

SCIENTIFIC INFORMATION ABOUT PROPHY POWDERS AND PROPHY PASTES

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Some of the investigations cited in this brochure were supported by orochemie GmbH + Co. KG, a company belonging to the Dürr Dental Group. The corresponding source references point them out.

EVERYONE HAS NEED FOR PREVENTION

With respect to oral health, every person has need for prevention. For some people, teeth cleaning and caries prevention measures are enough, but in many cases parodontitis treatment or peri-implantitis prophylaxis is also needed.

In the area of professional prophylaxis and periodontology, dentists and their teams can choose from numerous products and solutions from various suppliers. These include, for example, fissure sealant and fluoridation compounds for caries prevention and germ-reducing dental rinses as well as various hand instruments and powder jet devices in the area of prevention and treatment of periodontal disease. Suppliers have continuously expanded their product portfolio in the past decades. That certainly goes together with society's increased consciousness about the importance of oral health. Healthy-looking oral soft tissue and gleaming white teeth are deemed essential for an attractive smile and self-esteem and contribute directly to a good health-related quality of life. [1, 2]

Adults and seniors keep their natural teeth longer nowadays, thanks to successful dental prophylaxis measures and improved oral hygiene at home. Despite all this, almost 65 percent of seniors in Germany suffer from periodontal disease. Compared to investigations from 2005, the number of those over 65 years old with severe periodontal disease dropped by 55 percent, but 44.8 percent of seniors still suffer from a moderate form of the disease. Even in the group of 35- to 44-year olds, 43.4 percent have already been diagnosed with moderate periodontitis. A severe form of periodontitis was diagnosed in over 8 percent of this age group, according to findings from the Fifth German Oral Health Study (DMS V) [3]. This points to continued challenges for dental care.

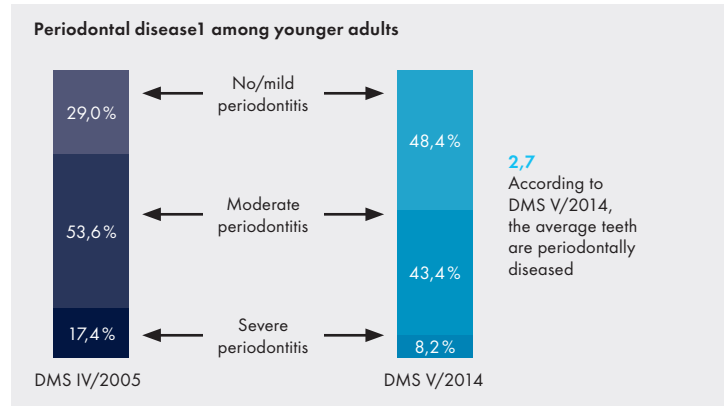


Fig. 1: Severe periodontal disease among younger adults (35 to 44 years old) has been cut in half from 2005 to 2014. [3]

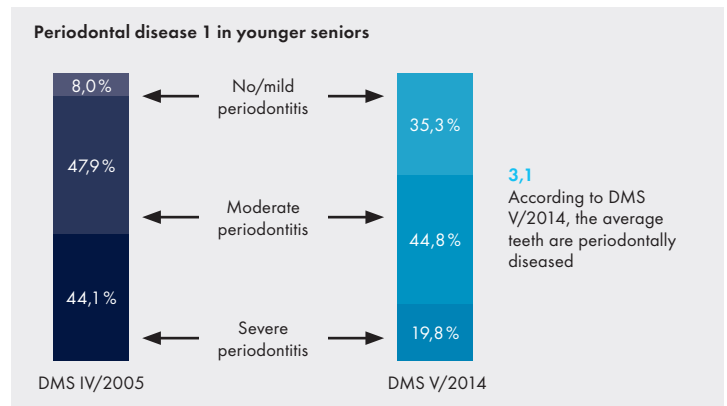


Fig. 2: Severe periodontal disease among younger seniors (65 to 74 years old) has been cut in half from 2005 to 2014. [3]

¹CDC/AAP case classification

OPTIMAL PREVENTION AND THERAPY FROM A SINGLE SOURCE: LUNOS® FROM DÜRR DENTAL

With this as background, DÜRR DENTAL SE began many years ago to develop an extensive dental care system. The goal: to offer dentists and practice teams a comprehensive and user-oriented product range to meet as many needs as possible in dental care. With Lunos® prevention and therapy succeed at the highest level. The products are designed for a minimally invasive treatment. This means, they are effective but simultaneously protect dental hard and soft tissue. Lunos® products fit together optimally and ensure perfect all-round treatment of patients within professional teeth cleaning, comprehensive prevention, or supportive periodontitis treatment. Development of Lunos® products is based on many years of experience in the areas of periodontology and prophylaxis, in which the company has successfully established itself – for 80 years DÜRR DENTAL SE has been a partner of health professionals worldwide.

The Lunos® portfolio includes a powder jet handpiece, an ultrasound-based floor-mounted appliance, various prophy powders, prophy pastes and fissure sealants, a dental rinse and a fluoride gel. These prophylaxis materials are supplemented by a prophylaxis cushion made of comfortable visco foam and a wellness towel for better patient comfort. Training and services for dental practices perfectly round out our offering (see detailed product overview on page 29)

- [1] Pithon, M. M.; Nascimento, C. C.; Barbosa, G. C.; Coqueiro Rda, S.: *Do dental esthetics have any influence on finding a job? Am J Orthod Dentofacial Orthop*; 146(4):423-9. doi: 10.1016/j.ajodo.2014.07.001.
- [2] Bennadi, D.; Reddy, C. V.: *Oral health related quality of life. J Int Soc Prev Community Dent*; 3(1):1-6.; 2013; doi: 10.4103/2231-0762.115700.
- [3] Kassenzahnärztliche Bundesvereinigung, Körperschaft des öffentlichen Rechts, Bundeszahnärztekammer – Arbeitsgemeinschaft der Deutschen Zahnärztekammern e. V. (German National Association of Statutory Health Insurance Dentists and German Dentists Association) (BZÄK): *Fifth German Oral Health Study DMS V/2014*).

MILD AND EFFECTIVE – LUNOS® PROPHY POWDERS FOR GENTLE CLEANING

Powder jet treatments today play an important role in caries prevention, periodontitis prophylaxis, supporting periodontal therapy and in professional teeth cleaning. The procedure is being used increasingly in orthodontic treatment, e.g. for cleaning the surface before attaching braces.

The newly developed powders for powder jet treatment of the Lunos® line consist mainly of the very water-soluble disaccharide trehalose. Trehalose is non-cariogenic, in contrast to many other disaccharides, as it is not metabolised until it reaches the small intestine. [4] Moreover, glucanes, which favour adhesion of carious biofilm, are not formed in the mouth. [5] In addition, lactic acid production of typical caries-causing germs in the mouth is inhibited by trehalose. [4] As an abrasive particle, trehalose is also gentler to hard and soft tissue than, for example, the most frequently used prophylaxis powder based on sodium bicarbonate. And compared to the classic curettage with hand instruments used in the subgingival area, powder jet treatment using trehalose-based powders is a minimally invasive alternative, which is especially gentle to tissue. Additionally, more invasive methods, such as scaling or classic curettage as well as use of sonic and ultrasonic devices, are quite demanding on the user and so take more time than a powder jet treatment. Most patients in fact find this modern alternative much more pleasant than the classic treatment methods, especially in the subgingival area (see page 10)

The Lunos® prophylaxis line offers two prophy powders for subgingival and supragingival application: The Lunos® Prophy Powder Gentle Clean with a particle size of ~ 65 µm gently and effectively removes supragingival plaque and stains. The Lunos® Prophy Powder Perio Combi was developed for thorough subgingival and supragingival cleaning. With a particle size of ~ 30 µm, it subgingivally removes the biofilm as well as sonic application – and is significantly more comfortable for patients. The abrasive particles, based on trehalose, clean softly and thoroughly. In addition, mucous membranes are not irritated and do not dry out. Repolishing of the cleaned surfaces in the supragingival area is often not necessary, as they do not show any noticeable roughness after treatment. Both trehalose-based prophy powders can be used in powder jet treatment with the MyLunos® powder jet unit. A supragingival and a subgingival nozzle with sterile disposable tips are available for the MyLunos®.



SMOOTH SURFACES – GOODBYE BACTERIA

If tooth polishing is needed, the prophylaxis pastes Lunos® Super Soft and Lunos® Two in One are on offer. They make it difficult for germs to resettle on the surface. The fine polish Lunos® Prophylaxis Paste Super Soft gently removes bacterial coatings, contains hydroxylapatite to support remineralisation, and gently polishes smooth and bright. It is especially suitable for sensitive surfaces and implants and is free from pumice or gluten.

