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Enamel Surface after Stripping Procedure – Profilographometric Evaluation

Powierzchnia szkliwa zębów po zabiegu strippingu – ocena profilografometryczna

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Abstract

Background. Air Rotor Stripping (ARS) described in 1985 by Sheriden is based on reduction of mesio-distal interproximal surfaces of posterior teeth and can provide required amount of space in dental arch. It is a common procedure applied to patients who have got crowded teeth. During the procedure, external layer of enamel is removed.
Objectives. Roughness evaluation of enamel surface after ARS procedure.
Material and Methods. Research material were 24 mesio-distal surfaces of human premolars. Following dental burs were used: bur No 806.314.166.514012–U.S.MESH 230/270, fine. Surfaces were polished with Sof-Lex F.
Results. Sets of enamel topographical maps and values of enamel 3D parameters statistically different before and after stripping were obtained.
Conclusions. The authors have conducted occurency of differential topography of enamel surface after ARS procedure (both „smooth" and „rough" areas after polishing). Selection of 3D parameters was useful in roughness evaluation of enamel surface (**Dent. Med. Probl. 2005, 42, 1, 41–44**).

Key words: human enamel, stripping, profilometric measurements.

Streszczenie

Wprowadzenie. *Stripping* turbinowy (ARS) opisany przez Sheridana w 1985 r. opiera się na redukcji powierzchni międzystycznych bliższych i dalszych zębów przedtrzonowych i trzonowych, pozwalając uzyskać odpowiednią (wymaganą) ilość miejsca w łuku zębowym. Jest to zabieg dość często stosowany u pacjentów z występującymi stłoczeniami zębów. Podczas zabiegu jest usuwana powierzchniowa warstwa szkliwa.
Cel pracy. Ocena chropowatości powierzchni szkliwa po zabiegu ARS.
Materiał i metody. Materiał badawczy stanowiły 24 powierzchnie międzystyczne bliższe i dalsze ludzkich zębów przedtrzonowych. Do przeprowadzenia zabiegu ARS użyto następujących narzędzi tnących: wiertło nr 806.314.166.514012–U.S.MESH 230/270, fine. Do polerowania użyto dysków Sof-Lex F.
Wyniki. Otrzymano mapy topograficzne szkliwa oraz wartości parametrów 3D przed i po zabiegu różniące się istotnie statystycznie.
Wnioski. Stwierdzono występowanie zróżnicowanej topograficznie powierzchni szkliwa (gładszych i bardziej chropowatych obszarów po wypolerowaniu). Dobór wybranych parametrów 3D okazał się przydatny w ocenie chropowatości powierzchni szkliwa poddanego *strippingowi* (**Dent. Med. Probl. 2005, 42, 1, 41–44**).

Słowa kluczowe: szkliwo ludzkie, *stripping*, pomiary profilometryczne.

Stripping is a common treatment in orthodontic therapy for patients who have crowded teeth. This method is based on the reduction of mesio-distal interproximal surfaces of posterior teeth and can provide the required amount of space in dental arch. Procedure of stripping can be performed using various kinds of rotating instruments, such as diamond burs, diamond coated discs and polishing discs [1–6]. In the last decade, many investigators reflected if roughness of enamel surface

after stripping is sufficient or could rougher surface affect some unwanted changes [7–8]. Evaluation of human enamel can be conducted by profilographometric techniques which can describe the surface in quantitative and qualitative way. It appears that stylus profilometer measurements are better for naturally curved surfaces [9–10].

The aim of this research was to evaluate roughness of enamel surface after stripping procedure.

Material and Methods

Research material were 24 mesio-distal surfaces of human premolars. Teeth were extracted from orthodontic indications and were free from caries and restorations. Biological material was gained from white patients (caucasian race), both sex, aged between 12–18. Preparing procedure for profilometric evaluation was as follows: teeth were washed after extraction under running water and then stored in destilled water in marked containers. Prepared teeth were mounted in gips forms, which simulated the shape of the natural arch form. Stripping was performed under water cooling. The authors used following dental burs: diamond bur No 806.314.166.514012–U.S.MESH 230/270, fine, PONAR-ŁÓDŹ. Surfaces were polished with Sof-Lex discs No. F (3M ESPE), polishing time: 45 seconds. Profilometric registration was performed on 4 × 2 mm area of enamel surface before and after stripping. Number of recorded profiles amounted to 200 with distance beetwen rows of 10 μm. From obtained 3D topographical maps of stripped enamel surface (from 4 × 2 mm profilometric registration) the authors have chosen areas on which furrows and scratches were not visible ("smooth surfaces") and others with clearly visible furrows and scratches ("rough surfaces"). Analysis were performed on chosen "smooth" and "rough" areas; 2 × 2 mm, and gave sets of 3D parameters values and roughness maps of surfaces. The authors used contact profilometer Form Talysurf 120L (Rank Taylor Hobson Limited) cooperating with computer Dell Pentium III with software 3D Talymap Expert. The surface roughness was evaluated with the accuracy up to 0.01 μm vertical and 0.25 μm horizontal dimension, diamond stylus with tip radius of 2 μm was used. The authors have analyzed the following parameters: Sa – arithmetic mean of the deviations from the mean, Sq – quadratic mean of the deviations from the mean, Sv – maximum depth of valleys, St – total height of the surface, Sds – density of tops. 9600 profiles were recorded.

