Emanuela Carla dos Santos
(Organizadora)

Comunicação Científica
e Técnica em Odontologia

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APRESENTAÇÃO

A Odontologia vem ampliando cada vez mais sua área de atuação dentro do campo da saúde. Hoje aliamos o conhecimento teórico de base às novas tecnologias e técnicas desenvolvidas através de pesquisas para elevar a qualidade e atingir excelência na profissão.

Diante da necessidade de atualização frequente e acesso à informação de qualidade, este E-book, composto por dois volumes, traz conteúdo consistente favorecendo a Comunicação Científica e Técnica em Odontologia.

O compilado de artigos aqui apresentados são de alta relevância para a comunidade científica. Foram desenvolvidos por pesquisadores de várias instituições de peso de nosso país e contemplam as mais variadas áreas, como cirurgia, periodontia, estomatologia, odontologia hospitalar, bem como saúde do trabalhador da Odontologia e também da área da tecnologia e plataformas digitais.

Espero que possam extrair destas páginas conhecimento para reforçar a construção de suas carreiras.

Ótima leitura!

Profª. MSc. Emanuela Carla dos Santos

SUMÁRIO

CAPÍTULO 4

MONITORING OF ABFRACTION LESIONS BY CONFOCAL LASER MICROSCOPY METHOD

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RESUMO: O objetivo deste estudo foi avaliar a progressão da lesão de abfração por microscopia confocal a laser. Foram avaliados onze pacientes, com 1 a 2 lesões de abfração na superfície vestibular dos dentes, que não necessitaram de restauração. Estes foram avaliados inicialmente (basal), após 3, 6, 9 e 12 meses, utilizando moldes confeccionados com silicone de adição (Express XT - 3M ESPE; 3M Brasil Ltda.) na técnica de moldagem simultânea: pasta leve injetada na lesão de abfração, seguida da pasta pesada. A fundição dos moldes foi feita com resina epóxi, obtendo-se as réplicas das lesões. Cada réplica foi metalizada com prata coloidal e colocada no paralelômetro para padronizar a inclinação da face vestibular de cada dente. Em seguida, foi realizada a análise pela microscopia confocal 3D a laser (LEXT; Olympus), obtendo-se as imagens tridimensionais. Utilizando o software OLS4000, foram realizadas 10 leituras em cada lesão, analisando o perfil de desgaste. Os dados foram analisados pelo teste de Friedman e Tukey ($p < 0{,}05$). Observou-se diferença estatisticamente significante entre os tempos com ($P = < 0{,}001$) gradativamente sobre o

desgaste das lesões. Pode-se concluir que a metodologia utilizada permitiu monitorar e mensurar a evolução das lesões de abfração ao longo do tempo, demonstrando ser um método eficaz.
PALAVRAS-CHAVE: Abfração, lesões cervicais não-cariosas, desgaste dentário.

MONITORING OF ABFRACTION LESIONS BY CONFOCAL LASER MICROSCOPY METHOD

ABSTRACT: The objective of this study was to evaluate the progression of abfraction lesion by confocal laser microscopy. Eleven patients were evaluated, having 1 to 2 abfraction lesions on the vestibular surface of the teeth, which did not require restoration, initially evaluated (baseline), after 3, 6, 9 and 12 months, using moldings made with silicone of addition (Express XT - 3M ESPE; 3M Brazil Ltda), using the one time technique, the light paste was injected into the abfraction lesion, followed by the heavy paste. The casting of the molds was done with epoxy resin, obtaining the replicates of the lesions. Each replicate was metallized with colloidal silver and placed on the paralellometer to standardize the slope of the buccal face of each tooth. Then the 3D confocal laser microscopy (LEXT; Olympus) was performed, obtaining the three-dimensional images. Using OLS4000 Software was, 10 readings realized in each lesion, analyzing the wear profile. Data was analyzed by Friedman and Tukey test ($p<0,05$). A statistically significant difference was observed between the times with ($P = <0.001$), observed gradated in significant increment of lesion wear. It can conclude that methodology used allowed to monitor and measure the evolution of abfraction lesions over time, proving to be an effective method.
KEYWORDS: Abfraction, non-carious cervical lesions, dental wear.

1 I INTRODUCTION

Non-carious cervical lesions occur due to loss of hard tissue in the cervical third of the crown and the root surface due to processes not related to dental caries (Grippo et al. 2012). The onset and progression of these lesions have a multifactorial etiology, but the relation of the several contributing factors is controversial (Michael et al. 2009). However, clinical findings indicate that the direction and intensity of the forces applied on the teeth are important contributing factors for the occurrence of these lesions (Brandini et al. 2012).