Lunos® Two in One effectively removes stubborn stains and simultaneously polishes the enamel with the help of self-reducing wollastonite abrasive particles. The abrasive strength declines after about ten seconds, and the polishing particles made of feldspar and hydroxylapatite, which help with remineralisation, come into play and ensure a smooth polish.

For Dürr Dental, it is important to put these new developments on a scientifically grounded foundation and prove their effectiveness with studies. Corresponding summaries of initial results are introduced on the following pages.

These investigations were supported by orochemie GmbH + Co. KG, a company belonging to the Dürr Dental Group. The corresponding source references point them out.

[4] Neta, T.; Takada, K.; Hirasawa, M.: Low-cariogenicity of trehalose as a substrate. *J Dent.*; 28(8): p. 571-6; 2000.

[5] Schüler, V.: Glykanbindungsspezifität von Lektinen kariesätiologisch bedeutsamer Bakterien; *Dissertation, in Medizinische Fakultät Charité – Universitätsmedizin Berlin*; 2010.



Video of Lunos® prophylaxis system

1. PROPHY POWDER

1.1 THE SUBGINGIVAL USE OF TREHALOSE POWDER

GOAL OF THE STUDY

A comparison of clinical parameters upon subgingival application of trehalose powder by means of air-powder-water jet device versus ultrasonic treatment during maintenance therapy.

METHOD

In this blind, randomised clinical study with a split-mouth design, 44 patients were examined and treated over a period of six months. Single-root teeth with probing depths (PPD) of 4 mm and with positive bleeding on probing (BOP) as well as PPD (probing pocket depth) > 4 mm were randomised to treatment with an air-powder-water jet device with trehalose powder (Lunos® Perio Combi/DÜRR DENTAL SE and Air-Flow-Master® with Perio-Flow® nozzle/EMS) or a sonic device (SonicFlex 2003 L, tip 60A/KaVo). Trehalose is a non-cariogenic, water-soluble disaccharide from the food industry. The clinical baseline examinations (BL = baseline immediately after the first application) included the plaque control record (PCR), sulcus bleeding index (SBI), PPD, clinical attachment level (CAL) and BOP. Immediately after the subgingival debridement, the subjects rated their sensation of pain for both procedures using a visual analogue scale (VAS, from 0 to 10). The clinical investigation of all parameters was repeated after three and six months. If PPD = 4 mm and positive BOP or PPD > 4 mm was detected, the teeth were treated again using the previously assigned procedure.

RESULTS

Both methods showed a significantly significant reduction of PPD (Fig. 1, test BL 5.52 ± 0.93 , six months 3.66 ± 0.81 , control BL 5.55 ± 0.9 , six months 3.68 ± 0.86 , $p < 0.001$), CAL (Fig. 2, test BL 6.93 ± 1.5 , six months 5.3 ± 1.52 , control BL 7.27 ± 1.8 , six month 5.84 ± 1.71 , $p < 0.001$) and BOP (Fig. 3, test BL 86%, six months 41%, control BL 89%, six months 34%, $p < 0.001$). There were no significant differences between the two groups over six months. The need for retreatment after three and six months also showed no significant difference. The subjects' assessment of their sensation was significantly better for the air-powder-water jet spray treatment (Fig. 4, test 2.33 ± 2.14 , control 4.91 ± 2.65 , $p < 0.001$). [6]

CONCLUSION

The powder jet treatment with trehalose powder in this study showed the same clinical effectiveness as the sonic instrument treatment, measured on three typical periodontic parameters. The patients rated the air-powder-water jet spray treatment with trehalose powder as subjectively more pleasant and less painful.

[6] Kruse, A. B.; Akakpo, D.; Maamar, R.; Al-Ahmad, A.; Woelber, J.; Vach, K.; Ratka-Krueger, P.: Trehalosepulver zur subgingivalen Instrumentierung in der Erhaltungstherapie; Parodontologie; 27(3): 353-386; 2016 (Poster, DG PARO Annual Meeting 2016, Würzburg).

Supported by orochemie GmbH + Co. KG, a company belonging to the Dürr Dental Group.

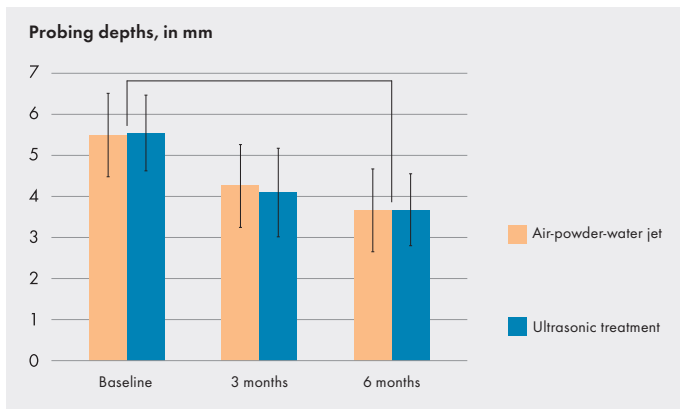


Fig. 1: Probing depths (PPD) in mm for single-root teeth of 44 patients before and after treatment with air-powder-water jet or sonic instrumentation in the split-mouth design. Error bars symbolise the standard deviation.

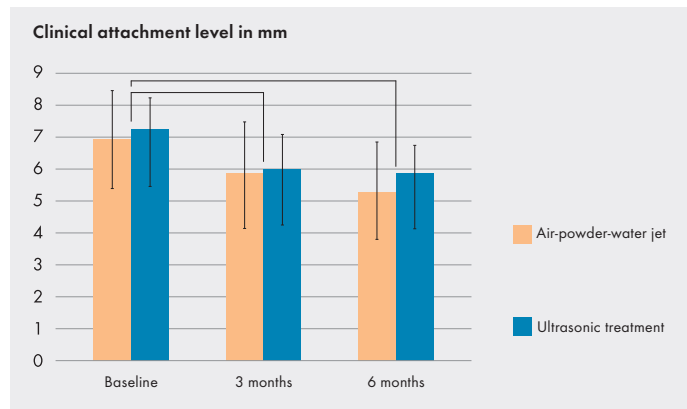


Fig. 2: Clinical attachment level (CAL) in mm for single-root teeth of 44 patients before and after treatment with air-powder-water jet or sonic instrumentation in the split-mouth design. Error bars symbolise the standard deviation.

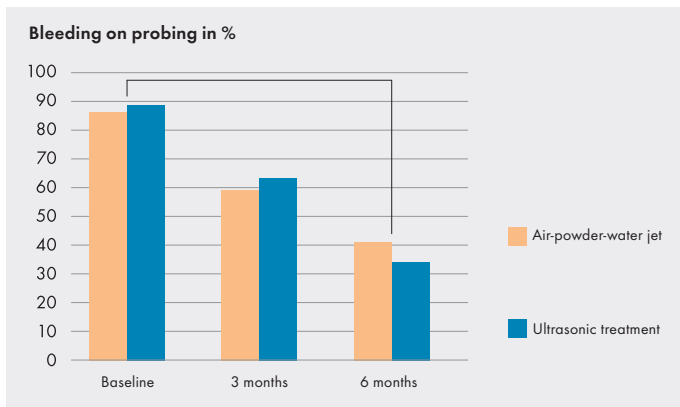


Fig. 3: Bleeding-on-probing (BOP) in % for single-root teeth of 44 patients before and after treatment with air-powder-water jet or sonic instrumentation in the split-mouth design. Error bars symbolise the standard deviation.

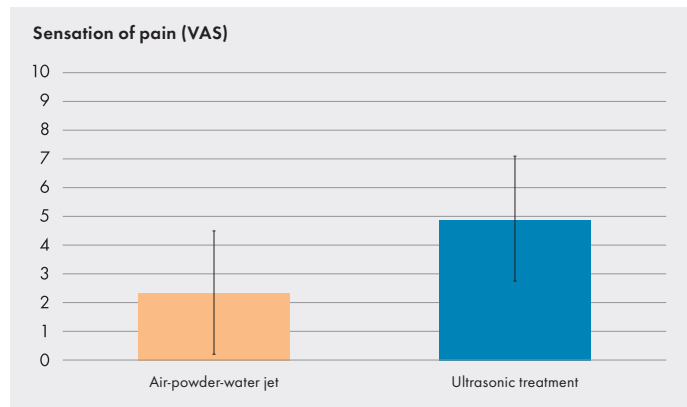


Fig. 4: Sensation of pain ($p < 0.001$), increased through a visual analogue scale (from 0 = no pain to 10 = max. pain) of 44 patients after treatment with air-powder-water jet or sonic instrumentation in split-mouth design. Error bars symbolise the standard deviation.

