LUNOS®
MAKING SMILES BRIGHTER

SCIENTIFIC INFORMATION ABOUT PROPHYLAXIS POWDERS AND PROPHYLAXIS PASTES

DÜRR DENTAL
THE BEST, BY DESIGN

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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.

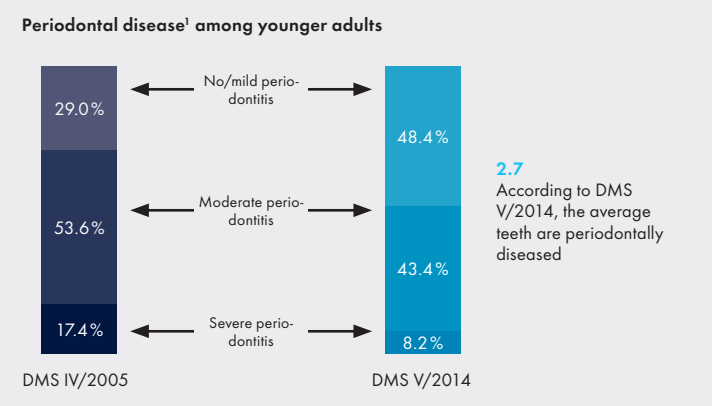


Fig. 1: Severe periodontal disease among younger adults (35 to 44 years old) has been cut in half from 2005 to 2014. [3]

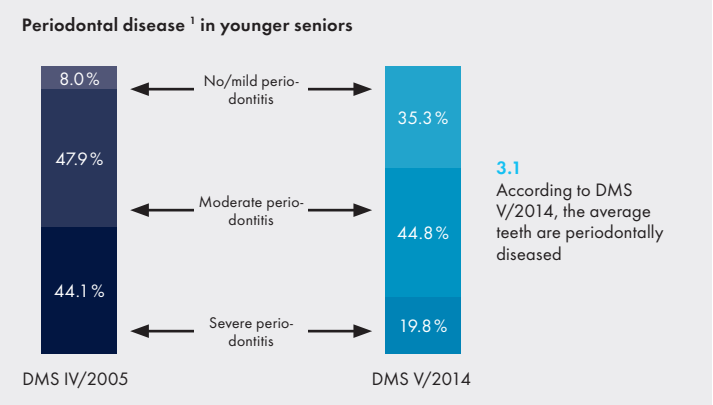


Fig. 2: Severe periodontal disease among younger seniors (65 to 74 years old) has been cut in half from 2005 to 2014. [3]

[1]CDC/AAP case classification

OPTIMAL PREVENTION FROM A SINGLE SOURCE: THE NEW LUNOS® PROPHYLAXIS LINE FROM DÜRR DENTAL

With this as background, Dürr Dental SE began many years ago to develop an extensive prophylaxis 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 prophylaxis. The new Lunos® prophylaxis line offers prevention at the highest level. The products are designed for a minimally invasive treatment. This means, the products 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 the Lunos® line is based on many years of experience in the areas of periodontology and prophylaxis, in which the company has successfully established itself – for 75 years, DÜRR DENTAL SE has been a partner of health professionals worldwide.

The Lunos® portfolio includes various prophylaxis powders, prophylaxis pastes and fissure sealants, as well as a dental rinse, fluoride gel and fluoride varnish. 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 POWDER 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 prophylaxis 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.

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® Prophy 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.

1. PROPHYLAXIS POWDER

1.1 THE SUBGINGIVAL USE OF TREHALOSE POWDER

GOAL OF THE STUDY

Comparison of clinical parameters upon subgingival application of trehalose powder by means of air-powder-water jet device versus sonic 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® mit Perio-Flow® nozzle/EMS) or a sonic device (SonicFlex 2003 L, Spitze 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.

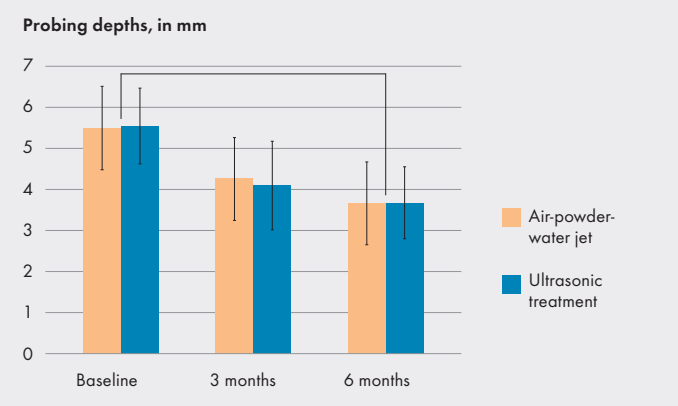


Fig. 1: Probing depths (PPD) in mm for single-root teeth of 44 patients before and after treatment with air-powder-water jet or sonic instrumentation in the split-mouth design. Error bars symbolise the standard deviation.

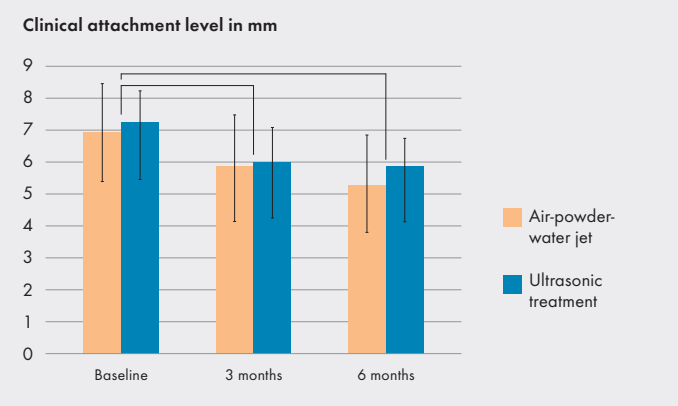


Fig. 2: Clinical attachment level (CAL) in mm for single-root teeth of 44 patients before and after treatment with air-powder-water jet or sonic instrumentation in the split-mouth design. Error bars symbolise the standard deviation.

