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Review Article

Dental erosion in restorative dentistry

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ABSTRACT

Over time, teeth undergo both physical and chemical changes that result in the wearing down and thinning of dental hard tissues. These changes include various forms of damage, including abrasion, attrition, abfraction, and erosion. Among these, dental erosion caused by acids has emerged as a significant concern in the field of dentistry. While the incidence of tooth decay has decreased, dental erosion has become more prevalent, largely due to shifts in dietary habits. Detecting erosion at an early stage is crucial because the process is irreversible. The diagnosis involves a thorough examination of the teeth to identify specific erosion characteristics. Both external and internal factors contribute to the occurrence of erosion, and even children are susceptible to it. Implementing preventive measures, such as educating patients, providing dietary advice, and employing fluoride therapy, plays a vital role in managing erosion. Treatment approaches vary depending on the severity of the erosion and may include techniques ranging from sealing and direct composite restorations to more extensive reconstructions involving ceramic restorations. It is important to emphasize that adequate preventive measures and regular follow-up are crucial for achieving long-term success in managing erosion.

Keywords: Dental erosion, Abrasion, Attrition, Abfraction, Intrinsic and extrinsic factors, Preventive measures

INTRODUCTION

Teeth undergo a variety of physical and chemical changes over the duration of a lifetime, which contribute to the wearing loss and thinning of dental hard tissues. The various processes include abrasion which is exogenous material rubbing against tooth tissue during chewing or brushing, attrition which includes the effect of opposing teeth, abfraction which is tensile and compressive forces acting on the tooth during flexure, and erosion, which includes chemical dissolution of tooth minerals. Wear is the consequence of the simultaneous and/or synergistic impact of several processes, which all occur in dentition to varying degrees.[1] Dental erosion is the breakdown of teeth by acids when the aqueous phase around them is not sufficiently saturated with tooth minerals.[2] The issue of erosive tooth wear (ETW) has recently come to the attention of the dentistry profession.[3] Caries rates have significantly decreased for a large portion of the population

as a result of community water fluoridation, fluoride-containing toothpaste, and patient education. The general population is well-informed about periodontal disease, and those who work in the field of oral health care devote a considerable amount of their time to preventing periodontitis. ETW is a significant issue for an increasing number of patients, and oral health professionals must be trained to identify its early warning signs to implement efficient prevention strategies and protocols and lessen the need for extensive restorative dentistry. It is important to note the incidence of dental erosion, a kind of tooth wear that can affect both primary and permanent teeth. The degree of tooth erosion is generally thought to worsen with age.[4,5] That phenomenon may have been primarily influenced by changes in dietary practices over the past several years, particularly an increased frequency of intake of recently introduced acidic foods and beverages.[6,7] The capacity of the dentist to precisely identify clinical indications and pertinent aetiologies is crucial for aiding in the development of effective management methods for dental erosion diagnosis, prevention, and treatment. Although early detection of the erosive process might be challenging, repeated exposure to acidic conditions can eventually result in a permanent loss of tooth-hard tissue that can be seen clinically.[8] Even the most severe erosion instances may result in asymptomatic patients, emphasising the significance of dental professionals' attention to detail and early identification.[9,10]

METHODOLOGY

This study is based on a comprehensive literature search conducted on June 24, 2023, in the Medline, PubMed and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed dental erosion in restorative dentistry. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

Dental erosion is a common oral condition, and it has become endemic in recent decades.[11] The majority of instances are seen in four populations: middle-aged men with gastroesophageal reflux, young men with increasing soft drink intake, young women with eating disorders such as bulimia and anorexia nervosa, and the older population as a result of medications. To avoid severe dental damage, early identification, and treatment are highly advised. The mineral in our teeth is composed of a calcium-deficient carbonated hydroxyapatite $(Ca)(PO_4)$ (CO_3) (OH). These changes to the mineral crystal lattice, particularly the replacement of carbonate, make hydroxyapatite less acid-soluble than tooth material.[1] These substances only interact with the mineral crystals' surfaces during acid and/or chelator erosion after they penetrate through the plaque, pellicle, and protein or lipid coating on each individual crystal. Direct surface etching results from the hydrogen ion's combined action with the carbonate and/or phosphate and the release of all the ions from that area of the crystal surface. Acids with a more complicated interaction include citric acid. They exist in water as a combination of hydrogen ions, acid anions (such as citrate), and undissociated acid molecules, with the proportions of each being influenced by the pH of the solution and the acid dissociation constant (pKa). In addition to the hydrogen ion's impact, calcium can be removed from the surface of crystals and/or saliva by forming a compound with the citrate ion.

