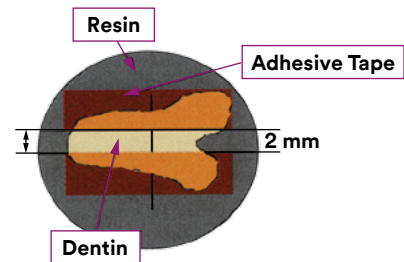


Figure 7: Experimental setup for standardized air polishing of extracted teeth.

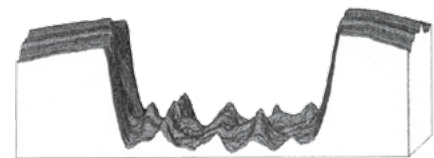


Figure 8: Characteristically resulting profile of trial after non-standardized air polishing.

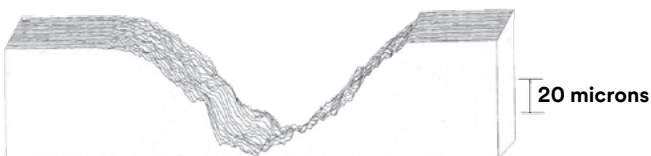


Figure 9: Dentin wear and surface roughness of human dentin after air polishing with a conventional sodium bicarbonate-based powder (scale 20  $\mu\text{m}$ ).



Figure 10: Dentin wear and surface roughness of human dentin after air polishing with Clinpro™ Glycine Prophy Powder (scale 2  $\mu\text{m}$ ).

### Conclusion:

Air polishing of dentin with Clinpro™ Glycine Prophy Powder leads to tenfold-reduced substance loss compared to conventional  $\text{NaHCO}_3$ -based powders. It can therefore safely be used subgingivally and on denuded root surfaces.

## Clinical Study: Abrasion on Bovine Dentin

# Determination of dentin wear within treatment time

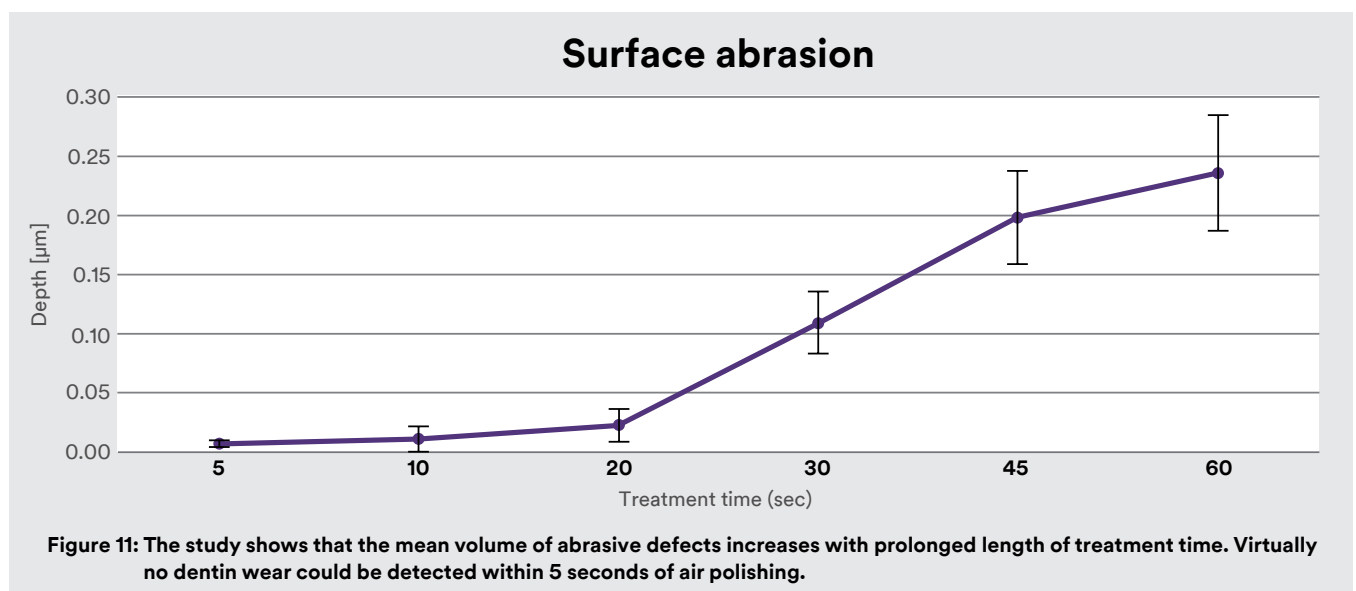
Häberlein, I., Fischeder, D. (2004). internal laboratory test data, 3M ESPE, Seefeld: Germany; unpublished data.