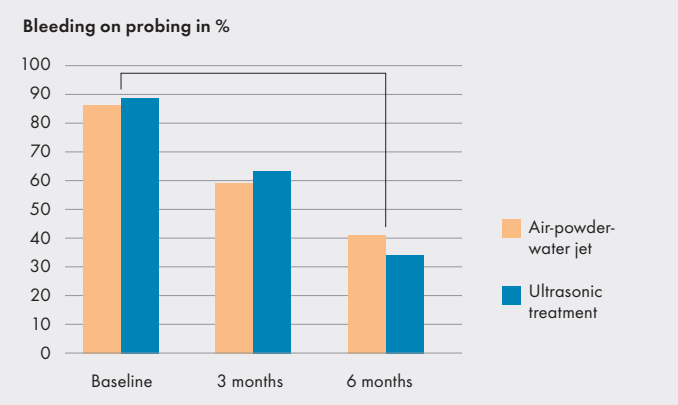


Fig. 3: Bleeding-on-probing (BOP) in % for single-root teeth of 44 patients before and after treatment with air-powder-water jet or sonic instrumentation in the split-mouth design. Error bars symbolise the standard deviation.

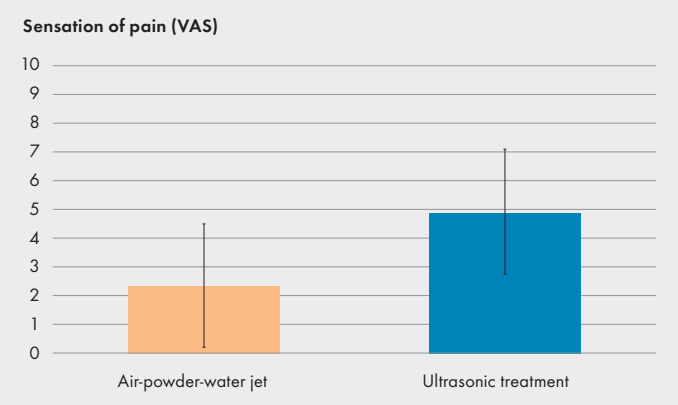


Fig. 4: Sensation of pain ($p<0.001$), increased through a visual analogue scale (from 0 = no pain to 10 = max. pain) of 44 patients after treatment with air-pwder-water jet or sonic instrumentation in split-mouth design. Error bars symbolise the standard deviation.

1.2 CLEANING EFFICIENCY OF PROPHYLAXIS POWDERS

GOAL OF THE STUDY

Evaluation of the cleaning efficiency of the Lunos ® Prophy Powder Gentle Clean/DÜRR DENTAL SE in comparison with two established branded products based on glycine and sodium bicarbonate.

METHOD

Embedded and planar ground 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 chlorhexidine (1 h) and then in black tea at 37 °C (4 h).

For practice-related, reproducible polish movements, the samples were placed in a toothbrush simulator with a fixed powder jet handpiece. The following parameters were set for treatment:

- Zig-zag movement with a motion length over the sample table of 5 mm
- Powder and water supply, each 50 %
- 1 cycle, speed 15 mm/s
- 4 bar air pressure at the powder jet device (Air-Flow-Master®)

The prophylaxis powders used were the Lunos® Prophy Powder Gentle Clean, branded Product A based on sodium bicarbonate and branded Product B based on glycine. 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.

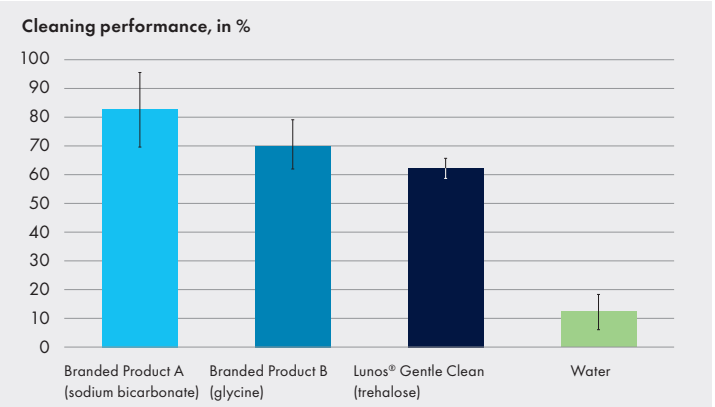


Fig. 1: Cleaning performance of different prophylaxis powders in % on prepared dental crowns; colorimetry; means + standard deviation of ten samples each per prophylaxis powder/reference. The grain sizes of all tested powders were approx. 65 µm.

RESULTS

In the quantitative evaluation by means of colorimetry, taking standard deviations into account, only small, scientifically insignificant differences in cleaning performance were observed. This was somewhat higher for branded Product A than for branded Product B, followed by Lunos® Prophy Powder Gentle Clean. Marked differences from the reference water were determined for all prophylaxis powders, likewise for Lunos® Prophy Powder Gentle Clean from branded Product A.

Very good reproducibility was substantiated for Lunos® Prophy Powder Gentle Clean. The standard deviation of 5% was clearly below the standard deviations of the other test products. (Fig. 1)

Photographic images (Fig. 2) confirmed the quantitative colorimetric measurements. They likewise showed that treatment with all the prophylaxis powders tested here resulted in a brightening or cleaning of the stained samples. The branded Product A based on sodium bicarbonate achieved the best cleaning result here. For branded Product B based on glycine and Lunos® Prophy Powder Gentle Clean based on trehalose, no differences in the cleaning performance could be established purely visually – both were similarly effective. Treatment with water resulted in almost no brightening, or only a very minor brightening, of the samples. [7]

CONCLUSION

The cleaning performance of the Lunos® Prophy Powder Gentle Clean was comparable to the cleaning performance of the tested glycine-based prophylaxis powder. The marginal cleaning performance with water (negative control) confirmed the effectiveness of the various prophylaxis powders. The trehalose-based Lunos® Prophy Powder Gentle Clean is suitable for effective cleaning of tooth surfaces.

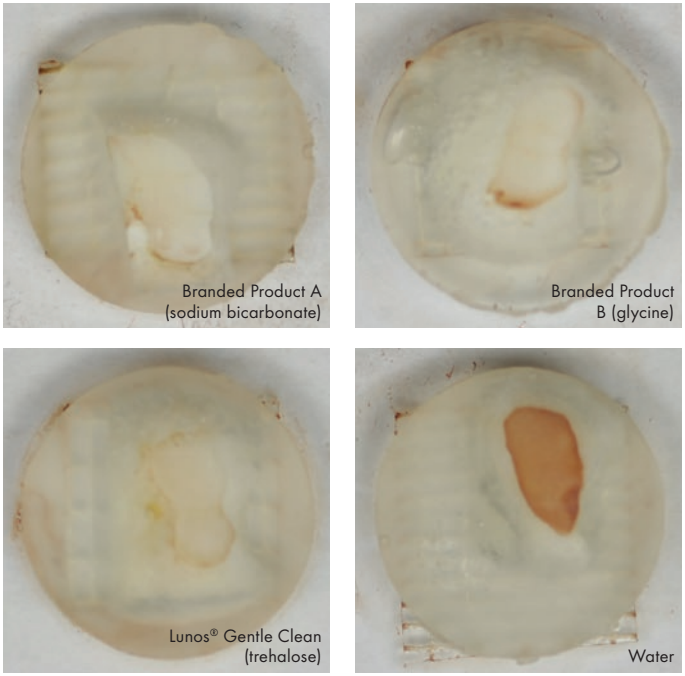


Fig. 2: Photography of selected representative samples of prepared dental crowns of human molars after cleaning with different prophylaxis powders and with water.