Results

Results were presented on one representative case.

The t-Student and Wilcoxon tests revealed statistically significant difference for Sa, Sq, Sv, St and Sds values between "smooth" and "rough" areas ($p < 0.0001$) and between values of "rough" areas and untreated enamel ($p < 0.0001$) (except Sds parameter). In comparison between values of "smooth" areas and values of untreated enamel surface only Sa and Sq parameters were statistically significantly different.

Disscusion

In presented research the authors stated increased values of amplitude parameters Sa, Sq, Sv, St and decrease in Sds (spatial parameter), for "rough areas" in relation to values of untreated enamel surface: 136%, 125%, 75%, 66%, 11%,

Table 1. 3D parameters values of enamel surface before and after ARS procedure

Tabela 1. Wartości parametrów 3D powierzchni szkliwa przed i po zabiegu strippingu

	Sa	Sq	Sv	St	Sds
Untreated enamel surface (Powierzchnia szkliwa przed zabiegiem)	1.12 ± 0.23	1.49 ± 0.45	6.28 ± 2.88	13.56 ± 10.26	2771.7 ± 1178.3
Rough surfaces – after ARS (Powierzchnie chropowate – po ARS)	2.65 ± 0.71	3.36 ± 0.79	11.02 ± 1.83	22.58 ± 5.22	2457.5 ± 1111.6
Smooth surfaces – after ARS (Powierzchnie gładkie – po ARS)	0.51 ± 0.4	0.79 ± 0.63	5.07 ± 3.66	8.70 ± 5.64	4065.9 ± 1274.7

