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The Effect of Baking Soda and Vinegar on Tooth Wear

Karbonat ve Sirkenin Diş Aşınması Üzerindeki Etkisi

ABSTRACT

Alternative products used for tooth whitening teeth cause serious wear on tooth surfaces. Knowing the factors that cause tooth wear and their localizations plays an important role in reducing risk factors and treatment. In this case report, 2 patients who presented to the clinic with the complaint of tooth wear are presented. Case 1 used a mixture of vinegar and baking soda to whiten her teeth, while Case 2 used baking soda and whitening toothpaste. The wear on the tooth surface deepened in the cervical area. Both patients had horizontal tooth brushing and bruxism. Reduction of risk factors and direct composite restoration were described in the treatment. Alternative products that can be used to whiten teeth cause serious wear on teeth. Elimination of risk factors plays an important role in the treatment of these wear. The location and depth of the lesion play an important role in the treatment.

Keywords: Vinegar, baking soda, tooth wear, cervical

ÖZ

Dişleri beyazlatmak amacı ile kullanılan alternatif ürünler diş yüzeylerinde ciddi aşınmalara sebep olmaktadır. Diş aşınmalarının meydana gelmesine sebep olan faktörlerin ve lokalizasyonlarının bilinmesi risk faktörlerinin azaltılmasında ve tedavide önemli rol oynamaktadır. Bu olgu raporunda, diş aşınması şikayetiyle kliniğe başvuran 2 hasta sunulmuştur. Olgu 1 dişlerini beyazlatmak için sirke ve karbonat karışımı kullanırken, Olgu 2 ise karbonat ve beyazlatıcı diş macunu kullanmıştır. Diş yüzeyinde meydana gelen aşınmalar servikal bölgede derinleşmekteydi. Her iki hastada da horizontal diş fırçalama ve brüksizm vardı. Tedavisinde risk faktörlerinin azaltılması ve direkt kompozit ile restorasyonu anlatıldı. Dişleri beyazlatmak amacı ile kullanılabilen alternatif ürünler dişlerde ciddi aşınmalara sebep olmaktadır. Bu aşınmaların tedavisinde risk faktörlerinin elimine edilmesi önemli rol oynamaktadır. Tedavisinde lezyonun konumu ve derinliği önemli rol oynamaktadır.

Anahtar Kelimeler: Sirke, karbonat, diş aşınması, servikal

INTRODUCTION

The basis of tooth discoloration is the dissolution of the enamel surface and the accumulation of coloured molecules on the surface. Intake of beverages such as wine, coffee, tea, alcohol, and similar substances can play a role in tooth discoloration. The basis of these discolorations is the dissolution of the enamel surface and the accumulation of coloured molecules on the surface. The whitening of teeth has been well described by researchers.¹ This process can basically be achieved by wearing the stains on the enamel surface with abrasive-based materials such as carbonate or oxidation of chromogen double bonds with chemical-based agents such as hydrogen peroxide.² Due to the high cost of in-office whitening and the necessity of its application by professionals, patients may turn to alternative products easily found at home to lighten their tooth colour.² Examples of these products include whitening toothpaste, over-the-counter products (OTC), and mixtures obtained by adding lemon concentrate.³ These products, which can be preferred to whiten teeth, may cause wear and sensitivity on tooth surfaces. Studies analysing dental wear occurring without caries have reported that the number of cases has increased significantly in recent years.^{4,5}

Dental erosion is as the loss of hard tissues eroded from the tooth surface by acid or chelating agents.⁶ While the chemical deterioration of the tooth surface structure is a corrosion event, it is also frequently used as erosion in the literature.⁷ In recent years, instead of explaining dental wear with a single mechanism, researchers have described them as complicated lesions that may occur under the influence of multiple factors.⁸ The incidence of dental wear, which can occur due to different factors without caries, increases with increasing age and as the teeth remain in the mouth for a longer period. However, when wear cause aesthetic problems, sensitivity, advanced mobility, migration, decrease in facial height, loss of occlusal stability in the posterior, and frequent fracture of teeth or restorations, they are considered pathological and treatment is required. In cases with severe wear, it is important to know the etiology, localization and severity of wear to achieve treatment success.