[7] Morawietz, M.; Sarembe, S.; Kiesow, A.: Evaluation of stain removal using different air polishing powders; Parodontologie; 28(3): 333–364; 2017 (Poster, DG PARO Annual Meeting 2017, Dresden).

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

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® Prophy 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 and titanium implant SCREW-LINE/CAMLOG®) was investigated.

First, the different test specimens 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.

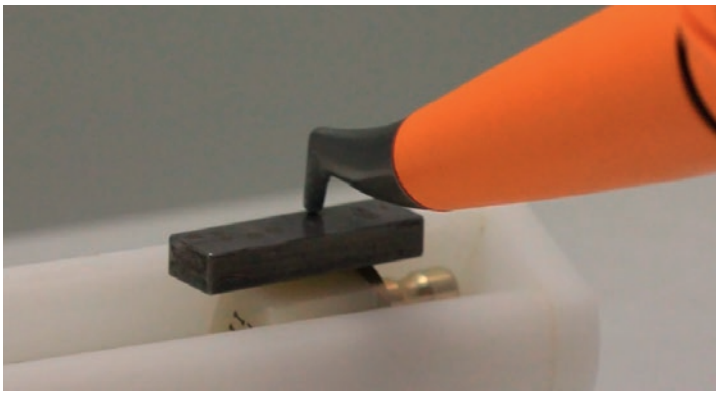


Fig. 1: Test setup with spacer for control.

RESULTS

Fig. 2a–2c show scanning electron microscope images of the ceramic test specimens 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® Prophy 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® Prophy 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.

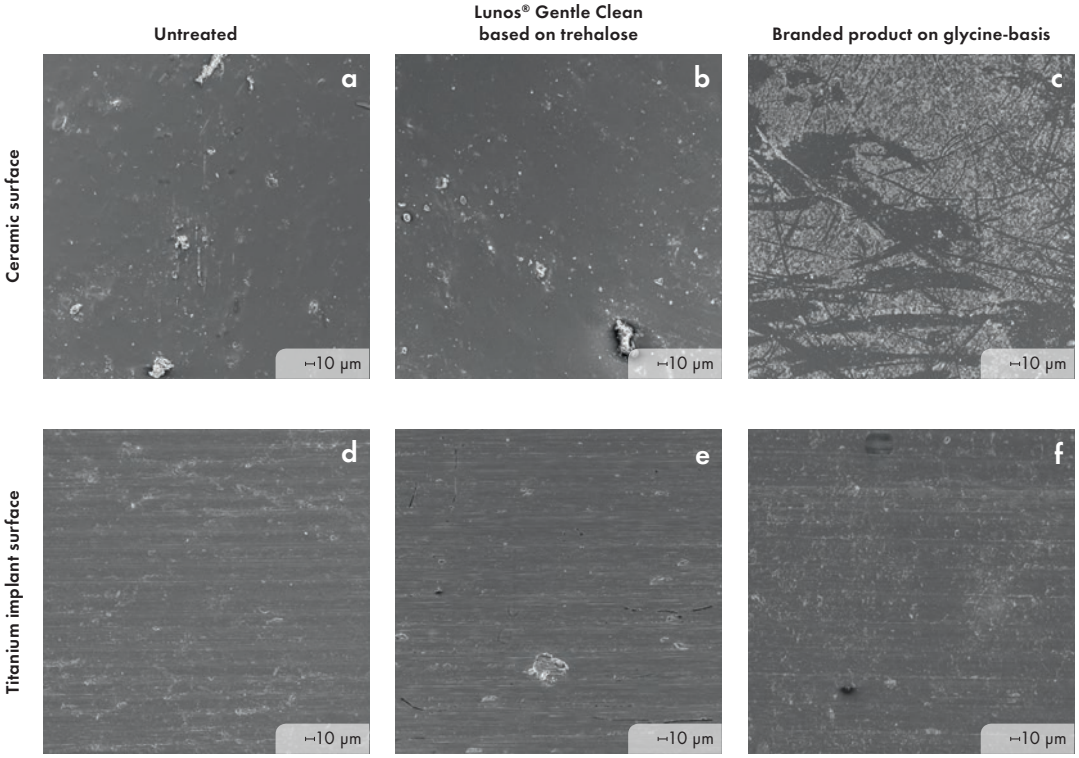


Fig. 2: Influence of prophylaxis powders on the surface of two dental materials after jet spray treatment at an angle of 45° and a distance of 5 mm using a standardised procedure.

1.4 DETERMINATION OF ABRASION CHARACTERISTICS OF PROPHYLAXIS POWDERS ON HUMAN TOOTH ENAMEL AND DENTINE SURFACES

GOAL OF THE STUDY

Comparative determination of the abrasion characteristics of various professional supra- and subgingival prophylaxis powders on enamel and dentine.

METHOD

With the help of an in-house developed 'Air Box Tests', the abrasion characteristics of various prophylaxis powders were tested under comparative conditions. First, powders which are declared exclusively for the supragingival area: Products A–D and Lunos® Gentle Clean; second, powders which can be used for the sub- and supragingival area: products E on erythritol basis (particle size D50 ~ 14 µm) and F on glycine base (particle size D50 ~ 25 µm) in comparison with Lunos® Perio Combi. Products A and D are not designed for use on dentine and were therefore used only on tooth enamel. The Air Box Test was performed with an Air-Flow-Master® powder jet device (year of fabrication 2013) with Supra nozzle from EMS.

The Air Box Test made it possible to perform punctual jet spraying of test surfaces with defined angle and distance setting as well as jet spraying of the surface while passing over with adjustable speed (Fig. 1). The test series was performed on planar ground enamel and dentine surfaces, with the material removal as abrasion precisely determined by means of a surface analysis (surface roughness and material removal).