One of the most accepted concepts of abfraction lesion is biomechanical theory, in which concentrations of tensions in the cervical region of the teeth provided by their flexion during intense occlusal load lead to the formation of micro-cracks in the cervical region, interrupting the connections of hydroxyapatite crystals of the enamel and dentin (Lee et al. 1984, Benazzi et al. 2014).The cyclic persistence of loads in the cervical region caused by chewing, swallowing and parafunctional habits maintains cracks formation (Grippo 1991, Sarode et al. 2013), that are continuously removed by the process of feeding and cleaning and thus the lesion evolves (Sarode et al. 2013).

The evolution of pathological tooth wear over time is essential for its prognosis and the beginning of the most appropriate therapeutic steps. Monitoring involves a series of tests and measurements that are repeated after a certain period of time in order to assess whether the phenomenon is progressive or not. Monitoring is the only way to determine if tooth wear is active or stationary (Marcauteanu et al. 2014).

Several methods of monitoring tooth wear have been employed. One of these methods consists in the clinical evaluation of the degree of severity of the wear directly on the mouth through the tooth wear index (TWI) proposed by Smith and Knight (Smith et al. 1984), in order to mark the wear of all four visible surfaces of the teeth. However, the TWI is not accurate in quantitative terms (Lopez et al. 2012). Another method was the application of TWI in Bartlett study models (Bartlett 2003), the TWI was used to evaluate the degree and progression of dental debris by examining gypsum models of their patients at two different times of 3 and 6 months. This method also has limitations imposed by the precision and dimensional changes of the printing materials used to make the study models. In the literature there are too many indexes proposed and used but there is a lack of standardization, there is not still an ideal index that can be used for epidemiological studies of prevalence, clinical staging and monitoring (Lopez et al. 2012).

Another method that is being used is the Optical Coherence Tomography (OCT) system, which is a high-resolution interferometric technique that produces real time, contactless images in vivo, allowing a qualitative and quantitative analysis of the biological tissues health, with the advantage of not using ionizing radiation (Manesh et al. 2009). However, the studies found in the literature on dental wear monitoring are only in vitro studies with the use of extracted teeth (Demian et al. 2010, Nakajima et al. 2012, Marcauteanu et al. 2014).

One of the possibilities for monitoring dental wear is to use the patient model and analyze it with high-resolution morphological confocal laser microscopy. This equipment allows measuring small losses and does not cause damage to the sample surface because there are no contact forces between them. In this way, the objective of the present study was to monitor in vivo the progression of abfraction lesions over time of up to 12 months by analyzing lesion models using confocal laser microscopy.

2 I MATERIALS AND METHODS

2.1 Ethical aspects and sample selection

This study was approved by the Ethics Committee (CAAE: 20545013.7.0000.5419) of the School of Dentistry of Ribeirão Preto, University of São Paulo, and the patients were clarified verbally and in writing about their participation in the research through the Informed Consent Term, signed by them.

To be included in this study, participants had be in a good general health, no used chronic medication, and with almost teeth in mounth. The teeth select had adjacent and antagonist teeth. This way, Fifteen individuals of both sexes, with no predilection for race and over 18 years of age, were selected, having 1 to 2 abfraction lesions on the buccal surface of the teeth, which did not require restoration, being evaluated initially (baseline) and after 3, 6, 9 and 12 months, by a single calibrated examiner.

An initial (baseline) molding was performed and later every 3 months, of the teeth with the lesion, always including a anterior tooth and a posterior tooth (Figure 1a). The molding was performed with addition silicone molding material (Express XT-3M ESPE; 3M Brazil Ltda) using the one-time or simultaneous technique in which the light paste was injected into the abfraction lesion, then the dough, properly handled, was taken into position, without the use of a tray. Before casting, a layer of colloidal silver (Coloidal Silver Liquid; EMS) was applied in the abfraction lesion for a more accurate reading of the lesion by the microscopy without altering its size and the casting was done with epoxy resin (Arotec, Arotec S / A Ind. And commerce), obtaining the exact replicas of the lesion(Figure1b).