### Aim of the study:

Quantitative in vitro evaluation of the abrasive property of Clinpro™ Glycine Prophy Powder.

### Methodology

Roots of extracted bovine teeth were cleaned, planed and polished with finishing paper. The fixated teeth were air polished with the AIR-FLOW S1 (EMS, Switzerland) and Clinpro™ Glycine Prophy Powder under standardized conditions (distance 4.3 mm, spray angle 90°, device settings according to manufacturer's instructions). An impression of the treated surface of each tooth was taken and the dimensions of the abrasive defect were determined visually using a light microscope. The abrasive effect was determined for treatment times from 5 to 60 seconds. According to the manufacturer's instructions, the recommended application time for clinical use is 5 seconds.



### Conclusion:

Air polishing of bovine dentin with Clinpro™ Glycine Prophy Powder under the recommended and described conditions does not lead to any detectable loss of dentin. Therefore, the application on subgingival and denuded root surfaces can be considered safe.

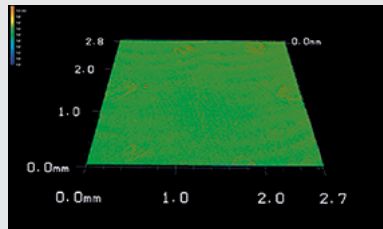
## Clinical Study: Surface Abrasion of Dentin and Enamel

# Surface analysis of enamel and dentin after different treatment by Keyence microscope system\*

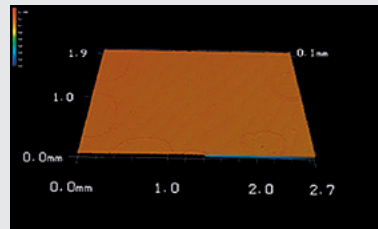
3M internal in vitro study, 2015.

### Aim of the study:

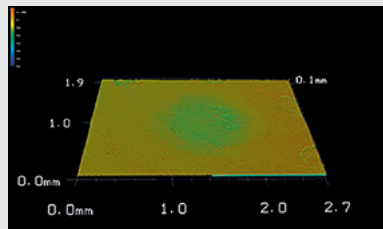
Evaluate morphological changes on enamel and dentin induced by treatment with Clinpro™ Glycine Prophy Powder in comparison to sodium bicarbonate air polishing by using Keyence microscope system.



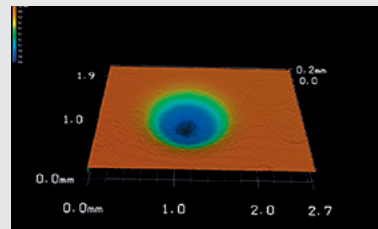
Enamel surface analysis after treatment with Clinpro™ Glycine Prophy Powder.



Enamel surface analysis after treatment with sodium bicarbonate.



Dentin surface analysis after treatment with Clinpro™ Glycine Prophy Powder.



Dentin surface analysis after treatment with sodium bicarbonate.

Figure 12: Surface analysis of enamel and dentin after different treatment by Keyence microscope system.  
\*Keyence 3D Laserscanning Microscope VK-X210, with 5x magnification

## Conclusion:

The Keyence microscope observation revealed a gentle cleaning effect on the enamel surface with Clinpro™ Glycine Prophy Powder and sodium bicarbonate air-polishing powder. The latter showed a slight surface change characterized by an increased roughness. The surface analysis of dentin showed no differences to enamel when using the glycine-based air-polishing powder, whereas the treatment with sodium bicarbonate air-polishing powder yielded surface defects after 5 seconds of treatment, which were characterized by the formation of craters and regions with deformed surface structure.