1.2 CLEANING EFFICIENCY AND ABRASION CHARACTERISTICS OF PROPHY POWDERS

GOAL OF THE STUDY

Evaluation of the cleaning performance and abrasion characteristics (abrasiveness) of the Lunos® Propfy Powders Gentle Clean and Perio Combi/DÜRR DENTAL SE on enamel in comparison with commercially available branded products based on glycine, erythritol and sodium bicarbonate for supra- and subgingival use.

METHOD

For evaluation of the cleaning performance, embedded and flat-ground (1200 grit) crowns of human molars (ten samples per test product) were pretreated with 35% phosphoric acid gel (1 min) and stored in artificial saliva (8 h), before they were placed in 0.2 % chlorhexidine (1 h) and then in black tea at 37 °C (4 h) (Fig. 1). For evaluation of the abrasion characteristics, 5 dental crowns per test product/reference were embedded and ground flat (4000 grit), but not discoloured.

For practice-related, reproducible polish movements, the samples were placed in a toothbrush simulator (ZM 3.8, SD Mechatronic) with a fixed MyLunos®/DÜRR DENTAL SE powder jet handpiece. The following parameters were set for treatment (Fig. 2):

- Distance between handpiece nozzle and enamel surface 5 mm - Zigzag movement with a travel of the sample table of 5 mm - Water supply 100 % at 2 bar water pressure - Air pressure 4 bar - 1 cycle (9 sec.), speed 15 mm/s

The supragingival prophy powders used were (with approximate average particle size given):

- Lunos® Propfy Powder Gentle Clean/DÜRR DENTAL SE (trehalose, ~65 µm)
- Branded Product A (glycine, ~65 µm)
- Branded Product B (sodium bicarbonate, ~65 µm)

The subgingival prophy powders used were:

- Lunos® Propfy Powder Perio Combi/DÜRR DENTAL SE (trehalose, ~30 µm)
- Branded Product C (glycine, ~25 µm)
- Branded Product D (erythritol, ~14 µm)
- Branded Product E (glycine, particle size n/a)

To determine the cleaning performance, colour characterisations of the samples were made using colorimetric measurements to determine the L*a*b* values (spectrophotometer CM-3600A/Konica Minolta) before and after staining as well as after cleaning. From these values, the cleaning performance in % was determined.

To determine the abrasion characteristics, the average surface roughness Ra was determined on the uncoloured enamel samples before and after powder jet treatment using mechanical profilometry. In addition, a qualitative evaluation of the samples was carried out by scanning electron microscopy (SEM) on selected samples after powder jet treatment in order to identify possible morphological changes of the enamel surface.

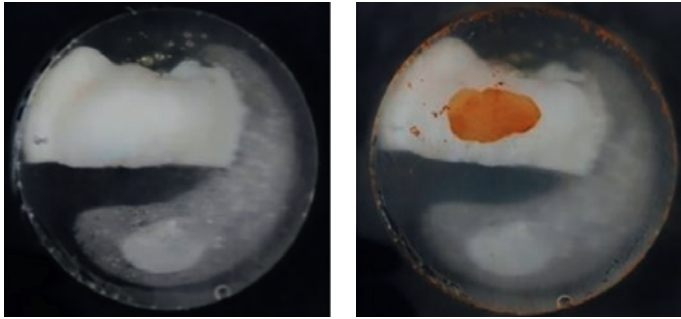


Fig. 1: Typical presentation of embedded tooth enamel samples: (left) ground, before discolouration, (centre) after discolouration, (right) after powder jet treatment.

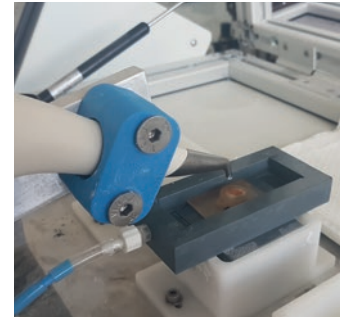


Fig. 2: Test setup with fixed MyLunos® powder jet handpiece

RESULTS

Supragingival powders

The quantitative evaluation by means of colour measurement revealed the best cleaning performance was achieved with Lunos® Propphy Powder Gentle Clean, which differed significantly from branded product A based on glycine (ANOVA, Tukey post-hoc test) (Fig. 3, left).

At the same time, the abrasion evaluation of Lunos® Propphy Powder Gentle Clean showed a significantly lower abrasiveness towards tooth enamel than did the branded products A and B based on glycine and sodium bicarbonate, respectively. Abrasion after trehalose treatment was not significantly higher than after treatment with water or without treatment. (Fig. 3, right)

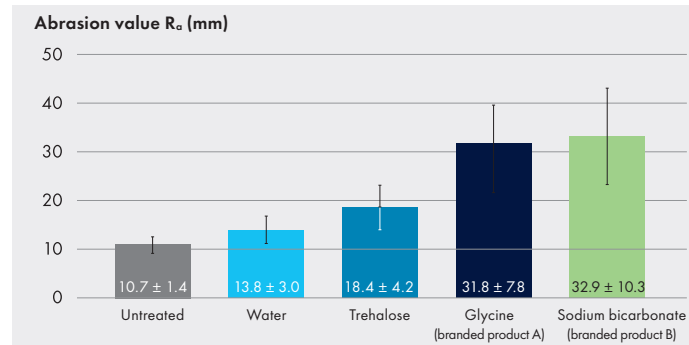
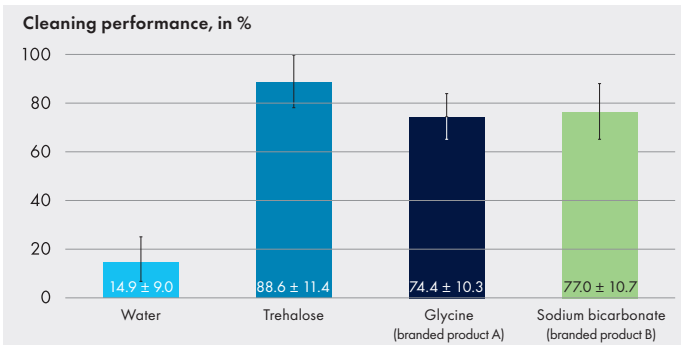


Fig. 3: Left: Cleaning performance of different supragingival prophy powders by means of powder jet using MyLunos® (DÜRR DENTAL SE) on coloured human tooth enamel; control: water. Right: Abrasion values R_a after powder jet treatment with various prophy powders using MyLunos® (DÜRR DENTAL SE) on coloured human tooth enamel; controls: untreated and water.

Sub-/supragingival powders

The quantitative evaluation by means of colour measurement showed comparable cleaning performance for Lunos® Prophy Powder Perio Combi as well as branded product D based on erythritol and branded product E based on glycine. (Fig. 4, left). The abrasion caused by branded product C (glycine) resulted in significantly greater surface abrasion of tooth enamel than that from Lunos® Prophy Powder Perio Combi, the other prophy powders, and the controls (water, untreated).

Scanning electron micrographs (Fig. 5) confirmed the surface quality of the treated enamel surfaces and thus indirectly the abrasion characteristics of the prophy powders. All prophy powders tested here resulted in a change in the surface morphology of the polished and subsequently treated enamel. Unevenly distributed, different surface roughnesses, isolated, deeper damage (micrometre range) and/or exposure of enamel prisms were detected.

CONCLUSION

The effectiveness of use in supragingival cleaning of tooth surfaces could be confirmed for all tested prophy powders. The best cleaning performance among the supragingival powders was achieved with the Lunos® Prophy Powder Gentle Clean as indicated by the lowest observed abrasion and thus the best preserved surface quality. Among the sub-/supragingival powders, Lunos® Prophy Powder Perio Combi showed comparable cleaning performance to erythritol and one of two glycine-based products with minimal abrasion or damage potential. The Lunos® Prophy Powder Gentle Clean and Perio Combi trehalose-based powders are suitable for the effective cleaning of tooth enamel while causing little surface damage. The minimal invasiveness of Lunos® prophy powders is thus confirmed.