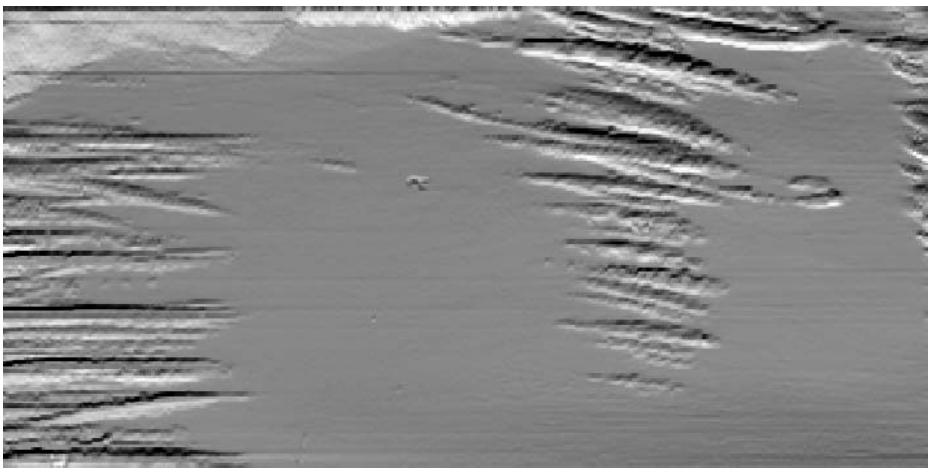

Fig. 1. Profilometric photosimulation of stripped surface

Ryc. 1. Profilometryczna fotosymulacja powierzchni poddanej strippingowi

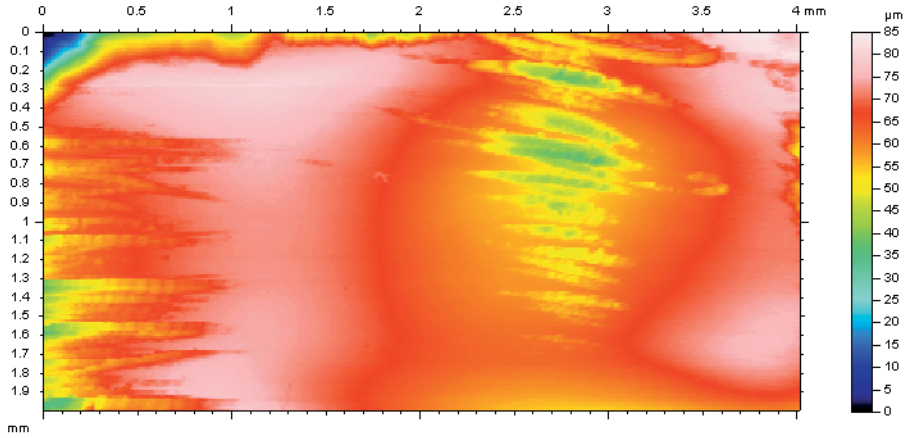

Fig. 2. Color image of stripped surface

Ryc. 2. Kolorowa mapa powierzchni poddanej strippingowi

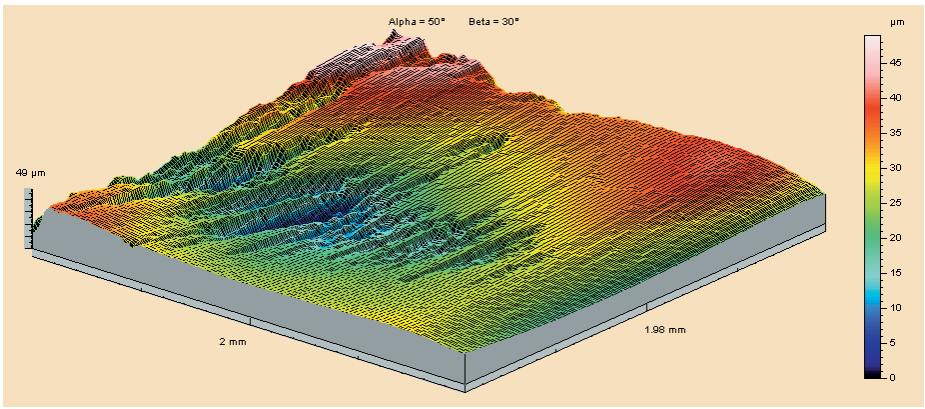

Fig. 3. Topographical map of stripped surface – rough area

Ryc. 3. Mapa topograficzna powierzchni poddanej strippingowi – obszar o większej chropowatości

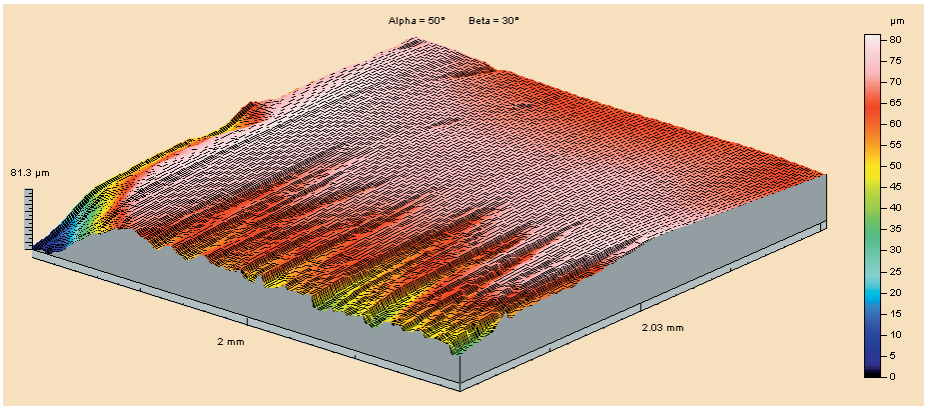

Fig. 4. Topographical map of stripped surface – smooth area

Ryc. 4. Mapa topograficzna powierzchni poddanej strippingowi – obszar o mniejszej chropowatości

accordingly. Criteria for parameters selection (from more than 30) were based on accesible literature [11–12]. In study done on human teeth (roots) Stout et al. performed analysis of Sa, Sq, St, Sp, Sv, Ssk, Sku parameters. They measured the root surface after scaling (with ultrasonic scaler). They did not give information in research about application times, manual loadings or initial values of discussed parameters [13]. Values obtained in presented study indicate that even after polishing procedure some areas are more rough than untreated surface. On the other hand parameter values of chosen "smooth areas" Sa, Sq, Sv, St, have decreased accordingy: 54%, 47%, 19%, 36% and Sds value has increased 46% in relation to values of untreated enamel surface. It must be underlined that both areas "smooth" and "rough" were polished but the results were different. Others studies which were performed using different laboratory technique, delivered information – similar to presented conclusions – that even patient's effort to polish stripped surfaces failed and rough areas were still present [4, 14].

There are many factors which constitute roughness of enamel surface after ARS procedure: dental bur (hand guidance, number of revolution per minute, diamond grain coarseness) and polishing disc (hand guidance, number of revolutions per minute, diamond grain cornesess) and texture of dental hard tissue.

It seems necessary to provide research into which mineralization of deeper enamel areas will be conducted.

It must be underlined that there have been a few studies done on human dentition using 3D profilometry.

According to obtained data the authors conclude that after stripping procedure – on every investigated surface presented study – the authors found both "smooth" and "rough" areas. Selection of parameters which described given surface seems accurate because it showed differentiation of reached data.

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