# Clinical Studies: The Effect of Cleaning with Clinpro™ Glycine Prophy Powder in Various Clinical Situations

Effects on Clinical Orthodontics

Safe and Gentle Cleaning in the Presence of Restorative Materials

Comparison to Other Debridement Methods in Treating Peri-implantitis

## **Clinical Study: Effects on Clinical Orthodontics**

# **Application of 3M™ ESPE™ Clinpro™ Glycine Prophy Powder in Clinical Orthodontics**

Wilmes, B., Vali, S., Drescher D.; University of Düsseldorf, Germany

Assessment of surface alterations on fixed orthodontic appliances after air-polishing, Abstract #P66, Deutsche Gesellschaft für Kieferorthopädie; 79th annual meeting, 2005

### **Aim of the study**

This in vitro study examines whether air polishing with Clinpro™ Glycine Prophy Powder from 3M causes surface changes of orthodontic arches and brackets.

### **Methodology**

Orthodontic wires and brackets (steel, ceramic and plastic) were exposed to air polishing using either sodium carbonate (AIR-FLOW powder, EMS) or glycine-based powders (Clinpro™ Glycine Prophy Powder, 3M). After treatment, the surface roughness of orthodontic wires was quantified using a friction measuring setup. Surface changes on brackets were quantitatively assessed using a scanning electron microscope. Overall, only slight changes in surface roughness were detected with both powders.

### **Conclusion:**

This study shows that Clinpro™ Glycine Prophy Powder can safely be used in orthodontic treatment to clean the tooth surface and orthodontic appliances.

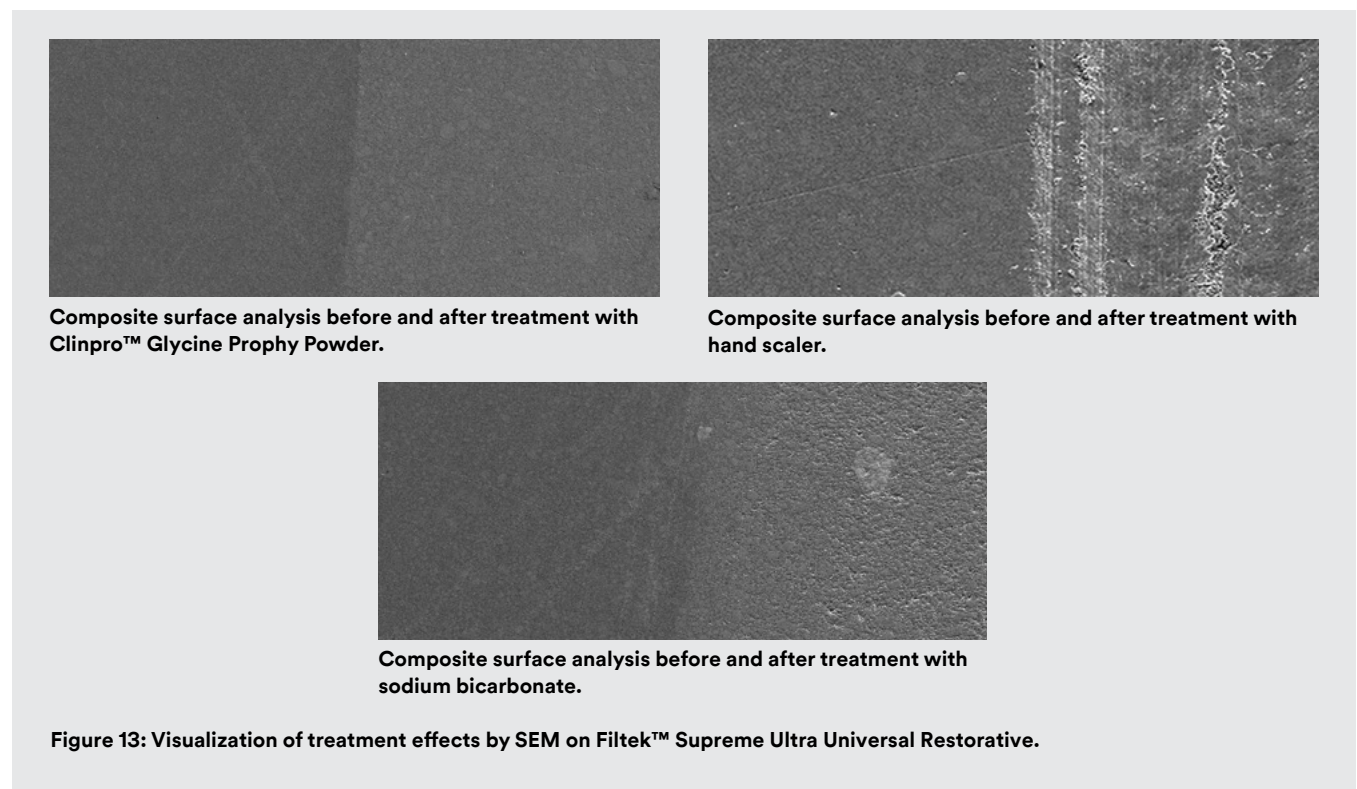
## Clinical Study: Safe and Gentle Cleaning in the Presence of Restorative Materials