For these investigations, the supragingival jet nozzle and the following jet parameters were used for all prophylaxis powders:

- Jet angle a = 45°
- Nozzle distance z = 5 mm
- Static spot treatment
- Spray duration t = 8 s

These jet spray parameters were selected to achieve technically measurable and comparable material removals on dental hard tissue. It should be noted that the parameters used here must be considered limit parameters, which should not be used in practice when the respective operating instructions for the device are complied with. Several powders were applied to the surfaces next to each other in different regions of the same sample to take into account the natural differences in tooth substance. This resulted in a five-fold determination per prophylaxis powder.

The surface analysis was made with the aid of a laser scanning microscope (Dmi 8/Leica) in order to exactly measure and evaluate changes in the surface (abrasion depths and volumes, mean roughness [Ra/µm] and mean roughness depth [Rz/µm]).

Fig. 1: Test setup of Air Box Test with PC control to the left, jet tub with sample holder and adjustable jet nozzle to the right.

SUPRAGINGIVAL PROPHYLAXIS POWDERS

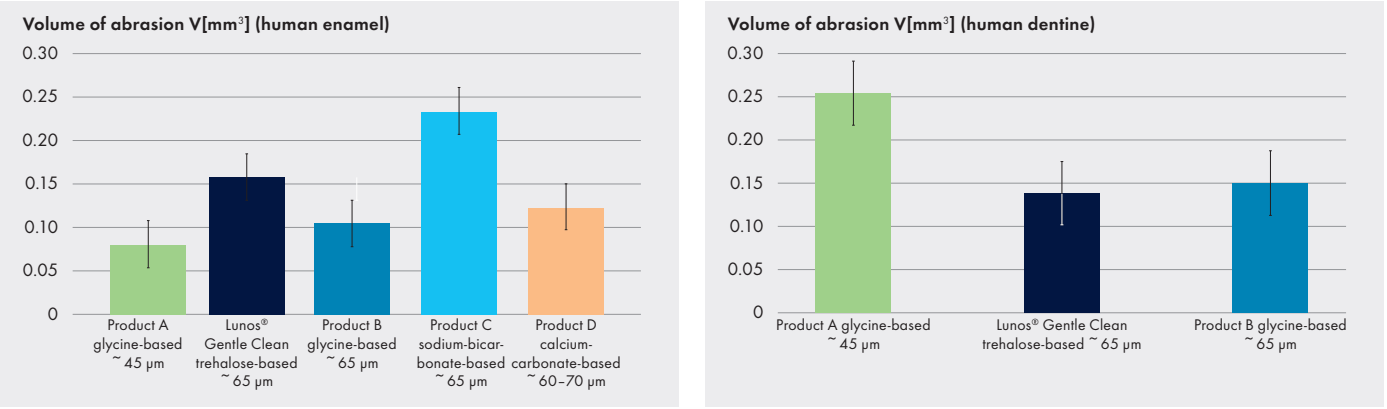


Fig. 2: Abrasion volume after defined surface jet spray treatment of polished human dentin and enamel samples using various supragingival prophylaxis powders. Product A and D are not advertised for use on dentine, and so they were tested exclusively on human enamel. Error bars symbolise the standard error.

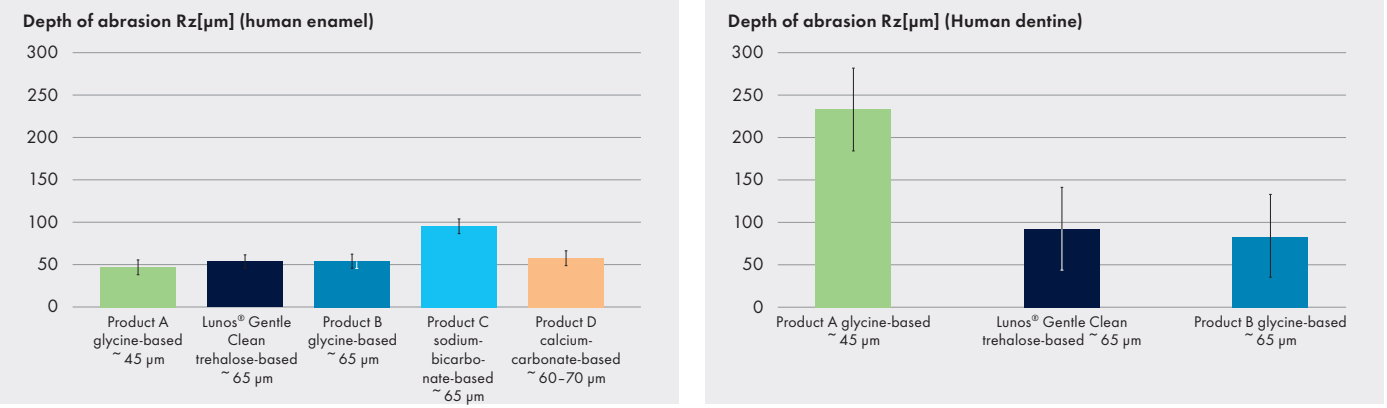


Fig. 3: Abrasion depth after defined surface jet spray treatment of polished human dentin and enamel samples using various supragingival prophylaxis powders. Product A and D are not advertised for use on dentine, and so they were tested exclusively on human enamel. Error bars symbolise the standard error.

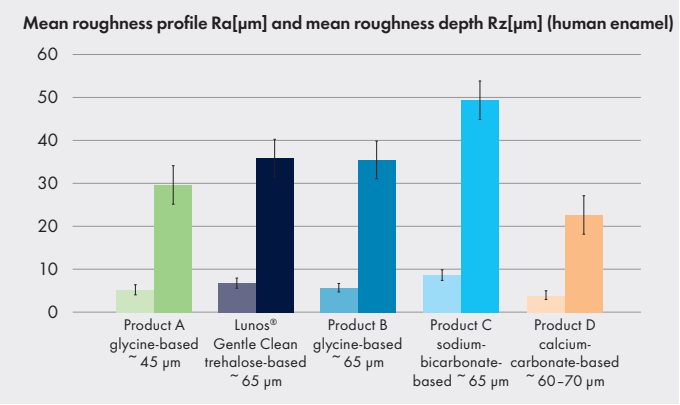
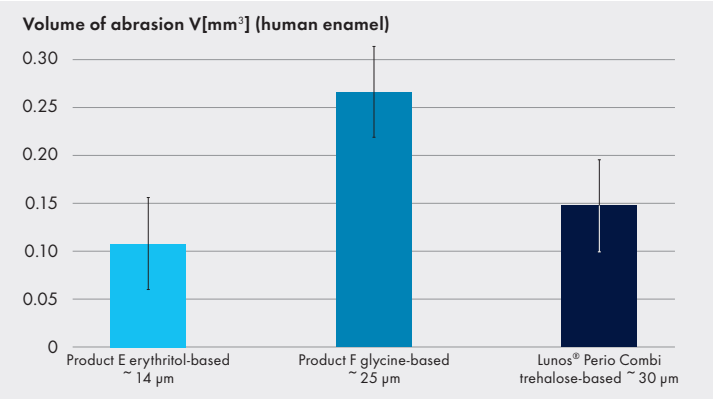