Diagnosis of erosion

It is difficult to get a correct diagnosis without looking at the teeth and the area around them.[12] Acid-induced tissue loss is distinguished from other types of wear by the unique differences from the original anatomical tooth morphology used to make the clinical diagnostic of erosion. The initial indications of erosive tooth erosion manifest as a polished, lustrous surface with a smooth texture. As the condition progresses, there are noticeable alterations in the original shape of the affected area. The primary distinguishing features are shallow depressions found on smooth surfaces, situated above the junction between the enamel and cementum.[1] Continued advancement of occlusal erosion results in a smoothing of the pointed parts of the teeth, the formation of grooves on these pointed parts as well as on the biting edges, and dental restorations that extend beyond the neighbouring tooth surfaces. In more severe instances, the entire shape of the occlusal surface vanishes. To monitor and manage the progress of tooth erosion, it is advisable to regularly capture photographs and diagnostic models using either traditional or digital methods.[13,14] However, it might be difficult to compare research in this area because several study groups have created their tooth wear index. They may differ in their method of evaluation, scale, choice of teeth, and other different modalities and are created for each unique study in accordance with the study goals.[15] Attrition must be distinguishable from erosive lesions. They frequently have shiny, flat sections with definite edges that match the opposing teeth's traits. Occlusal erosion is distinguished from abrasion which can sometimes be of equal severity.[1] When possible, the clinical examination should be followed by a thorough history-taking procedure that includes questions about eating habits, general health, and saliva flow rates. Particularly when other risk factors like keeping the drink in the mouth are present, patients with more than four dietary acid intakes are at greater risk for erosion. Another significant risk factor for the development of erosion that must be considered is the release of stomach acids such as reflux, vomiting, alcohol misuse, etc.

Intrinsic and extrinsic erosion

Extrinsic, intrinsic, or a combination of both variables may be the reason for erosion. Extrinsic variables often have to

do with a person's nutrition, way of life, risk factors at work, acidic prescriptions, and other pharmaceuticals [16,17]. In contrast, intrinsic factors involve the regurgitation of stomach acids at a rate greater than the capacity of saliva to function as a buffer.[17,18]

Erosion in children

Children frequently have erosive tooth wear.[1] In deciduous teeth, the overlap between erosion and mechanical forces like attrition or abrasion is probably more obvious than in permanent teeth. Early permanent tooth erosion can affect dentition for the remainder of one's life and necessitate costly restorative operations. Early disease diagnosis and suitable preventative treatments are crucial for this reason. Such measures require an understanding of the etiological reasons for erosive tooth wear. Like in adults, extrinsic, intrinsic, or a mix of these variables may contribute to the disease in children and adolescents. However, behavioural issues, including peculiar eating and drinking patterns, the use of synthetic medications, and socioeconomic considerations, are also significant.

Control protocol

Clinicians should focus on erosion prevention and early detection, as severe stages of erosion may require challenging and expensive interventions.[3] Patient education on behavior change is as important as stopping/slowing the progression of erosion. Psychological counseling referrals should be made for eating disorder patients, and definitive restorative management should not continue until a green light has been given by the attending psychologist. However, because of the high recurrence rates of this disorder, the consequences of a resumed purging habit on the definitive dental restorations should be discussed with the patient. Obtaining written consent is important.[19] As dental hard tissues are more prone to damage in cases of erosion brought on by dietary factors, patients should be advised not to brush their teeth for 30 minutes after an acid attack and to rinse their mouths with water, milk, sodium bicarbonate, or fluoride before an acid attack. The use of gentle toothpaste and soft toothbrushes should be suggested in order to reduce abrasive pressure. In addition to pilocarpine, sugar-free or xylitol mints and gums may be used to improve salivary flow.[3] To accelerate the process of remineralization of the tooth, fluoride varnish treatment and other fluoride therapy techniques can be used. The patients may be recommended a preventative program that is specially designed for them. Dietary recommendations, fluoride routine optimization, stimulation of salivary flow rate, use of buffering medications, and special encouragement for non-destructive tooth brushing practices using a low abrasive toothpaste may all be included. In addition to fluoride toothpaste, regular use of fluoride gel and solution gives the chance to considerably lessen tooth material abrasion. Abrasive tooth washing and whitening treatments should also be avoided since they may remove the outer layer of enamel and make teeth more susceptible to erosion.