### Visualization of treatment effects by scanning electron microscopy on Filtek™ Supreme XT Universal Restorative

Kiesow et al. (2015). Fraunhofer Institute of Mechanics and Materials, Germany.

#### Aim of the study

Evaluate morphological changes induced by treatment with Clinpro™ Glycine Prophy Powder in comparison to sodium bicarbonate air polishing or hand scaler treatment by using scanning electron microscopy (SEM).



#### Conclusion:

SEM observation revealed a gentle cleaning effect only with slight surface changes using Clinpro™ Glycine Prophy Powder. The treatment with sodium bicarbonate air-polishing powder yielded surface change, which is characterized by an increased roughness with the formation of little craters. With a hand scaler treatment, material loss and damages were observed.

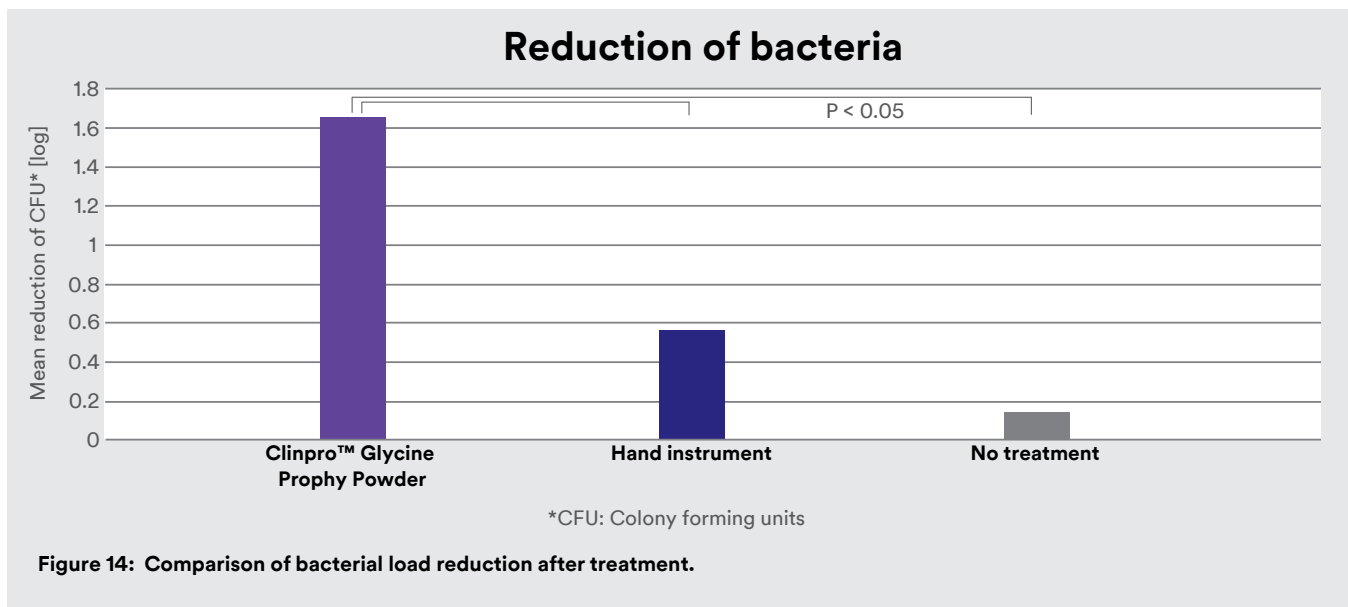
## Clinical Study: Subgingival Plaque Biofilm Removal

# Subgingival plaque removal in buccal and lingual sites using a novel low abrasive air polishing powder

Petersilka, G.J., et al. (2003c). *Journal of Clinical Periodontology*, 30(4), 328–333.