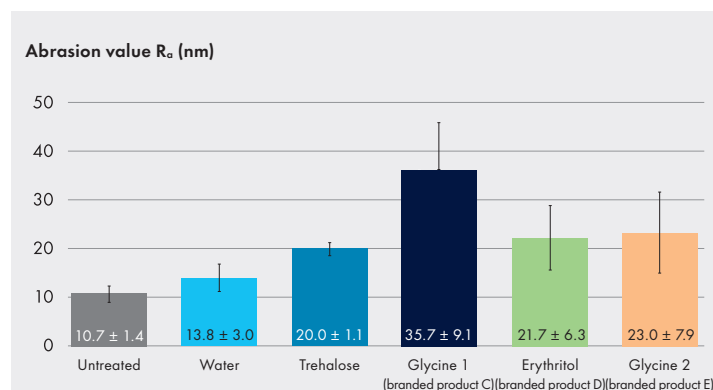
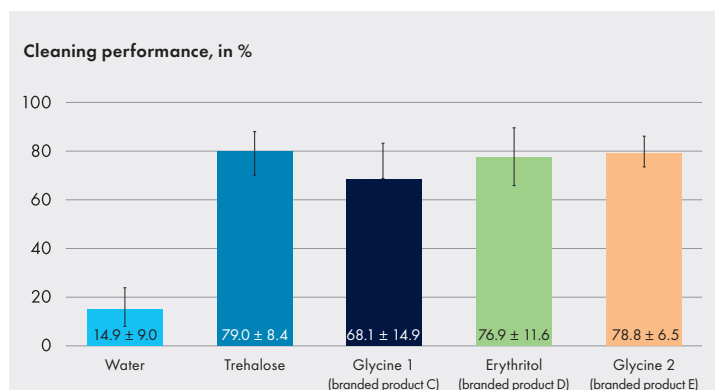


Fig. 4: Left: Cleaning performance of different supragingival prophy powders by means of powder jet using MyLunos® (DÜRR DENTAL SE) on stained human tooth enamel; control: water. Right: Abrasion value R_a after powder jet treatment with various prophy powders using MyLunos® (DÜRR DENTAL SE) on stained human tooth enamel; controls: untreated and water.

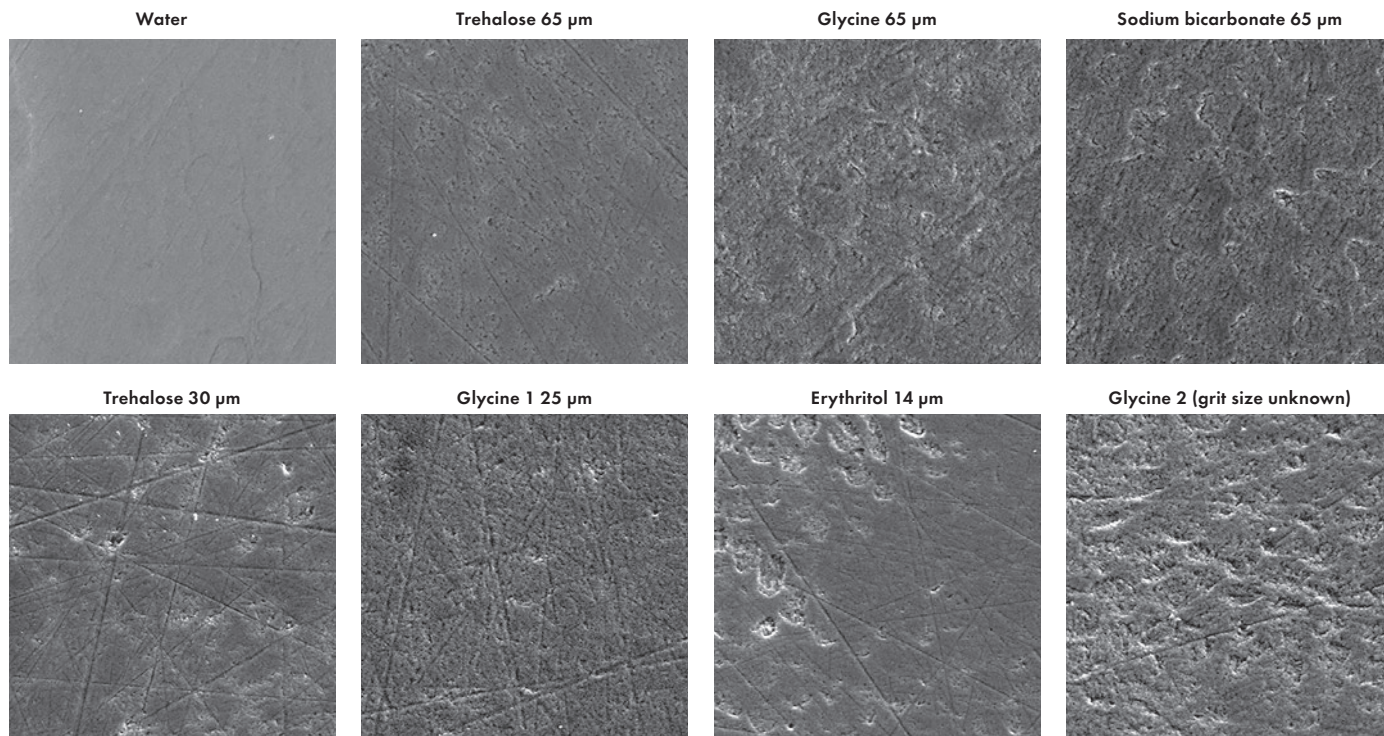


Fig. 5: Scanning electron micrographs of human enamel samples after powder jet application with MyLunos® (DÜRR DENTAL SE) using different prophylactic powders.

[7] Morawietz, Maria; Sarembe, Sandra; Kiesow, Andreas; Hartl, Jennifer; Hänel, Kristina (2020): AIR-POLISHING: INVESTIGATION OF CLEANING PERFORMANCE AND ABRASIVENESS OF DIFFERENT POWDERS. FRAUNHOFER INSTITUTE FOR MICROSTRUCTURE OF MATERIALS AND SYSTEMS IMWS. IADR/AADR/CADR, General Session & Exhibition, Washington D.C., USA, March 18-21 2020 (2984). Available online at <https://iadr.abstractarchives.com/abstract/20iags-3322644/air-polishing-investigation-of-cleaning-performance-and-abrasiveness-of-different-powders>.

1.3 DO POWDER JET TREATMENTS HARM THE SURFACE QUALITY OF DENTAL MATERIALS?

GOAL OF THE STUDY

Determination of the influences of prophylaxis powders based on trehalose and glycine on the surface of dental materials.

METHOD

In this series of experiments, the effect of the Lunos® Prophylaxis Powder Gentle Clean/DÜRR DENTAL SE and of a commercially available glycine-based branded powder on the surface quality of different dental materials (here: Ceramic Vitablocs® Mark II/VITA Zahnfabrik und Titanimplantat SCREW-LINE/CAMLOG®) was investigated.

First, the different test phantoms were punctually powder-jet treated for 15 seconds using a standardised procedure at an angle of 45° and a distance of 5 mm (Fig. 1). Then the surfaces were thoroughly rinsed with water for 1 minute. Finally, the characteristics of the surfaces were evaluated in the scanning electron microscope (SEM) and each compared to the untreated test specimens.

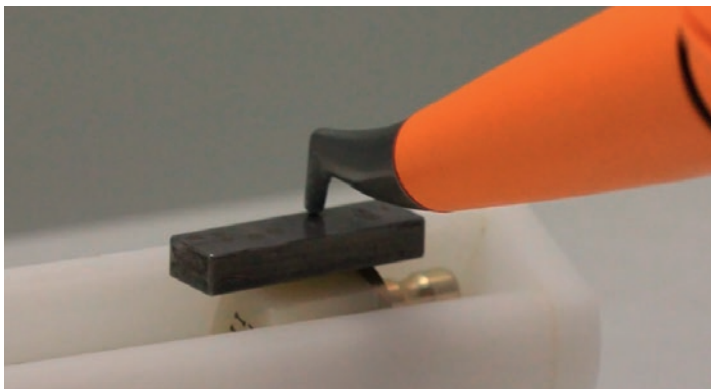


Fig. 1: Test setup with spacer for control.

RESULTS

Fig. 2a–2c show scanning electron microscope images of the ceramic test phantoms before and after jet spray treatment. Fig. 2a documents the initial situation, in which a defined structure of the untreated ceramic surface can be recognised. After treatment with trehalose-based Lunos® Prophylaxis Powder Gentle Clean (Fig. 2b) as well as with the reference powder based on glycine (Fig. 2c), the surface was still comparable in its structure.

