ABORDAREA TERAPEUTICĂ A UZURII DENTARE DATORATĂ EROZIUNII

THERAPEUTIC MANAGEMENT OF DENTAL WEAR BY EROSION - LITERATURE REVIEW

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Abstract:
Dental wear is clinically defined as the progressive and irreversible loss of hard dental tissue caused by various mechanisms that do not involve plaque bacteria. The evolutions of lifestyles and diet, as well as the appearance of other pathologies have favored the development of new losses of dental tissues, associated with dental wear which includes abrasion, erosion and attrition. The objective of this work was to determine the therapeutic management of dental wear and especially erosion by an extensive review of literature. The successful treatment of dental wear requires early diagnosis, profound patient sensitization and an individualized protocol. These three points are essential in order to prevent the progression of the lesions and to limit at best their severity. Finally, school dental prevention programs should include the concept of dental erosion so that children learn the dangers quickly and adopt good eating and oral hygiene habits at an early age.

Key-words: *dental wear by erosion, management, literature review.*

Dental wear is a physiological or pathological process. Physiological wear, which has existed since the beginning of humanity and in all civilizations, was results from the use and friction of dental surfaces against each other, during the functional demands of everyday life. [9, 14, 53] The maintenance of the teeth on the arch and the extension of the lifespan logically explain the wear problems encountered in the elderly. These losses are due to chewing and tooth contact with food whose pH may be acidic [17].

The pathological wear is found in people of all ages, with characteristics: pain (hyper-sensitivity), faster than normal progression, uncorrelated with aging, functional changes (loss of DVO, TMJ disorders), aesthetics (change of shape, hue), and can be associated with eating disorders (anorexia, bulimia) and parafunctions (bruxism) [8, 43, 47, 50].

The limit between physiological and pathological wear is difficult to define. According to Smith and Knight (1984), wear is pathological when the loss of hard dental tissue compromises or compromises function and aesthetics, considering life expectancy and rate of wear degradation [1, 4, 9, 16, 22, 29, 37].

Dental wear is a generic term commonly used in dentistry to describe the different mechanisms that are attrition, abrasion, erosion and abfraction. However, this ancient terminology (John Hunter 1778) does not fully reflect the reality and variability of the physical or chemical mechanisms involved. [50] Historically, the terms "odontolysis" and "mylolysis" have been used to describe losses of dental substances of non-carious origin, located respectively on the incisal and cusp edges and in the vestibular cervical zone [2, 7, 43, 39].

These "non-carious cervical lesions" are recognized as chronic lesions, most often multifactorial, but this notion remains vague. Indeed, other non-carious lesions can affect dental crowns such as fractures or external cervical resorptions.

Thus, the terminology that seems most appropriate to employ is that of dental wear injuries, which correctly refers to degradation processes by triboerosion and abrasion. [9] Tribology is the science of friction, wear and lubrication. It studies the frictions applied to the teeth and classifies them according to the mechanisms involved [44, 46, 48].

The etiology of the lesions of dental wear is particularly important to control their activity, their evolution, to prevent their recurrence, to evaluate their prognosis and to guide the plan of treatment [7, 11, 12, 41, 42].

The reason for consulting the patient and the discovery of dental wear injuries can be varied:

- the patient may present because of dentinal hyperesthesia: the pain caused by thermal, electrical, chemical and mechanical agents is acute. Very often it appears between 25 and 30 years, and hygiene is usually excellent.
- it may come from embarrassment of the unsightly appearance of his teeth, aesthetics is usually the first reason for consultation [13, 34, 37, 38, 39]
- the discovery of wear injuries takes place during a simple periodic check [17, 19, 26, 29, 34].
- the anamnesis must evaluate the risks and identify the etiological elements in order to intercept the pathological process [7, 10]. It should highlight individual risk factors to identify patients exposed to erosive and / or abrasive lesions [1, 14, 46].

The first step involves a complete clinical evaluation to determine the incidence and severity of the lesions, their origin and any other abnormality or functional, biological or aesthetic pathology. The clinical examination consists of several stages:

1. the study of the form and degree of severity of lesions observed in the mouth,
2. the study of their location and their extent,
3. detection of early wear injuries, evaluation of aesthetic and functional repercussions [16].