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The aim of this case report is to evaluate the effects of the long-term use of alternative whitening products on teeth. The etiology and treatment methods of non-caries cervical lesions caused by long-term use of products that can be used to whiten the tooth surface are discussed.

CASE PRESENTATION

This study was conducted in the Inonu University, Faculty of Dentistry, Department of Restorative Dentistry. In Case 1, a 53-year-old woman presented to our clinic with aesthetic concerns and tooth sensitivity. She reported that her teeth had recently become darker in colour and were also sensitive to hot and cold contact. The patient was a housewife and was not engaged in any occupation that would cause external wear of her teeth. She was very careful about her oral hygiene and mentioned that she had been using a special mixture to keep her teeth white. It was a mixture of grape vinegar and baking soda, which whitened his teeth considerably. For the last 3 years, she has been brushing her teeth horizontally for 10 minutes every day in the evening. The formula of the mixture consisted of half a teaspoon of baking soda and 1 teaspoon of vinegar (Figure 1). In general, wear defects were observed on the outer surfaces of all teeth (Figure 2). While vinegar is a medium-strength acidic substance, baking soda is a high-strength basic substance. When the pH value of the mixture made according to the formula applied by the patient was measured, the result was approximately 6.9 (Figure 3). The enamel surfaces of all teeth were worn and smooth. In the cervical areas, where the enamel is structurally thinner and less resistant to wear, deep defects were formed and became wedge-shaped compared to the other parts. The patient also suffered from bruxism and heavy occlusal forces were applied on the teeth. This is one of the important factors in increasing the depth of the lesions in the cervical area. Multiple factors were involved in the formation of lesions and multifactorial pathodynamic mechanisms are involved in the etiology as described by Grippo et al.⁹



Figure 1. Half a teaspoon of baking soda, one teaspoon of vinegar and its mixture



Figure 2. Right, front and left views of the teeth of a 53-year-old female patient



Figure 3. pH value of a mixture of half teaspoon baking soda and 1 teaspoon vinegar

In Case 2, the patient was 61 years old and presented to our clinic with the complaint of dental wear. After the clinical examination, all teeth had visible non-caries cervical area wear and shiny enamel surfaces (Figure 4). In addition, severe attrition was present. The patient had no occupational history that could cause external wear on the teeth. He had a long-standing history of using hard toothbrushes and whitening toothpaste. He also said that he occasionally brushed with baking soda before his appointments. During the treatment planning, the patient was asked to return to the clinic the next day and to bring the toothbrush and toothpaste with him. The toothbrush was hard and had bent bristles indicating that a lot of pressure was applied during brushing (Figure 5). The toothpaste were 2 toothpastes, both of which were whitening toothpaste. When the contents of both toothpaste were analyzed, they contained hydrated silica and calcium carbonate which can erode the tooth surface.¹⁰ The patient also had bruxism, which increased the depth of the defects in the cervical area. The teeth had abrasion due to hard toothbrush and horizontal brushing, wear due to prolonged use of baking soda and whitening toothpaste, and abfraction and attrition defects due to bruxism.



Figure 4. Right, front and left views of the teeth of a 61-year-old male patient



Figure 5. Toothbrush with hard bristles

In both cases, the factors that caused wear on the surfaces of the teeth before the restoration stage can be listed as horizontal brushing, use of abrasive chemical agents, and bruxism. Oral hygiene habits, brushing frequency and duration, whitening agents, and brushes used were analyzed in detail. Instead of whitening agents, toothpaste containing desensitizing agents and not intended for whitening were recommended. Instead of horizontal brushing movement, brushing with Modified Bass technique and toothbrush with medium hardness were recommended.¹¹ Reduction of risk factors constitutes the first stage of treatment for the prevention of non-caries cervical lesions.¹²