On the untreated implant surface (Fig. 2d), a groove structure was detectable due to a previous test specimen preparation. After treatment with the Lunos® Prophylaxis Powder Gentle Clean (Fig. 2e) and the commercially available branded product (Fig. 2f), the SEM image showed structure and surface characteristics comparable to the initial situation. The original polishing stripes of the implant surface were visibly unchanged after treatment with both prophylaxis powders. [8]

CONCLUSION

The microscopic images showed no recognisable changes in the surface structure of the ceramic blocks and titanium implants used for the two tested prophylaxis powders based on glycine and on trehalose. The results confirmed the Lunos® principle of minimally invasive treatment with prophylaxis powders based on trehalose.

[8] Hartl, J., employee in the R&D Prophylaxis department, Kornwestheim: *Einflüsse verschiedener Prophylaxepulver auf die Oberflächenqualität dentaler Werkstoffe*; orochemie GmbH + Co. KG; 2014 (unpublished, status 2018).

Supported by orochemie GmbH + Co. KG, a company belonging to the Dürr Dental Group.

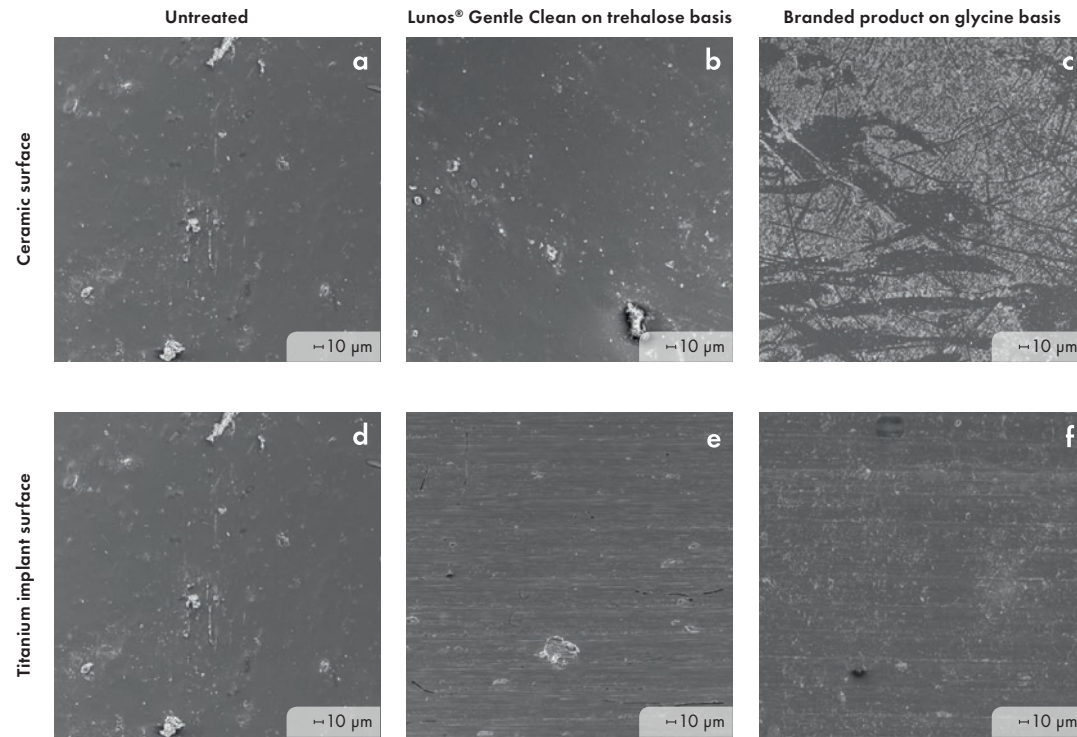


Fig. 2: Influence of prophylactic powders on the surface of two dental materials after jet spray treatment at an angle of 45° and a distance of 5 mm using a standardised procedure.

2. PROPHY PASTES

2.1 THE CLEANING POTENTIAL OF PROPHY PASTES PUT TO THE TEST

GOAL OF THE STUDY

Evaluation of the cleaning performance of the self-rounding Lunos® Propphy Paste Two in One/DÜRR DENTAL SE and a comparable commercially available branded product.

METHOD

First, embedded and flatly ground crowns of human molars, after pretreatment with 35% phosphorous acid rule (1 min) and storage in artificial saliva (8 h), were placed in dental rinse containing chlorhexidine (1 h) and then in black tea at 37 °C.

For practice-related, reproducible polish movements, samples were clamped in a toothbrush simulator below a fixed polishing cup and treated with the following parameters:

- Wetting with 50 µl of water before the cleaning process
- 100 mg of prophy paste per sample
- ProCup™/Kerr™ polishing cup
- Zig-zag movement with a motion length over the sample table of 5 mm
- 2 cycles, speed 15 mm/s
- Rotation speed of the polishing cup 2,000 rpm
- Weight 200 g

For colour characterisation of the samples, colorimetric measurements were made to determine the L*a*b* values (spectrophotometer CM-3600A/ Konica Minolta) before and after staining as well as after cleaning, and from this the cleaning performance in % was determined.

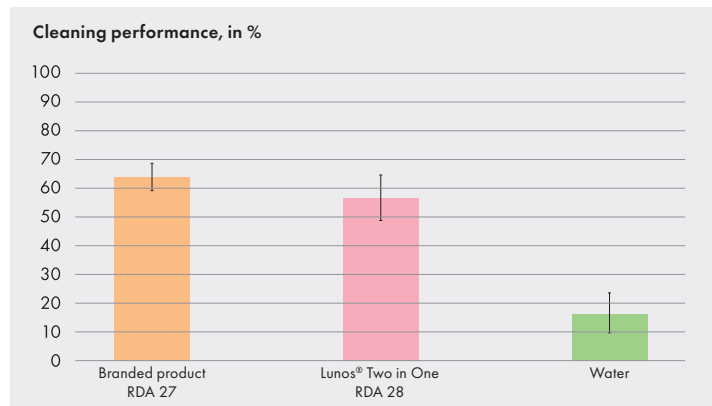


Fig. 1: Cleaning performance of different prophy pastes in % on prepared dental crowns; colorimetry; means + standard deviation of ten samples each per prophy paste/reference.

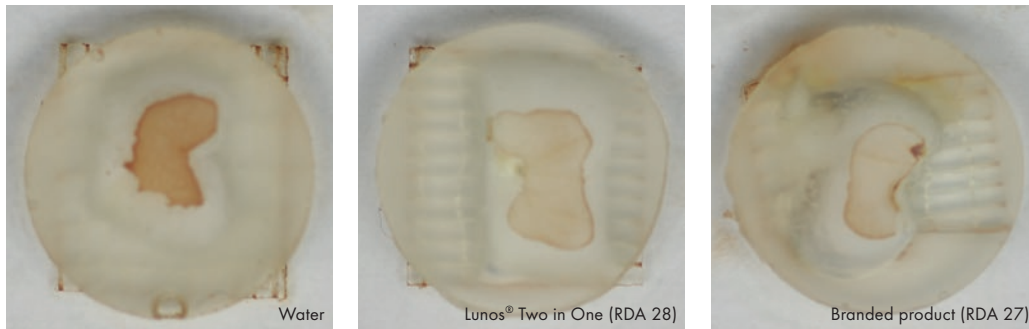


Fig. 2: Photography of selected representative samples of prepared dental crowns of human molars after cleaning with two different prophylaxis pastes and with water.

RESULTS

In the quantitative evaluation using colour measurements, both prophylaxis pastes showed a similar cleaning potential. Although the cleaning performance of Lunos® Prophylaxis Paste Two in One (56 %) was somewhat less than that of the branded product, the difference was not scientifically significant ($p = 0.14$).

Significant differences from the control reference water (16 %) were determined for both prophylaxis pastes ($p < 0.001$). (Fig. 1)

The photographic images (Fig. 2) confirm the quantitative colour measurements that showed a brightening/cleaning of the stained samples after application of both prophylaxis pastes. Treatment with water resulted in only very minor to minor brightening of the samples. [10]

CONCLUSION

Under the specified experimental conditions, both prophylaxis pastes showed a similar cleaning potential. The marginal cleaning performance of water (negative control) confirmed the effectiveness of both products. Lunos® Prophylaxis Paste Two in One is suitable for effective cleaning of tooth surfaces.