The treatment plan is adapted to each situation. Indeed, a patient unable to control the etiological factors (GERD, anorexia-bulimia, addiction to sodas, stress, pipe smoker...) will not be treated the same as the patient with the same loss of dental tissue, but with complete disappearance of risk and etiological factors. To achieve a relevant and patient-specific management, the diagnostic procedure must be comprehensive and will make it possible to establish a prognosis according to the character, rather benign or rather severe, of the degree of destruction achieved. The degree of severity of the lesions will allow the therapeutic decision-making, the choice of preventive measures, the modes of restoration and oral rehabilitation.

Objectives

The purpose of this review is to identify all descriptive studies conducted in children, adolescents and adults about erosion. Its main objective is to determine the choice of treatment according to the grade of severity of erosion; its secondary objective is to identify all factors related to erosion.

Material and Methods

An electronic search was conducted on Pubmed using the keywords:

Erosion, Erosive, Teenager, Child, Children, Adult, Treatment

These terms were used separately and cross-referenced to identify the items to be analyzed after inclusion. Included were studies related to the therapeutic management of erosion meeting the objectives described above. Only publications in French or English have been selected.

Were excluded systematic reviews, in-vitro studies, recommendations, comparative studies, studies targeting only the prevalence of erosion on temporary and permanent teeth.

Electronic research of erosion treatment in children, adolescents and adults has identified 838 references in dental journals. For reasons of comparability of the results, only full-text articles and abstracts of articles published from 2012 were analyzed, meaning a total of 157 articles.

Refining the selected articles lead to an inclusion of only 32 articles in the end of our selection following a certain protocol and due to various reasons explained in table 1.

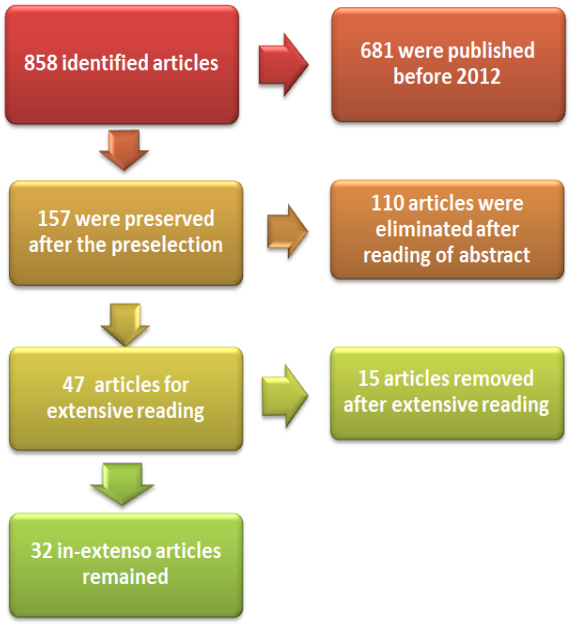

Fig 1- Algorithm of article processing

Studies on erosion of bone tissue or TMJ	15
Soft tissue studies	6
Studies on dental erosion-In-Vitro Study	8
Diagnostic studies	7
Narrative Literature –Studies	10
Comparative studies	10
Studies not written in French or in English	2
Recommendations	5
Studies related to dental erosion associated with a pathology	11
Cohort study	4
Studies case-control	3
Studies prevalence only	4
Studies related to oral health status more targeted to carious lesions	6
Evaluation of practitioners' knowledge of erosion	4
Studies relating to the role of saliva	3
Studies relating to the role of oral hygiene	2
Studies relating to the role of eating habits	5
Studies related to the food role themselves	3
Study in swimmers	1
Studies relating to general diseases with oral manifestations	15
Quality of life-erosion	1
Total	125

Table 1- Reasons for removing articles from the study

Results and discussions

The analysis of these 32 articles made it possible to highlight the risk factors, the different means of prevention and the solutions of treatment of dental wear by erosion.

Risk factors have been highlighted in 13 articles, whether intrinsic or extrinsic / behavioral.

The secondary prevention means were analyzed in 15 articles, including the use of rinse solution and fluorinated gel), chewing gum containing CPP-ACP, fluorinated toothpaste and laser.

Finally, direct or indirect prosthetic solutions were discussed in 4 articles.

As mentioned above, knowledge of etyopathogenic factors and the identification of risk factors lead to proposing preventive, prophylactic and therapeutic approaches to the patient.

Risk factors of erosion

Extrinsic risk factors are distinguished from intrinsic ones.