2.2 Surface wear analysis

The epoxy resin replicates of the initial abbreviating lesions, 3, 6, 9 and 12 months of evaluation were taken to 3D confocal laser microscope (LEXT OLS4000; Olympus) for surfaces wear analysis (Figure1c). Obtaining the profile of the surfaces was based on the control area (healthy enamel of the vestibular face). Thus, after the determination of the profile, the wear measurement (µm) was obtained by the micrometer distance between the midline of the graph and the wear line (control area). For the analysis, the center of the lesion was firstly demarcated, the inclination of the buccal face of each tooth in the model was standardized, positioned in the microscope where a standardized image was obtained with a 107x increase in the abfraction lesion, taking care that the image encompasses the entire lesion seen by vestibular. Using specific software (OLS4000), the images were evaluated by the lesion profile and obtained 10 standardized readings (Figure1d) that were repeated in the same way in the subsequent models to minimize the risk of change.

The data were analyzed for their distribution and since they were not homogeneous, the Friedman and Tukey test was used, with a significance level of 5%.

3 I RESULTS

During the evaluation, 4 individuals give up, remaining 11 participants between the ages of 18 and 50 years, being 2 males and 9 females, totaling 16 abfraction lesions that were monitored over time of 3, 6, 9 And 12 months through the confocal laser microscope.

It can be observed that there was a gradual and significant evolution of lesions over time ($p < 0.05$), with a more significant variation after 6 months (Table 1).

4 I DISCUSSION

Non-carious cervical lesions can be studied by clinical observations of the characteristics of the lesions and their pattern of attrition (Miller et al. 2003, Pegoraro et al. 2005, Smith et al. 2008, Takehara et al. 2008, Ibrahim et al. 2012), associated with questionnaires to assess their etiology in witch individuals are asked about their eating habits, oral hygiene and the presence of parafunctional habits, assessments of occlusal patterns (Pegoraro et al. 2005, Smith et al. 2008, Takehara et al. 2008, Ibrahim et al. 2008) and by obtaining study models (Bartlett et al. 2003, Demian et al. 2010, Ibrahim et al. 2012) for observational monitoring of injuries.

The monitoring of the lesions is important to know the size, if it is evolving, and therefore to designate the best form of treatment. A variety of strategies have been proposed to control abfraction lesions, some are specific, and others are used to control non-carious cervical lesions of varying etiologies. When the lesions are not causing clinical consequences, and / or are only superficial in depth (less than 1mm), is possible to only monitor them at regular intervals (Michael et al. 2009). Other treatment strategies have been proposed: restorations (Michael et al. 2009), occlusal adjustments (Piotrowski et al. 2001, Chowdhry et al. 2012), occlusal plaques (Piotrowski et al. 2001, Michael et al. 2009), and elimination of parafunctional habits and alteration of tooth brushing.

In the present study the abfraction lesions were molded with addition silicone because they promote the obtaining of more accurate and trustworthy replicas to the molded structures (Mandikos 1998) and their leakage was performed with epoxy resin due to the need to obtain a precise and durable model, besides the compatibility with the molding material used, allowing the obtaining of models with superior surface smoothness (Michael et al. 2010).

It can be observed in the present study that it was possible to monitor the evolution of the abfraction lesion and the use of the confocal microscope allowed to measure the wear occurred during the period of 1 year. This equipment allowed the capture of high quality three-dimensional images quickly and accurately and their measurement without promoting any damage or loss of the sample. In contrast, Wood et al. (2009) evaluated the progression of abfraction lesions through the section of epoxy resin models analyzed under a stereoscopic microscope, promoting the loss of the sample after the analysis.

Other method can be measure, Optical Coherence Tomography (OCT) that can be monitored for non-carious cervical lesions, its use is not yet possible because it does not have equipment available for intraoral clinical use. OCT has been more widely used in in vitro studies, requiring the development of devices that allow intraoral use by resolving the limitations of access caused by the anatomy of the oral cavity (Marcauteanu et al. 2014). In a previous study (Brandenburg et al. 2003), OCT coupled to a surgical microscope was used with the objective of detecting demineralization lesions in their initial phase in vivo, but not all teeth and faces were equally accessible with the surgical microscope, the anterior teeth being easier to access. Wilder-Smith et al. (2009) used the OCT and an optical probe that allowed the real-time realization of combined video and OCT images to assess the reduction of dental tissue loss. The readings provided information on the thickness of the enamel and the backscatter signal of the surfaces and subsurface providing data on the size of the cavity and the remaining structures, but it needs clinical studies to validate it as a monitor of the evolution of this type of lesion.