Treatment protocol

Initial restoration procedures have to be modest and involve the use of adhesives [1]. Modern therapeutic theories suggest that only minor reductions should be made to healthy tooth material. Restorative treatments must be adapted to the tooth, not the other way around. However, when teeth weaken, the alveolar bone and the surrounding tissues compensate for the change to some extent. While reducing crown height, teeth maintain their occlusal contact, which might cause problems with reconstruction since there isn't enough room for the restorative material. Gaining interocclusal space using orthodontic methods might be useful to avoid an intrusive, whole-mouth rehabilitation, particularly if predominantly groups of teeth (for example, all the teeth in the anterior area) are affected by erosive tooth wear. Appliances that are either fixed or removable, like the Dahl appliance, can be used to complete orthodontic therapy.[20] The weakened teeth can then be repaired after orthodontic treatment. Prior to the last 10 years, only costly crown and bridge work, or in more severe situations, removable overdentures, could restore the badly damaged dentition. It is now feasible to restore weakened dentitions in a less intrusive way thanks to advancements in adhesive procedures and composite restorative materials. The wear resistance of posterior composite fillings has improved recently. Therefore, even in load-bearing settings, the use of contemporary direct restorative materials may offer a longer lifespan .[1] Several case studies show how adhesive procedures can successfully restore erosive-damaged dentition.[21-23] The degree of tooth material loss (such as loss of vertical dimension) should be taken into account while designing the restorative treatment plan. It should be remembered that erosive tooth wear is a complex disorder and that, frequently, all etiological factors cannot be identified and eliminated. The long-term success of the rehabilitation may be compromised in such circumstances as the following: [1]

Loss of vertical dimension 0.5 mm: sealing or direct composite restoration

Early treatment of erosive tooth wear is necessary to stop the emergence of functional and aesthetic issues. The sealing of the tooth surface is the least invasive procedure. However, periodic repetition of the sealing operations is required. Occlusal erosions frequently have grooves on their occlusal sides, and the restorations' edges are elevated above the level of the neighbouring tooth surfaces. These grooves show a lengthy period of a low pH value following an acid attack, which will cause the erosive process at this location to continue to advance. In certain situations, less invasive composite fillings can shield the injured area. Because conventional glass-ionomer cement dissolves in acidic environments, they are not advised for use as permanent restorations.

Loss of vertical dimension 2 mm: direct reconstruction with composite materials

The teeth can be quickly reconstructed using composite materials as long as there is just a loss of 1-2 mm of interocclusal space. Patients often have no issues with such a slight increase in the vertical dimension. Teeth are 'freehand' reconstructed in accordance with their original anatomy. Localised facial or palatal surface abnormalities can be repaired with this restorative procedure. Direct composite restorations have the benefit of being simple to repair and adjustable to the problem. If the occlusal and vestibular erosions combine, the original tooth form is barely discernible, and the loss of vertical dimension often exceeds 2 mm, making the situation more serious.

Loss of vertical dimension 2 mm: rehabilitation with indirect ceramic veneers and overlays

In general, direct adhesive techniques are preferred to indirect methods for reconstructive treatments due to their reduced invasiveness. However, porcelain veneers could occasionally be used if the upper anterior teeth need to be rebuilt due to significant tooth erosion. Reconstruction with complete ceramic overlays is practical if the flaws on posterior teeth extend over two or more tooth surfaces and the vertical tooth substance loss is greater than 2 mm. With the use of this procedure, it is shown that all-ceramic restorations may be used to create reconstructions that are both attractive and sensible. However, such dental procedures are costly. To ensure long-term success, it is crucial to combine active therapy with preventative measures and frequent recall.

Loss of vertical dimension 4 mm: rehabilitation with indirect ceramic restorations

Complex reconstruction involving indirect restorations such as ceramic crowns and bridges becomes necessary in patients who have severe tooth surface loss on more than two surfaces per tooth and significant loss of vertical dimension. However, this type of treatment should be reserved for advanced erosion cases and not used as a routine approach. Just like other patients with erosive tooth wear, proper preventive measures and regular follow-up appointments should be implemented to maintain oral health and prevent further damage.

CONCLUSION

Teeth undergo physical and chemical changes over time, leading to wear and thinning of dental hard tissues. Dental erosion, caused by acids, has become a significant concern in dentistry, with its prevalence increasing due to changes in dietary habits. Early detection of erosion is crucial, as it is an irreversible process. The diagnosis involves examining the teeth for specific erosion characteristics. Extrinsic and intrinsic factors contribute to erosion, and preventive measures such as patient education, dietary advice, and fluoride therapy are essential for managing erosion. Treatment approaches range from sealing and direct composite restorations to more extensive reconstructions with ceramic restorations, depending on the severity of erosion. Adequate preventive measures and follow-up are necessary for long-term success.

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