### Aim of the study

Assess the clinical efficacy of Clinpro™ Glycine Prophy Powder on subgingival plaque removal of lingual and buccal sites during supportive periodontal therapy.



## Conclusion

Clinpro™ Glycine Prophy Powder is superior to cures in bacterial load reduction and produces comparable results for subgingival plaque from pockets of 3–5mm depth in supportive periodontal therapy and offers greater patient comfort.

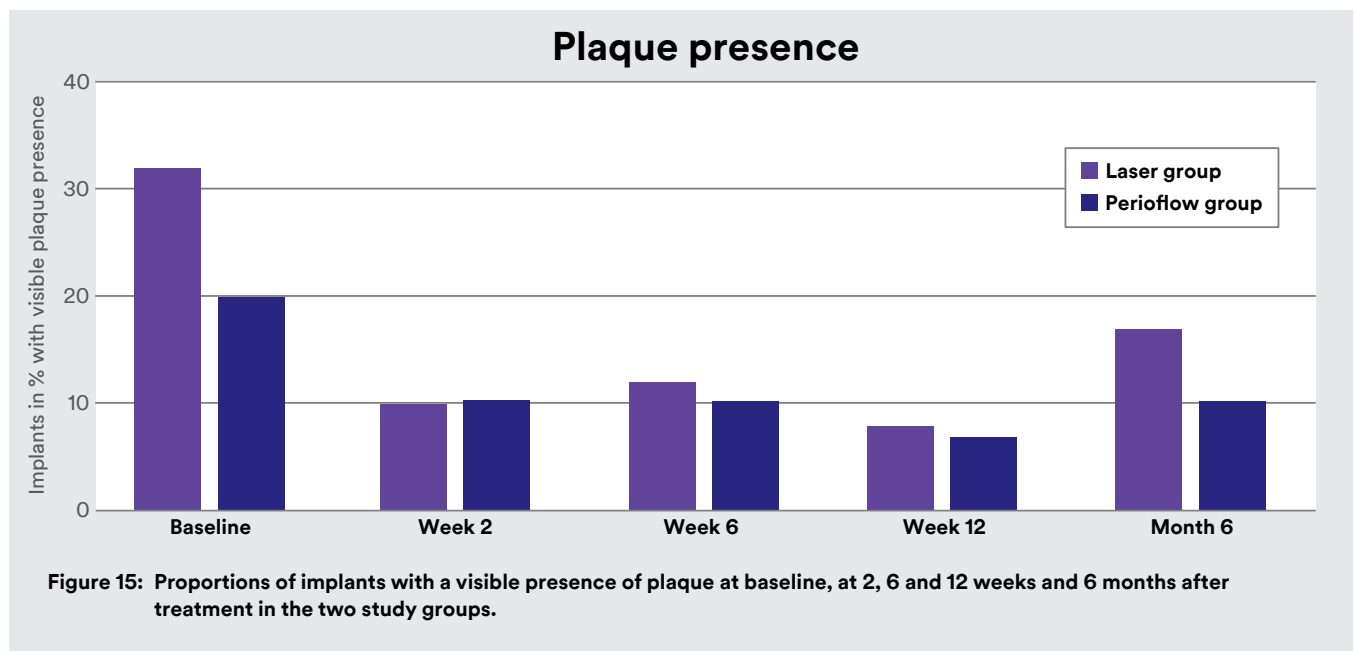
## Clinical Study: Comparison to Other Debridement Methods

# Treatment of peri-implantitis using an ER: YAG laser or an air-abrasive device: a randomized clinical trial.

Renvert, S., et al. (2011). *Journal of Clinical Periodontology*, 38, 65–73.

### Aim of the study:

Compare the treatment effects between air polishing (glycine air-polishing powder) and ER: YAG laser mono-therapy in cases with severe peri-implantitis.