[10] Morawietz, M., employee of the group Charakterisierung medizinischer und kosmetischer Pflegeprodukte, Halle; Sarembe, S., employee of the group Charakterisierung medizinischer und kosmetischer Pflegeprodukte, Halle; Kiesow, A., head of the group Charakterisierung medizinischer und kosmetischer Pflegeprodukte, Halle: Bewertung der Reinigungsleistung von Lunos® Two in One; Fraunhofer Institut für Mikrostruktur von Werkstoffen und Systemen IMWS, Halle, 2016 (unpublished, status 2018).

Supported by orochemie GmbH + Co. KG, a company belonging to the Dürr Dental Group.

2.2 HOW GENTLE ARE PROPHY PASTES TO TOOTH STRUCTURE?

GOAL OF THE STUDY

Examination of dentine and enamel abrasion: a comparison of different prophy pastes.

METHOD

The dentine and enamel abrasion of various prophylaxis pastes were examined using a special test procedure (pin-on-disc tribometer Ma 10/ Wazau, Fig. 1), which permits an exact abrasion examination on specifically prepared human enamel and dentine samples. A wear-free ceramic disc served as friction partner (Fig. 1). Using a friction solution (dilution of the prophylaxis pastes), the tribological examinations were performed with the tooth samples under constant test conditions.

The absolute abrasion correlated with the friction media was determined through the exact tuning of the friction parameters, in particular of the friction disc (roughness setting) and of the reference achieved with pure water as friction solution ($dz = 0 \mu\text{m}$). Not only the abrasion curve and the maximum

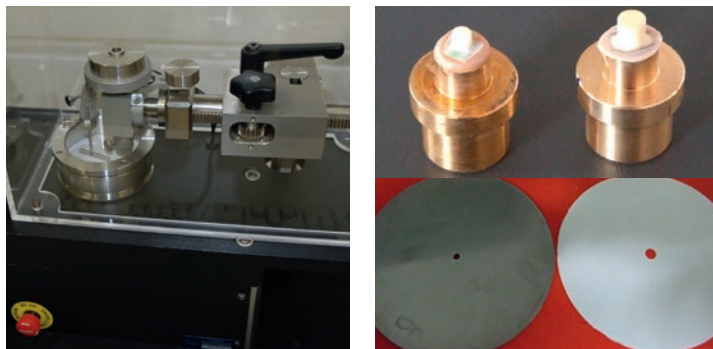


Fig. 1: Tribometer MT10 (left), dental hard substance samples and friction discs made of stainless steel and aluminium oxide ceramic (right).

abrasion depth, but also the achieved surface roughness were used here as criteria for evaluating the possible damage potential of professional prophylaxis pastes.

The following products were used in this test series: the fine polishing pastes Product A (RDA 7) and Lunos® Prophy Paste Super Soft/DÜRR DENTAL SE (RDA < 5) as well as the self-rounding prophy pastes Product B (RDA 27) and Lunos® Prophy Paste Two in One/Dürr Dental SE (RDA 28), which optimise the cleaning effect through change in polishing particle size.

First, reference curves and reference roughness were determined for all friction bodies through rubbing in ultra-pure ampule water. All measurements were performed with the following friction parameters:

- Oscillating mode of operation
- Friction load $F_N = 2 \text{ N}$
- Friction angle $\alpha = 45^\circ$
- Circulation speed $V_U = 0.105 \text{ m/s}$
- Oscillation frequency $f_{os} = 6.67 \text{ Hz}$
- Friction radius $r = 20 \text{ mm}$
- Friction duration $t = 20 \text{ min}$

The friction examinations were performed on each tooth sample with direct change of the friction solutions, in order to take into account the differences that exist in natural dental hard tissue with regard to abrasion characteristics.

RESULTS

The investigations with the fine prophy pastes Product A and Lunos® Prophy Paste Super Soft delivered closely adjacent maximum abrasion values (around $1 \mu\text{m}$, Tab. 1), whereby the Lunos® Prophy Paste tended to show somewhat less abrasion, both on the dentine and on the enamel ($dz = 0.2 \mu\text{m}$ versus $dz = 0.6 \mu\text{m}$).

n = 5	On human enamel	On human dentine
Product A RDA 7	1.5 ± 0.8	0.9 ± 0.5
Lunos® Super Soft RDA < 5	0.9 ± 0.5	0.7 ± 0.2
Product B RDA 27	9.9 ± 1.6	25.4 ± 5.2
Lunos® Two in One RDA 28	3.5 ± 1.0	9.7 ± 2.6

Tab. 1: Average abrasion (five samples) on tooth substance to be maintained through friction with fine (Product A and Lunos® Prophy Paste Super Soft/DÜRR DENTAL SE) and self-rounding prophy pastes (Product B and Lunos® Two in One/DÜRR DENTAL SE).

The resulting surface quality was evaluated as very homogeneous, which leads to the conclusion of a very good polishing performance with simultaneously low surface damage. The results for the mean roughness (Sa) and mean roughness depth (Sz) were between $1.3 \mu\text{m} < Sa < 1.6 \mu\text{m}$ and $8.3 \mu\text{m} < Sz < 15.6 \mu\text{m}$.

In Fig. 2, the effect of the two self-rounding cleaning and polishing pastes on dentine can be seen very well: Rough particles ensured a steep run of the measurement curve, while disintegrated particles with rounded edges caused a flatter run. In comparison to Product B, Lunos® Prophy Paste Two in One achieved markedly lower abrasion values – these were 65% in enamel and 62% lower for dentine – and so was gentler to dental hard tissue (Tab. 1). The resulting surface quality was comparable for both self-rounding prophylaxis pastes. With mean roughness values $Sa = 1.4\text{--}1.9 \mu\text{m}$ and mean roughness depths $Sz = 12.3\text{--}14.6 \mu\text{m}$, the achieved surface quality was comparable to that achieved with the fine prophylaxis pastes. [11]

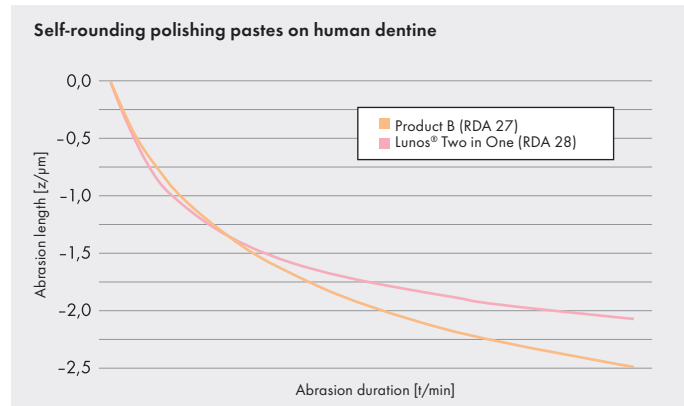


Fig. 2: Measurement curves of abrasion (average of three measurements) through friction with the self-rounding prophy pastes Product B and Lunos® Prophy Paste Two in One on human dentine.

CONCLUSION

Of the two self-rounding prophy pastes, Lunos® Two in One was less abrasive on retained tooth substance than the examined reference product. Based on the determined values for absolute abrasion, the Lunos® Prophy Paste Super Soft can be certified to have a lower damage potential with good surface quality in direct comparison to the examined branded product. The results supported the Lunos® principle of minimally invasive treatment.

[11] Danyi, P., medical-technical laboratory assistant, Ulm; Stegmayer, T., Entwicklungsingenieur, Königsbrunn; Schmid, T., master (fine mechanics), Herbrechtingen; Diebold, R., scientist and project lead, Stuttgart: *Wie zahnstrukturschonend sind die Polierpasten?*; Institut für Lasertechnologien in der Medizin und Meßtechnik an der Universität Ulm; 2016 (unpublished, status 2018).

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2.3 DO PROPHY PASTES MODIFY THE SURFACES OF CERAMICS AND IMPLANTS?

GOAL OF THE STUDY

Comparison of the effect of various prophylaxis pastes on implant and ceramic surfaces.

METHOD

The used CAMLOG® implants/CAMLOG® Biotechnologies and Ceramics/VITABLOCS® Mark II for CEREC®/inLab®/Vita Zahnfabrik were first embedded in resin and then treated with polishing cup and prophy paste (polishing cup from Kerr Dental, 2000 RPM, weight 200 g, back-and-forth movement of the sample by around 10°, use of 0.1 g prophy paste and approx. 50 µl water, polishing time 15 s). The following prophy pastes were used on the implant surfaces: Product A (RDA 9,8), Product B (RDA 7) and Lunos® Prophy Paste Super Soft Orange/DÜRR DENTAL SE (RDA 5). For the Vitablocs® for CEREC®, the prophy pastes Product C (RDA 27), Product D (RDA 36) and Lunos® Prophy Paste Two in One/DÜRR DENTAL SE (RDA 28) were used. On the Vitablocs® for CEREC®, besides the polished surface, an untreated comparison surface was always marked, so that a direct comparison could be made in the scanning electron microscope image. After polishing, images were taken with the scanning electron microscope at various magnifications and the corresponding evaluations of the images were made.