Fig. 4: Mean roughness (each light bar) and mean roughness depth (each dark bar) after defined surface jet spray treatment of the polished enamel samples using supragingival prophylaxis powders. Error bars symbolise the standard error.

SUBGINGIVAL PROPHYLAXIS POWDERS



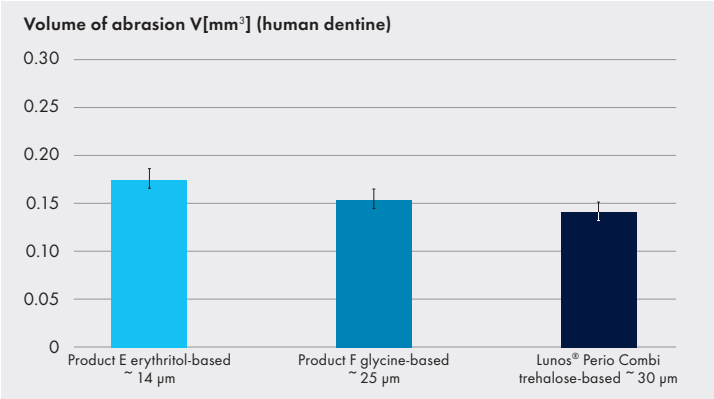
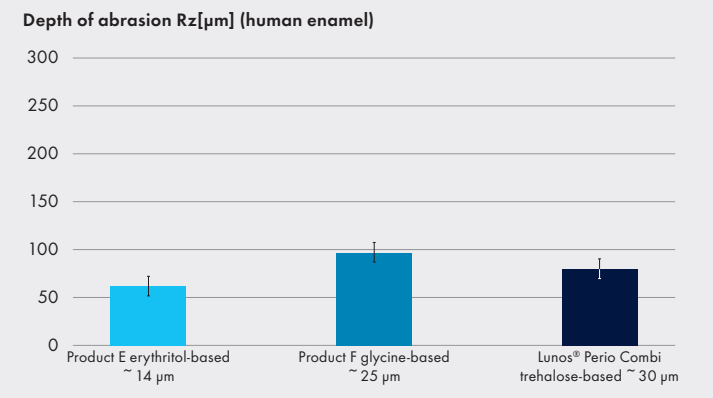


Fig. 5: Abrasion volume after defined surface jet spray treatment of polished human dentin and enamel samples using various subgingival prophylaxis powders. Error bars symbolise the standard error.



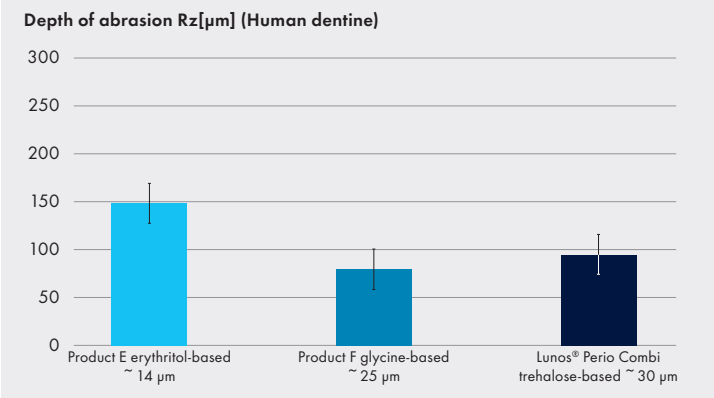


Fig. 6: Abrasion depth after defined surface jet spray treatment of polished human dentin and enamel samples using various subgingival prophylaxis powders. Error bars symbolise the standard error.

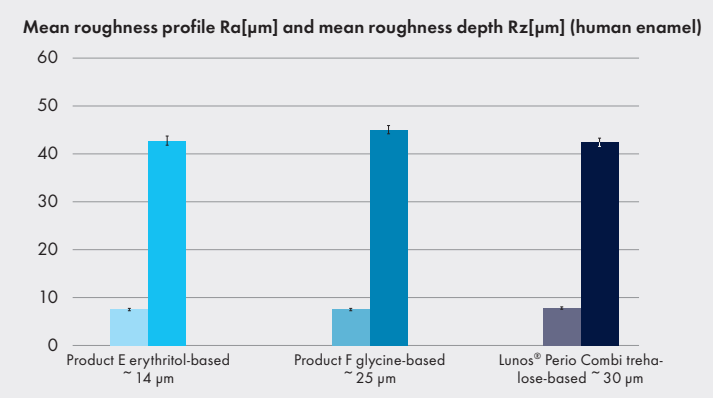


Fig. 7: Mean roughness (each light bar) and mean roughness depth (each dark bar) after defined surface jet spray treatment of the polished enamel samples using subgingival prophylaxis powders. Error bars symbolise the standard error.

RESULTS

The diagrams (Fig. 2 and 3) show abrasion volumes and depths. The highest abrasion potential in the enamel samples was documented for the supragingival prophylaxis powder Product C. The surface roughness was also the greatest here (Fig. 4), which in theory promotes accumulation of pigments and tartar. In contrast, comparably lower abrasion depths were measured with Lunos® Prophy Powder Gentle Clean (z = 54.1 µm), Product A (47.5 µm), Product B (54.6 µm) and Product D (57.9 µm).

When the surface roughness after jet spray treatment with Lunos® Prophy Powder Gentle Clean was compared with surface roughness after jet spray treatment with Product B, similar values were achieved for the mean roughness (5µm < Ra < 7µm) and for the mean roughness depth (RZ = 36 µm).