### Conclusion:

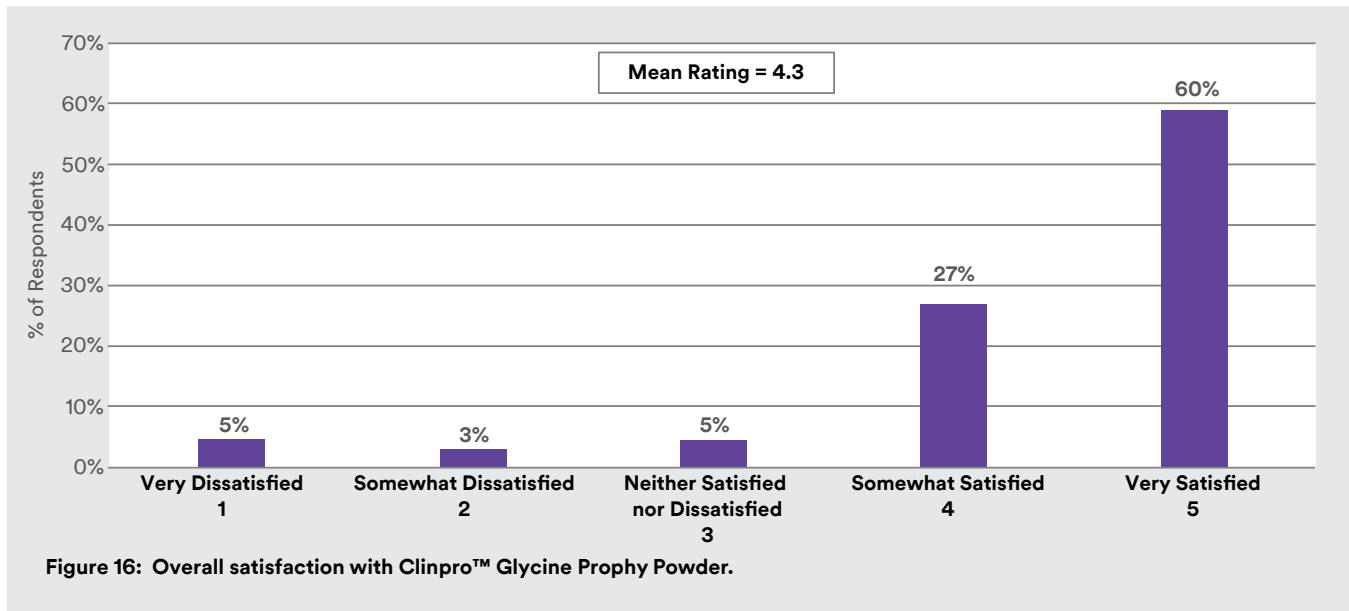
The results after 6 months are similar between both treatments for debridement of implants diagnosed with severe peri-implantitis. Both methods resulted in a reduction of probing depth, frequency of suppuration and bleeding at implants.

# Customer Feedback

Overall Satisfaction with Clinpro™ Glycine Prophy Powder Performance: Field Evaluation (62 Dental Hygienists from across the United States, 697 patients), 2015.

## Question:

How would you rate your overall satisfaction with the performance of Clinpro™ Glycine Prophy Powder? N=62