RESULTS

Fig. 1a-1h on the next page show the prophy pastes used and the examination overview for the CAMLOG® implants; similarly, Fig. 2a-2h show the examination overview for the Vitablocs® for CEREC® series. All illustrations are presented in 100x and 500x magnification.

Fig. 1a and 1b show the untreated implant surface with its typical stripe structure. This could still be seen after use of the various prophylaxis pastes (Fig. 1c-1h). In addition, light treatment marks (stripes and structures perpendicular to the stripe structure of the implant) can be seen on the surfaces after use of Product A (Fig. 1c and 1d) and Product B (Fig. 1e and 1f). These marks could not be seen with Lunos® Prophy Paste Super Soft (Fig. 1g and 1h).

In the comparison of the Vitablocs® for CEREC® ceramic surfaces, no significant differences could be detected between the untreated surface (Fig. 2a and 2b) and the treated surfaces (Fig. 2c-2h). The untreated surfaces appeared somewhat inhomogeneous, but no changes in the general status of the surfaces resulted from the treatment with prophylaxis pastes. [12]

CONCLUSION

The microscopic images showed no disadvantageous change in the CAMLOG® implant surfaces and the Vitablocs® für CEREC® ceramic surfaces. The Lunos® Prophy Pastes left no recognisable treatment marks on the tested implant and ceramic surfaces.

[12] Schellhammer, U., employee in the R&D Prophylaxis department, Kornwestheim: Vergleich der Oberflächen von Implantaten und Keramik nach der Behandlung mit verschiedenen Polierpasten; orochemie GmbH + Co. KG; 2014 (unpublished, status 2018).

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CAMLOG® implants

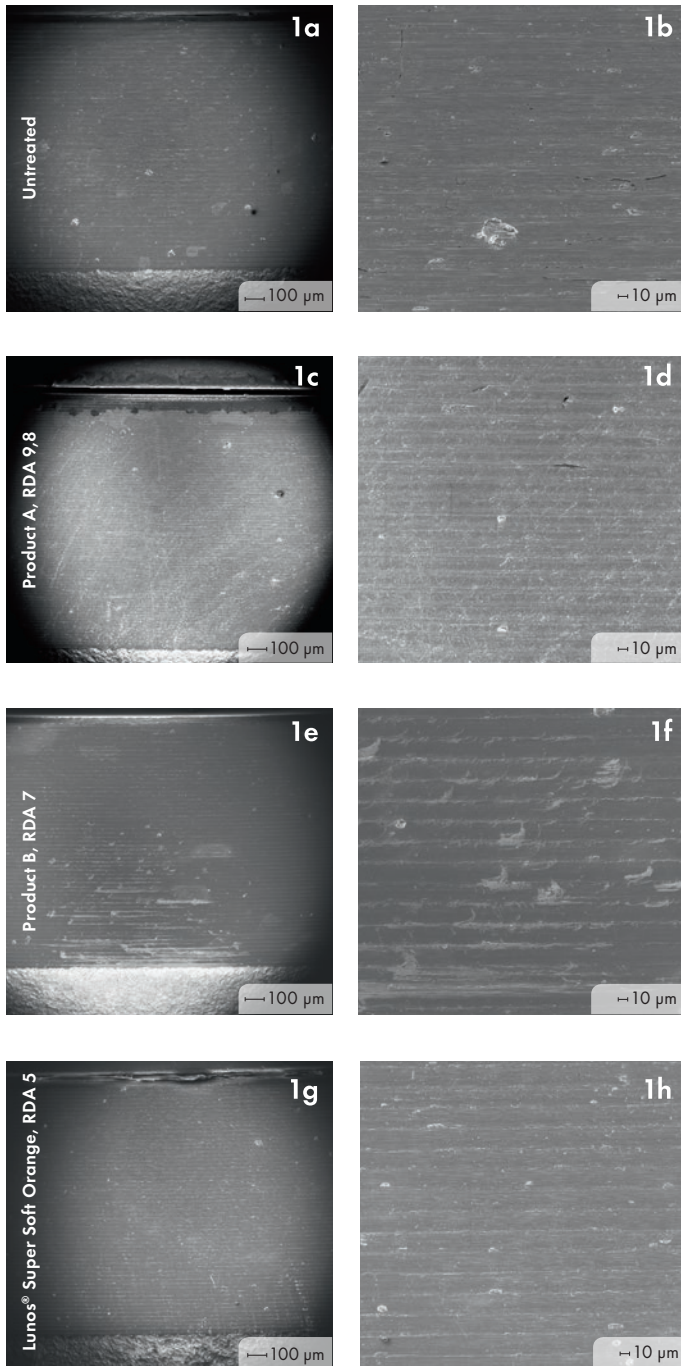


Fig. 1: SEM images of CAMLOG® implant surfaces before and after treatment with various prophylactic pastes. Each with 100x and 500x magnification.

Vitablocs® for CEREC® ceramic

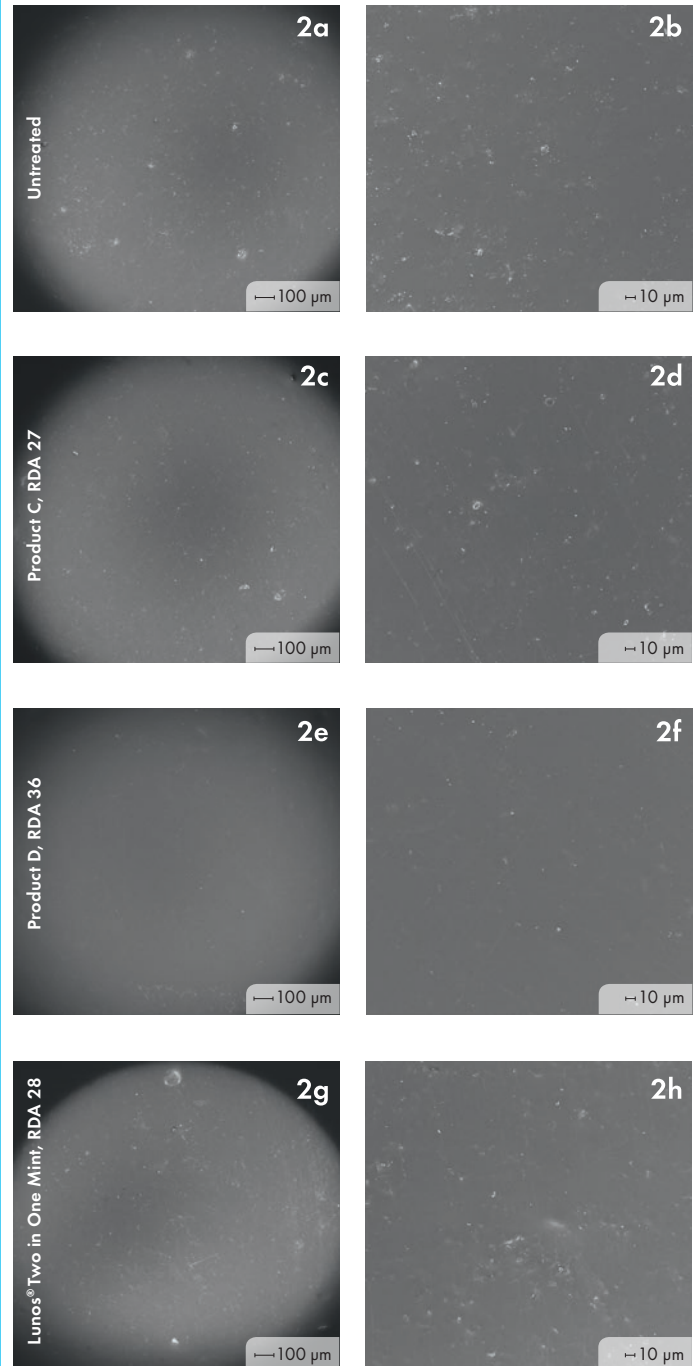


Fig. 2: SEM images of Vitablocs® for CEREC® ceramic surfaces before and after treatment with various prophylactic pastes. Each with 100x and 500x magnification.