The diagrams depicted in Fig. 5 and 6 show the respective material removal. The evaluations showed an 8% lower abrasion volume in dentine and a 44% lower abrasion volume in enamel for the Lunos® Prophy Powder Perio Combi compared to the glycine-based Product F. The measured abrasion depth for Lunos® Prophy Powder Perio Combi was 18% lower in enamel and 18% higher in dentine compared to the branded Product F.

In direct comparison to the Lunos® Prophy Powder Perio Combi, Product E showed a markedly higher abrasion depth in dentine (+57%) and a 22% lower depth in enamel.

The values for surface roughness (Fig. 7) hardly differ from each other for all tested products. A low likelihood of fast restaining and tartar formation can be assumed here. [9]

CONCLUSIONS

In this study, the supragingival trehalose-based Lunos® Prophy Powder Gentle Clean and glycine-based Product B showed a similarly low potential for abrasion of human dentine compared to relevant branded products. For tooth enamel, the greatest abrasion depths were observed after treatment with sodium-bicarbonate-based Product C. For the prophylaxis powders used subgingivally and tested here, it was shown under the specified experimental conditions that there was much less difference in abrasion behaviour between Lunos® Perio Combi and erythritol-based Product E than with glycine-based Product F.

[9] Danyi, P., medical-technical laboratory assistant, Ulm; Stegmayer, T., development engineer, Königsbronn; Diebolder, R., scientist and project lead, , Stuttgart: Bestimmung des Schädigungspotenzials von professionellen dentalen Reinigungspulvern (Prophylaxepulver); Institut für Lasertechnologien in der Medizin und Meßtechnik an der Universität Ulm; 2016 (unpublished, status 2018).

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2. PROPHYLAXIS PASTES

2.1 THE CLEANING POTENTIAL OF PROPHYLAXIS PASTES PUT TO THE TEST

GOAL OF THE STUDY

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

METHOD

Embedded and planar ground crowns of human molars were pretreated with 35% phosphoric acid gel (1 min) and stored in artificial saliva (8 h), before they were placed in dental rinse containing chlorhexidine (1 h) and then in black tea at 37 °C (4 h).

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 prophylaxis paste per sample
- ProCup™/Kerr™ polishing cup
- Zig-zag movement with a motion length of 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.

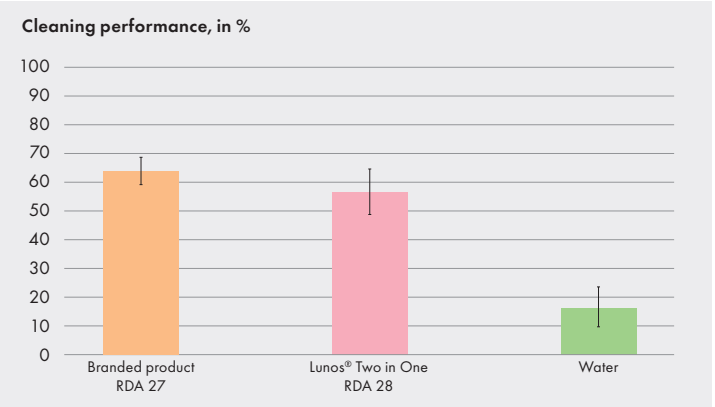

Fig. 1: Cleaning performance of different prophylaxis pastes in % on prepared dental crowns; colorimetry; means + standard deviation of ten samples each per prophylaxis paste/reference.

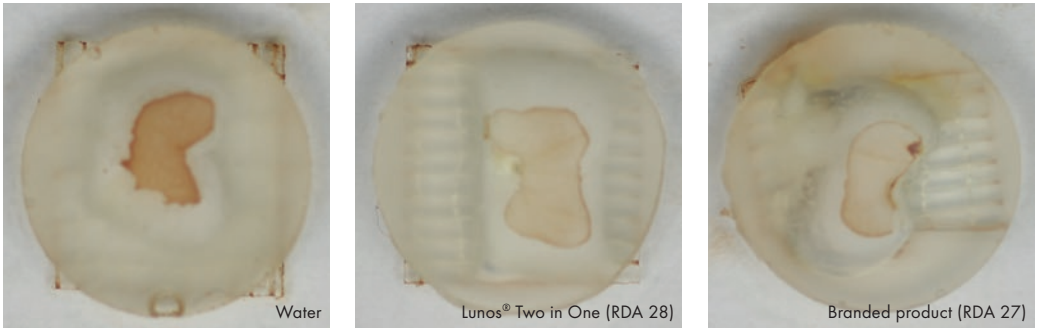

Fig. 2: Photography of selected representative samples of prepared dental crowns of human molars after cleaning with two different prophylaxis pastes and with water.

RESULTS

In the quantitative evaluation using colour measurements, both prophylaxis pastes showed a similar cleaning potential. Although the cleaning performance of Lunos® Prophy 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® Prophy 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 Gruppe 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).

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2.2 HOW GENTLE ARE PROPHYLAXIS PASTES TO TOOTH STRUCTURE?

GOAL OF THE STUDY

Examination of dentine and enamel abrasion: a comparison of different prophylaxis 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 µm). Not only the abrasion curve and the maximum abrasion depth, but also the achieved surface roughness were used here as criteria for evaluating the possible damage potential of professional prophylaxis pastes.

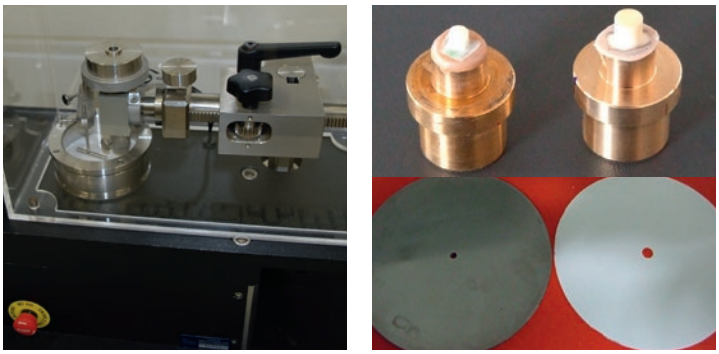

Fig. 1: Tribometer MT10 (left), dental hard substance samples and friction discs made of stainless steel and aluminium oxide ceramic (right).