After the periodontal treatment was completed, the restoration phase was started. Studies show that restorations tend to fall off as a result of vertical and horizontal forces in this area and the failure rate is high.^{8,13} Regular check-ups have been recommended for teeth with a depth of less than 1 mm.¹² Treatment of lesions in the cervical area

ensures the continuity of oral hygiene. It also reduces the thermal sensitivity of the tooth, strengthens its structure, and gives an aesthetically good appearance. In the restoration of both cases, it was decided to use a restorative material (A3 Estelite Asteria, Tokuyama, Japan) with a high filler ratio and low elastic modulus. The restorative material with nanohybrid particles was effective because the cervical area of the tooth is a dynamic movement area and it has an elastic modulus that can compensate for tooth movements caused by this dynamism.¹⁴ The area where the composite restoration would be applied was isolated with the help of a rubber dam. Thus, fluid flow from the mouth and gingival groove was prevented. The enamel surfaces close to the cavity were beveled to increase the retention of the restoration. Diamond-pointed end mills were used for bevelling. The enamel surface was then roughened with an acid (Scotchbond Universal Etchant, 3M ESPE, USA) for 20 seconds and washed. The enamel and dentin surfaces were prepared for composite application with 6th-generation self-etch adhesive (Clearfil SE Bond, Kuraray, Japan) according to the user instructions. Afterward, the nanohybrid composite was placed in the cavity and polymerized with the help of an LED light emitting 1200 mW/cm² light (Woodpecker, Guilin, China). After the restoration was completed, the rubber dam was removed. Firstly, a fine-grained diamond bur was used for correction and the excess was removed. Care was taken to protect the periodontal tissue during the finishing phase of the cervical restorations. Then, the surface of the composite restoration was polished with polishing discs and rubbers (Figures 6 and 7). After the completion of the restorative treatment phase in Case 1, splint treatment was decided to alleviate the occlusal forces caused by bruxism and to protect the teeth. In case 2, the prosthetic restoration phase was started for the treatment of missing teeth.

For the oral and written data used in this study, both patients were informed verbally and in writing. Consent forms were signed.



Figure 6. Direct composite restoration of case 1



Figure 7. Direct composite restoration of case 2

DISCUSSION

In the cases presented, severe tooth wear was observed as a result of prolonged and incorrect use of teeth whitening agents. Case 1 was using a mixture of vinegar and baking soda for bleaching. As a result of the general chemical reaction between vinegar and baking soda, carbon dioxide gas, water, and sodium acetate are formed.¹⁵ In general appearance, there is a foaming mixture and this may have encouraged the patient to bleach (Figure 1). The patient used this mixture for 10 minutes a day for 3 years, resulting in severe wear on the outer surface of the teeth. The researchers considered the baking soda and vinegar

mixture in the group of peroxide-free tooth whiteners and tested their effectiveness. In their in-vitro studies, they reported that these agents did not whiten as effectively as those containing peroxide.^{16,17} Contrary to these studies, significant tooth wear occurred in Case 1. The reasons for this may be that the formula of the mixture applied by the patient was different from the formula in the studies, horizontal brushing, and heavy occlusal forces caused by bruxism. Case 2 had been brushing with whitening toothpaste and occasionally with baking soda for many years. The outer surfaces of the teeth were significantly worn and the crown lengths were shortened due to attrition defects. The wear on the outer surface were visible throughout the teeth and increased in severity in the cervical area. When the whitening toothpaste used by the patient were analyzed, they contained calcium carbonate and hydrated silica as abrasives. These active substances increase roughness on the surface of the teeth.¹⁰ The patient was using a toothbrush with hard bristles. Horizontal tooth brushing movement caused the formation of abrasion defects. In recent years, it has been suggested that multiple factors play a role in the etiology of tooth surface wear occurring without caries. These effects are multifactorial.⁹ The depth of the defects formed on the outer surface of the teeth occurred mostly in the cervical area. Studies have shown that the stress caused by compression and tension forces on the teeth accumulates in the cervical area.¹⁸ The thickness of the tooth enamel decreases towards the cervical area. As a result of the incoming forces, it breaks and the underlying dentin is exposed. The fact that dentin wear more easily than enamel explains the reason for deep defects and tooth sensitivity in this area.

In the study, both patients were using highly abrasive chemical agents to clean the tooth surfaces and brushing their teeth incorrectly. These products had been used for a long time and non-carious lesions had formed on the teeth. Direct composite restorations were preferred for the treatment of these lesions. The follow-up visits after the completion of the restorations were short and satisfactory. The lack of long-term control sessions in both cases is one of the limitations of this study. Control sessions are necessary for patients to abandon their habits. In addition, the surface integrity of the direct composite restoration treatment should be examined. Fractures and discoloration should be re-evaluated.