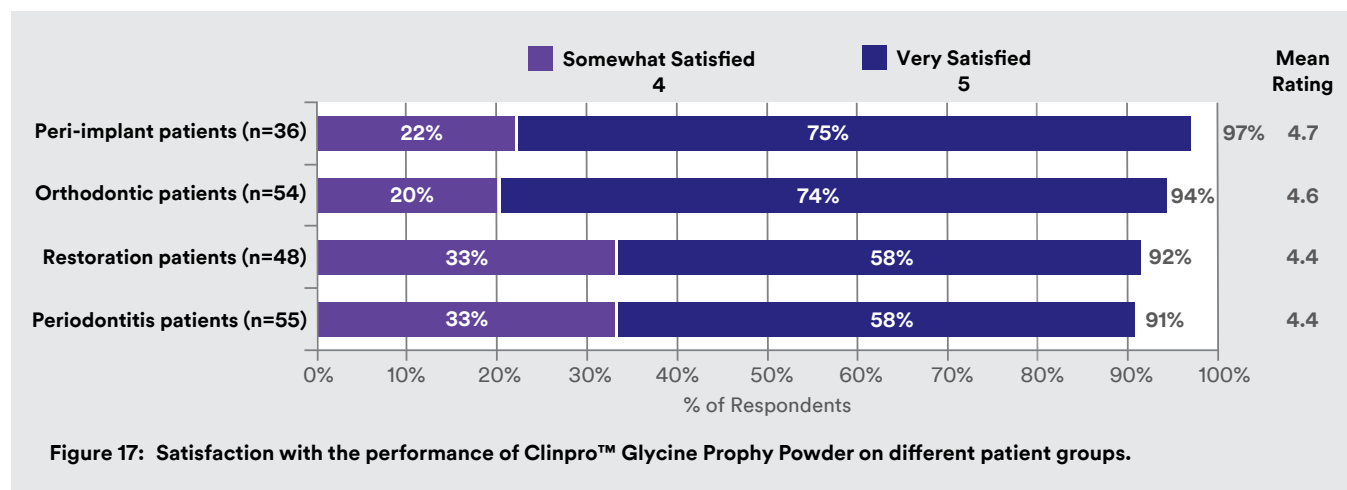


## Conclusion

87% of hygienists indicated they were somewhat or very satisfied with the performance of Clinpro™ Glycine Prophy Powder, with an overall mean rating of 4.3/5.0.

## Question:

How satisfied are you with the performance of Clinpro™ Glycine Prophy Powder on the following patient types? N=62

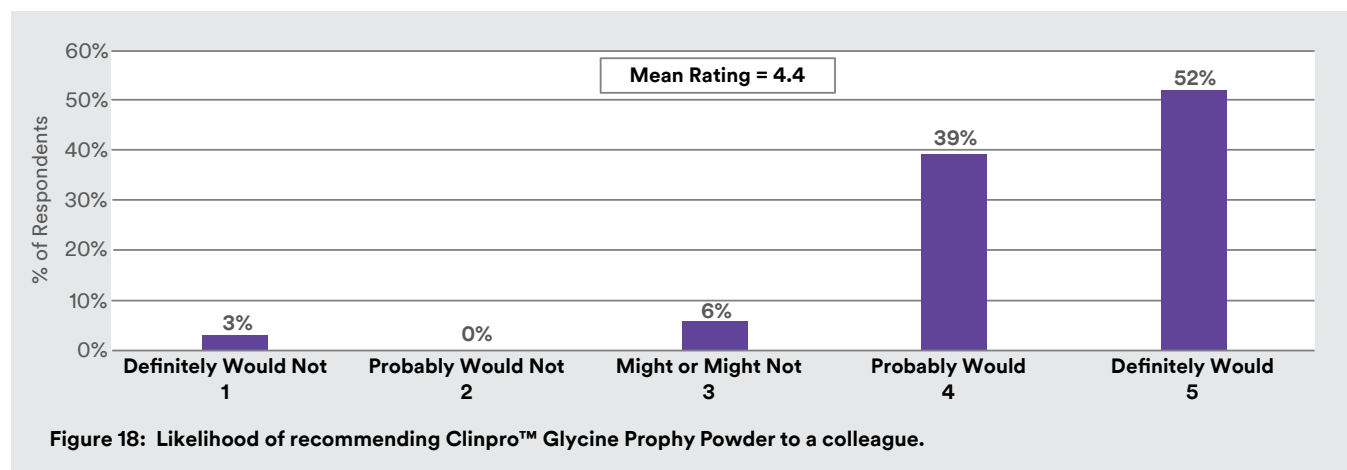


## Conclusion

Out of all four patient groups, over 90% of respondents who used Clinpro™ Glycine Prophy Powder were somewhat or very satisfied with its performance, with top satisfaction from those using the material on peri-implant and orthodontic patients.

## Question:

How likely would you be to recommend Clinpro™ Glycine Prophy Powder to your colleagues? N=62



## Conclusion

Likelihood to recommend Clinpro™ Glycine Prophy Powder to colleagues was high. Over 90% of respondents indicated they probably would or definitely would recommend it, giving a mean rating of 4.4/5.0.

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