Although it was an indirect method, it was possible to determine that after 6 months the lesions became larger and after 12 months these lesions were 3x larger than the initial lesion. Besides the possibility of measuring the lesion with a laser confocal microscope, this type of equipment also allows the analysis of profilometry, roughness, loss of dental volumetric substrate, and can be used to monitor all forms of non-carious cervical lesions without any pretreatment of the sample. Therefore, these images can be used for further analysis or even the continuation of an experiment (Derceli et al. 2016).

This type of monitoring has proven to be feasible and can quantitatively evaluate the evolution of abfraction lesion, and may be a methodology that can be used to determine the effect of treatments in this type of lesion. Determining to be an excellent device for use in the laboratory for clinical research. Therefore, this methodology was shown to be effective for evaluating the dimensions of abfraction lesions, as it can also be used for the measurement of other types of LCNC, however, new studies are necessary to validate it as a method of monitoring this type of lesions.

Based on the results obtained, it can be concluded that the methodology used allowed to monitor and measure the evolution of abfraction lesions over a period of one year without causing any harm to the researched individuals and without damaging the samples that may be used for other investigations if necessary.

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TABLE

Time	X ± DP	Median*
3M	10.32 ± 12.58	5 a
6M	15.21 ± 14.23	9 ab
9M	23.87 ±17.11	22 bc
12M	32.53 ± 21.66	39 c

Table 1. Average, standard deviation and median wear profile (µm) of patients.

*Same letter similarity statistics

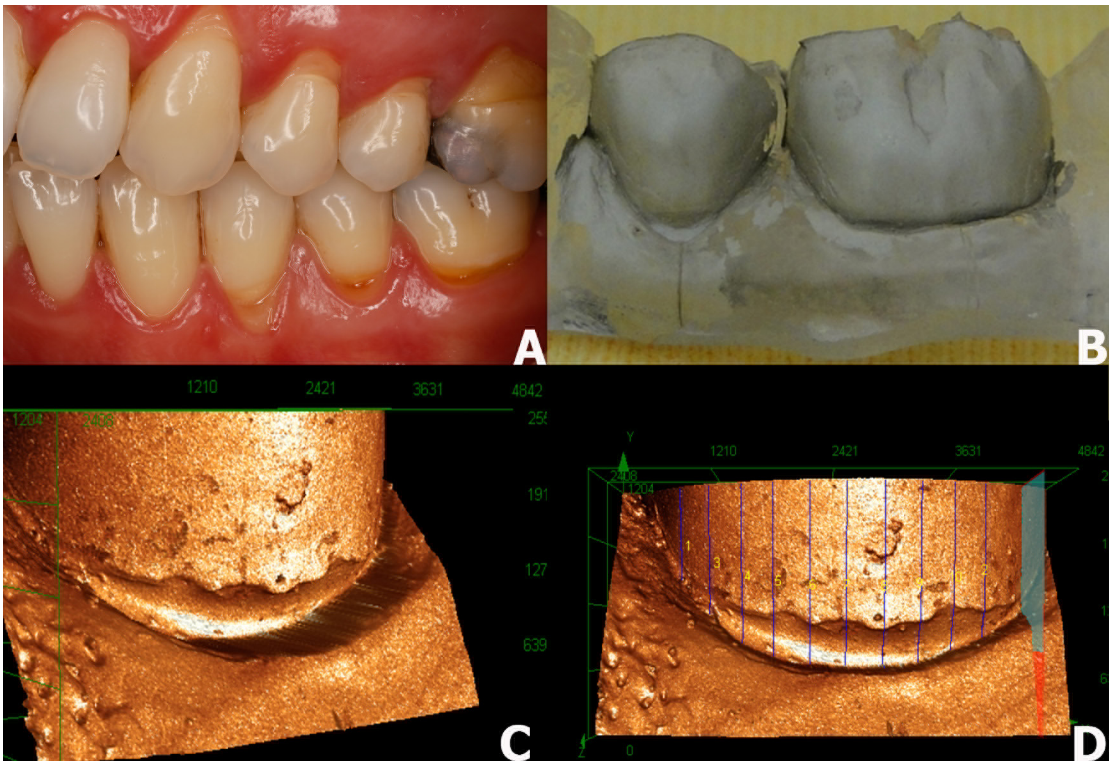

Figure 1. A) Abfraction lesions. B) Replication of lesion in epoxy resin. C) Image of lesion in 3D confocal laser microscope. D) Measurements made in the confocal microscope.

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