In conclusion, the following recommendations should be made to raise awareness of patients about the use of tooth whitening products and brushing: limiting the use of alternative tooth whitening products, providing training on tooth brushing, and ensuring the correct selection of toothpaste.

Informed Consent: For the oral and written data used in this study, both patients were informed verbally and in writing. Consent forms were signed.

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REFERENCES

1. Babot-Marquillas C, Sánchez-Martín M-J, Amigo JM et al. Tooth whitening, oxidation or reduction? Study of physicochemical alterations in bovine enamel using synchrotron based micro-FTIR. *Dent Mater.* 2022;38(4):670-679.
2. Senthilkumar V, Ramesh S. Comparative Evaluation Of Natural Tooth Whitening Agents-An Invitro Study. *Int J Dentistry Oral Sci.* 2021;8(02):1749-1752.
3. Benahmed AG, Gasmi A, Menzel A et al. A review on natural teeth whitening. *J Oral Biosci.* 2022;64(1):49-58.
4. Chan AS, Tran TTK, Hsu YH, Liu SYS, Kroon J. A systematic review of dietary acids and habits on dental erosion in adolescents. *Int J Paediatr Dent.* 2020;30(6):713-733.
5. Carvalho TS, Lussi A. Acidic beverages and foods associated with dental erosion and erosive tooth wear. *Monogr Oral Sci.* 2020;28:91-98.
6. Donovan T, Nguyen-Ngoc C, Abd Alraheem I, Irua K. Contemporary diagnosis and management of dental erosion. *J Esthet Restor Dent.* 2021;33(1):78-87.
7. Avunduk ATE, Yanardag EC, Topbas N. Does High Citrus Production Increase The Frequency of Consumption and Affect The Prevalence of Dental Erosion? *Cyprus J Med Sci.* 2021;6(1):67-73.
8. Nascimento MM, Dilbone DA, Pereira PN, Duarte WR, Geraldini S, Delgado A. Abfraction lesions: etiology, diagnosis, and treatment options. *Clin Cosmet Investig Dent.* 2016;8:79-87.
9. Grippo JO, Simring M, Coleman T. Abfraction, abrasion, biocorrosion, and the enigma of noncarious cervical lesions: a 20-year perspective. *J Esthet Restor Dent.* 2012;24(1):10-23.
10. Hamza B, Tanner M, Attin T, Wegehaupt F. Dentin abrasivity and cleaning efficacy of novel/alternative toothpastes. *Oral Health Prev Dent.* 2020;18(1):713-718.
11. Janakiram C, Taha F, Joe JJoC, Research D. The Efficacy of Plaque Control by Various Toothbrushing Techniques-A Systematic Review and Meta-Analysis. *J Clin Diagnostic Res* 2018;12(11):1-6
12. Pareek A, Sood H, Aggarwal G. Tooth wear: A review. *Int J Health Sci.* 2021;5(1):122-133.
13. Badavannavar AN, Ajari S, Nayak KU, Khijmatgar S. Abfraction: Etiopathogenesis, clinical aspect, and diagnostic-treatment modalities: A review. *Indian J Dent Res.* 2020;31(2):305-311.
14. Algailani U, Alshaikhli LO, Al-Zahawi A, Alzbeede A, Diyaa ASM, Osman O. Comparing occlusal and cervical microleakage in class V restorations using two different nanohybrid resin composite with different insertion techniques. *Mater Today: Proc.* 2022;60:1736-1740.
15. Chan K, Madsen L, Kashani N, Lee R. Bubbling Baking Soda. *Expedition.* 2021;11.
16. Ribeiro JS, de Oliveira da Rosa WL, da Silva AF, Piva E, Lund RG. Efficacy of natural, peroxide-free tooth-bleaching agents: A systematic review, meta-analysis, and technological prospecting. *Phytother Res.* 2020;34(5):1060-1070.
17. Ram S, Gowrish S. Non-Peroxide Bleaching Materials: A Review. *J Pharm Negat.* 2023;14(2):503-507.
18. Jakupović S, Anić I, Ajanović M et al. Biomechanics of cervical tooth region and noncarious cervical lesions of different morphology; three-dimensional finite element analysis. *Eur J Dent.* 2016;10(03):413-418.