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 prophylaxis 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 FN = 2 N
- Friction angle a = 45°
- Circulation speed VU = 0.105 m/s
- Oscillation frequency $f$os = 6.67 Hz
- Friction radius r = 20 mm
- Friction duration t = 20 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 prophylaxis pastes Product A and Lunos® Prophy Paste Super Soft delivered closely adjacent maximum abrasion values (around 1 µm, Tab. 1), whereby the Lunos® Prophy Paste tended to show somewhat less abrasion, both on the dentine and on the enamel (dz = 0.2 µm versus dz = 0.6 µm).

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 prophylaxis 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 µm < Sa < 1.6 µm and 8.3 µm < Sz < 15.6 µm.

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 = 1.4–1.9 µm and mean roughness depths Sz = 12.3–14.6 µm, the achieved surface quality was comparable to that achieved with the fine prophylaxis pastes. [11]

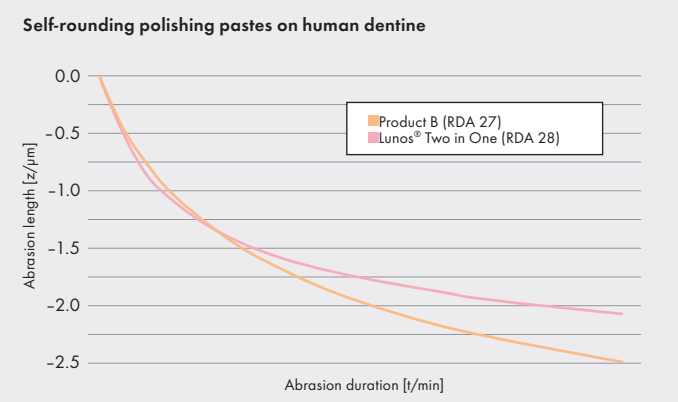

Fig. 2: Measurement curves of abrasion (average of three measurements) through friction with the self-rounding prophylaxis pastes Product B and Lunos® Prophy Paste Two in One on human dentine.

CONCLUSION

Of the two self-rounding prophylaxis 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., development engineer, Königsbronn; Schmid, T., master (fine mechanics), Herbrechtingen; Diebolder, R., scientist and project lead, Stuttgart: Wie zahnstruckturschonend 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 PROPHYLAXIS 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 prophylaxis 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 prophylaxis paste and approx. 50 µl water, polishing time 15 s). The following prophylaxis 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 prophylaxis 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 prophylaxis 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.

CONCLUSION

The microscopic images showed no disadvantageous change in the CAMLOG® implant surfaces and the Vitablocs® for 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

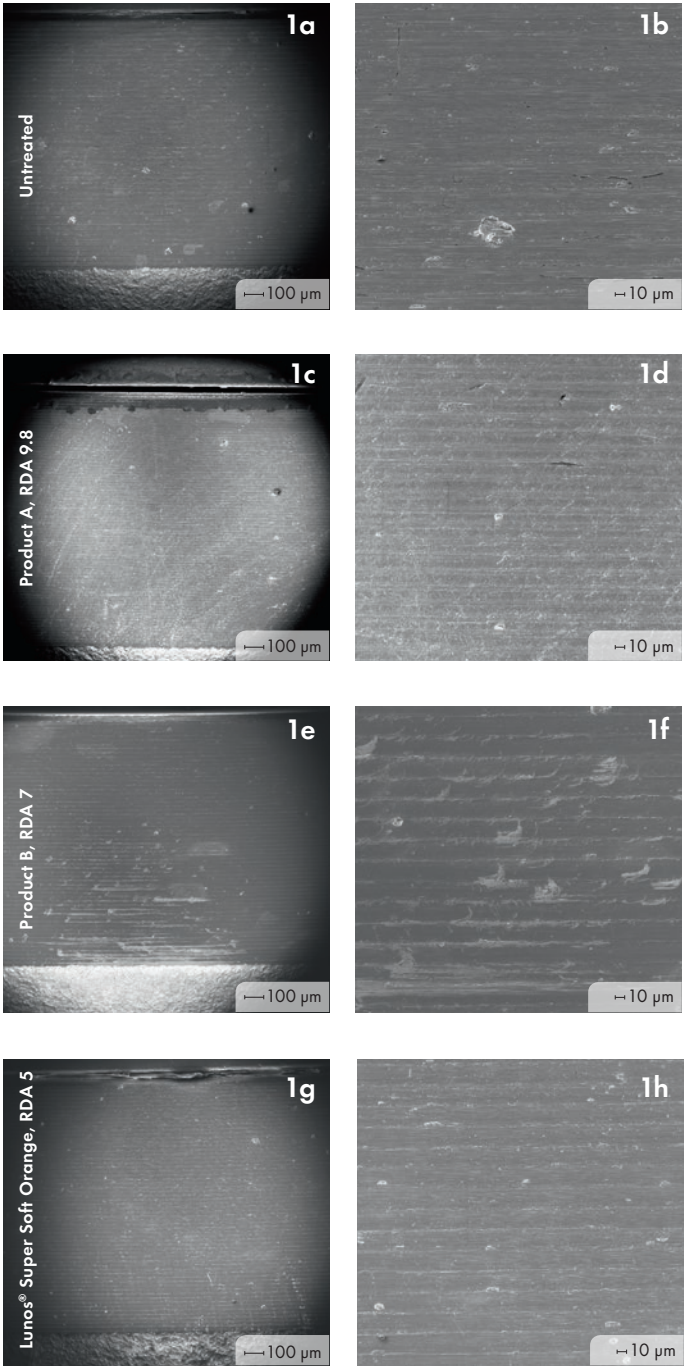

Fig. 1: SEM images of CAMLOG® implant surfaces before and after treatment with various prophylaxis pastes. Each with 100x and 500x magnification.