2.4 HOW EFFECTIVELY DO HYDROXYLAPATITE-BASED PROPHY PASTES REMOVE PLAQUE?

GOAL OF THE STUDY

Comparison of the efficiency of teeth cleaning when polishing with various fine prophylaxis pastes using an artificial plaque model. The treatment time needed until the surface is cleaned is used here as a comparison value.

METHOD

Twenty buccal tooth surfaces were divided by a vertical cut and separated for processing by an inserted metal band. The resulting 40 tooth surfaces were inoculated for 48 hours with an artificial dental plaque, consisting of couscous, sugar, milk and plaque stain (Mira-2-Ton/Hager & Werken). The tooth surfaces were assigned randomly to one of two cleaning procedures. A green 4:1 dental handpiece was used with a standard polishing cup (Pro-Cup/KerrHawe). Method I with hydroxylapatite-based prophy paste

(Lunos® Super Soft/DÜRR DENTAL SE, RDA 5); method II fine prophy paste (commercially available branded product as reference product, RDA 7). The end point of each cleaning procedure was a visually clean tooth surface. All treatments were performed by the same user, which permitted an intra-experimental comparison of the results. Samples for scanning electron microscopy (SEM) were generated through replication using a thin-flowing silicon impression material. These were generated and examined before inoculation with plaque and after complete removal of the plaque. [13]

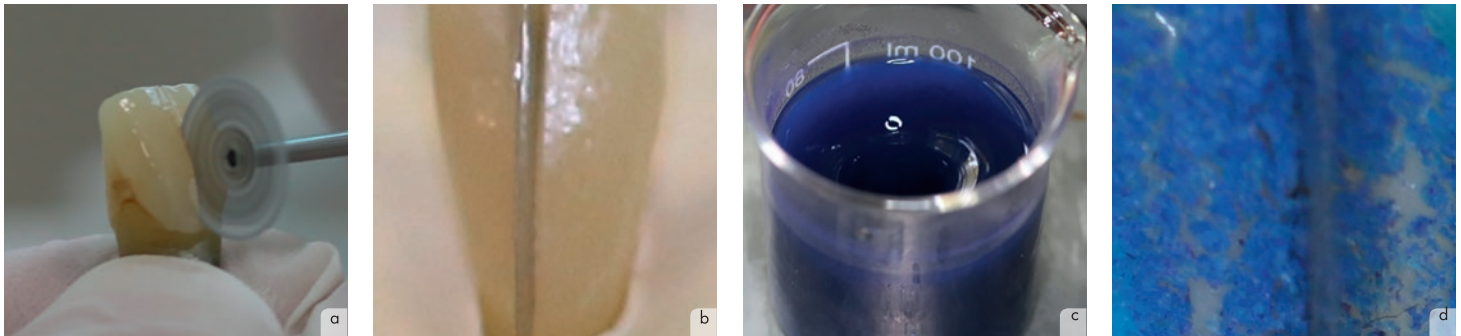


Fig. 1: Production of the test specimens: optical separation into two areas (a) with a metal band (b) and inoculation with artificial dental plaque (c), dried for 48 hours (d).

RESULTS

In Tab. 1, the determined treatment times until complete cleaning (visually clean tooth surface) are compiled. No statistically significant difference ($p > 0.05$) between the two prophylaxis pastes was found. Fig. 2 shows examples of SEM images of the surfaces before and after treatment. Both prophylaxis pastes left behind intact tooth surfaces. Enamel prisms were not exposed by any of the treatments.

Treatment time (in s)

n = 20	Lunos® Super Soft	Reference product
Average	15.1	17.2
Maximum value	25.7	24.8
Minimum value	11.0	12.7
Interquartile range	5.8	4.0

Tab. 1: Time (in s) for treatment of prepared buccal tooth surfaces with artificial plaque with two different prophylaxis pastes until visually clean surface.

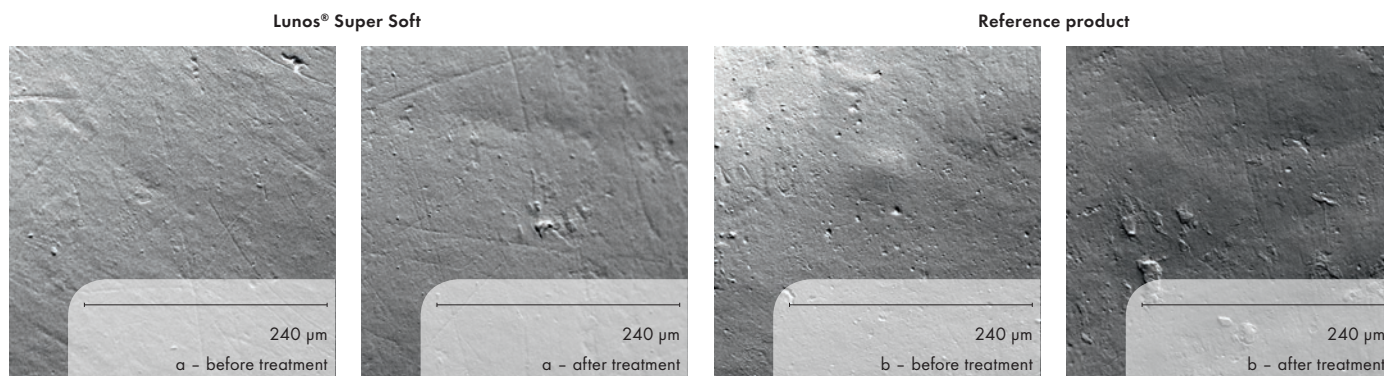


Fig. 2: "Scanning electron microscope" (SEM) images 500x prepared buccal tooth surfaces with artificial dental plaque before and after treatment with two prophylaxis pastes.

CONCLUSION

Both examined prophylaxis pastes were able to remove plaque in the presented model effectively and in comparable time.

[13] Wenzler, J.; Kozolka, F.; Frankenberger, R.; Braun, A.: Efficiency of a Hydroxyapatite-Based Polishing Paste in a Plaque Model; *J Dent Res* 95(Spec Iss A):3406; 2016 (Poster, IADR 2016, San Francisco, USA).

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SUMMARY

DÜRR DENTAL SE has been developing medical products for more than 80 years.

Our own mission is to offer products that meet the highest medical standards. Fulfilling the needs of our users and their patients is the standard by which we measure our products.

The Lunos® prophylaxis line is oriented on the needs of patients and users and is designed to be minimally invasive. To prove that these needs are met, scientific studies by independent research institutes, universities and our own research department follow the continuous development of Lunos® products. A selection of these studies is compiled in this brochure. They show the potential of the Lunos® products compared to well-known branded products and how they support professional prophylaxis and periodontology and thus can provide a positive contribution to dental health internationally.

Cooperation with universities and institutes is of enormous importance to us and supplements our own research activities.

We want to consistently follow this path in future as well, and with the support of applied science continue to develop innovative, high-quality and practice-oriented products.

We would like to sincerely thank our customers and partners for their trust.

LUNOS® PRODUCTS

Lunos® Prophy Powder Gentle Clean

Supragingival cleaning • gentle • effective • water-soluble
• flavour varieties orange, spearmint, wild berry and neutral

Lunos® Prophy Powder Perio Combi

Subgingival and supragingival cleaning • gentle • thorough
• water-soluble • lightly sweet taste • without aromatic additives

Lunos® Prophy Paste Super Soft

Gentle polish • Lunos® with hydroxylapatite • flavour varieties orange and neutral

Lunos® Prophy Paste Two in One

Self-reducing • effective cleaning and polishing • with hydroxylapatite
• flavour varieties orange and neutral as well as mint with added sodium fluoride

Lunos® Dental rinse

Alcohol-free • sugar-free • with xylitol • mild taste

Lunos® Prophylaxis wellness cloth

Refreshing towel • revitalising • with aloe vera • alcohol-free

Lunos® Prophylaxis cushion

With visco foam for maximum patient comfort • supports the throat and neck • for optimal placement • can be washed and disinfected

Lunos® Fluoride gel

With sodium fluoride (12,300 ppm) • protects and strengthens tooth enamel • promotes remineralisation • inhibits plaque regeneration

Lunos® Fissure sealant Clear

Transparent • composite-based • for high-quality aesthetic sealing
• light-curing • abrasion-resistant • moisture-tolerant

Lunos® Fissure sealant Opaque

Opaque • composite-based • contains fluoride for durable protection
• light-curing • abrasion-resistant • moisture-tolerant

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