Vitablocs® for CEREC® ceramic

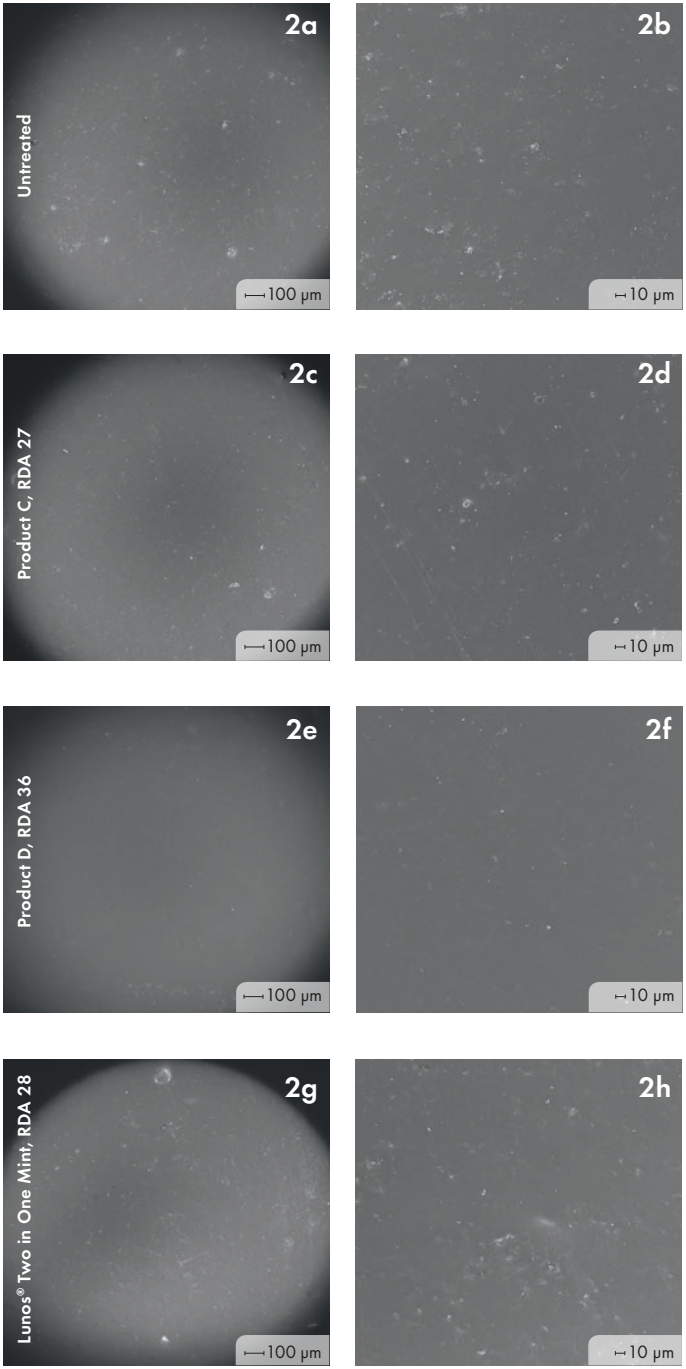

Fig. 2: SEM images of Vitablocs® for CEREC® ceramic surfaces before and after treatment with various prophylaxis pastes. Each with 100x and 500x magnification.

2.4 HOW EFFECTIVELY DO HYDROXYLAPATITE-BASED PROPHYLAXIS 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 prophylaxis paste (Lunos® Super Soft/DÜRR DENTAL SE, RDA 5); method II fine prophylaxis 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]

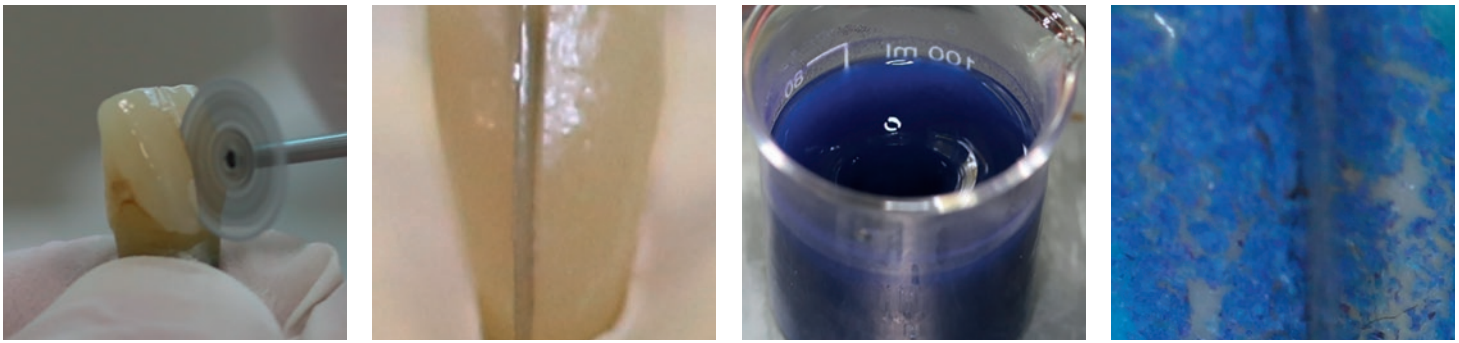

Fig. 1: Production of the test specimens: optical separation into two areas (a) with a metal band (b) and inoculation with artificial dental plaque (c), dried for 48 hours (d).

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 pasts until visually clean surface.

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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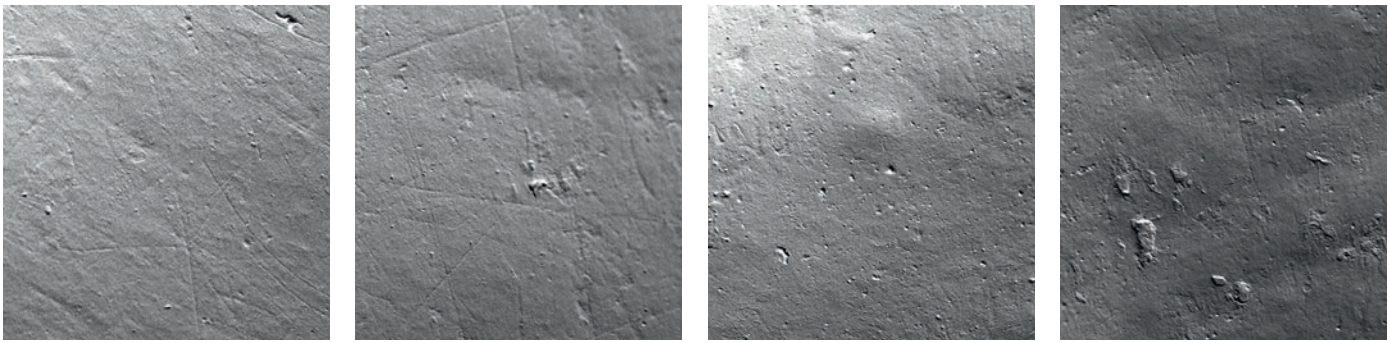

Fig. 2: "Scanning electron microscope" (SEM) images 500x prepared buccal tooth surfaces with artificial dental plaque before and after treatment with two prophylaxis pastes.

SUMMARY

DÜRR DENTAL SE has been developing medical products for more than 75 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.

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