Extrinsic risk factors

They are represented first by the chemical factors which by the erosive potential of acidic foods and beverages attack the dental structures. Among them we find citrus, soft drinks and / or acids, sports drinks, sweets and various drugs. The authors recalled that their erosive potential is not exclusively related to the pH value. It is also strongly influenced by the mineral content, the titratable acidity (measure the amount of base needed to neutralize it) and the chelating properties of the calcium component of the food or drink. Other studies have supplemented extrinsic factors with: exposure to chlorinated water in swimming pools, professional environment with exposure to corrosive products (acid fumes, aerosols).

Then, the behavioral food factors that concern, in addition to the frequency of consumption, the way in which food acids are introduced into the mouth - by swallowing, sipping, or using a straw - determines the contact time of the tooth surfaces with the erosive agent. Frequency and duration of exposure are essential elements in addition to the composition of beverages.

Another behavioral factor highlighted would influence the development of wear injury: the sedentary lifestyle of adolescents who spend a lot of time in front of the television/ computer, and who do not exercise sports activities.

Acidic drugs are represented by acetylsalicylic acid, vitamin C. Ingesting the following drugs reduces salivary secretion, promoting erosion: psychotropic drugs, anticholinergics, antihistamines, antiemetic, medication for Parkinson's and drug abuse.

Intrinsic risk factors

Intrinsic factors are repeated vomiting of multiple causes. These may be the consequence of psychological disorders, in anorexia and bulimia, for example. Other times, this is gastroesophageal reflux because of an abnormal gastrointestinal tract, especially during pregnancy, malabsorption syndrome or in the chronic alcoholism. The hydrochloric acid produced by the parietal cells of the stomach thus reaches the mouth. Unlike food acids, gastric juice has a lower pH and higher

titrability resulting in generally more severe destruction of dental tissue. Xerostomia is also an intrinsic risk factor, favoring the installation of erosion.

With respect to biological factors, dental tissue quality, saliva properties, tooth position, and soft tissue anatomy could affect the development of dental erosion. Serious erosive lesions not only affect the surface of the enamel, but may also lead to exposure of coronal or root dentin and, therefore, painful hypersensitivity to hot / cold / sweet / touch.

In addition, erosive tooth wear is not only found in permanent teeth, but is more and more common in the temporary dentition. The palatal surfaces of the upper incisors and the lingual surfaces of the mandibular molars (temporary or permanent) appeared to be more frequently affected. In the study by Uhlen et al (2014) [48], the authors demonstrated that at the level of the lower first molars the erosion lesions reached the dentin, whereas on the maxillary central incisors they were limited to enamel.

Prophylaxis and prevention

The authors complement each other on the fact that prevention is the starting point of wear therapy.

According to several authors, three checks must be made:

1. The control of oral hygiene: avoiding horizontal brushing and brushing post-consumption acid (it is recommended brushing 30minutes after the ingestion of an acidic drink), recommend the use of a brush to soft tooth or electric brush and low abrasive toothpaste, provide fluoridated toothpastes with more or less desensitizing agents, insist on the brushing technique most suited to the patient, as well as the frequency and duration, offer regular applications of fluoride at high concentrations for a few minutes to fight against hypersensitivity, and avoid bleaching products that increase the risk of erosion.
2. Control of eating habits and acid consumption: reduce the consumption of acidic foods (liquids and / or solids) if possible and limit them to a reduced number of main meals.
3. The control of the duration of action of the erosive mechanism. It is necessary to explain to the patient that he must drink acidic, carbonated beverages quickly, that following an acid consumption it is better to rinse the mouth with water or a solution with low concentration of fluoride, and after an acid attack, he can consume a chewing gum without sugar to stimulate salivary secretion. Hyposialy that promotes erosion should be kept to a minimum. Patients are also advised to drink the acidic drink during a meal, which is less aggressive than when it is swallowed over a long period of time. In general, salivary secretion is stimulated during meals and the buffering capacity of the oral medium is increased.

Non-invasive erosion therapy

Remineralization strategies are non-invasive treatments for dental erosion and have been used for many years. Fluoride has been considered an effective agent for reducing demineralization and dentin hypersensitivity. Fluoride favored remineralization and, since the critical pH of fluoroapatite was 4.5, it conferred greater resistance to demineralization. In the articles studied, we found fluoride in various forms and with various uses. We have distinguished the professional products, products usable at home.

In the office, we found fluoride in the form of gels and varnishes. Concerning the fluorinated gels, the authors agreed to use gels based on calcium silicate and fluorine phosphate (1450ppmF). In the study by Conceição et al (2015), a gel containing 1% NaF and 9% sodium hexametaphosphate (HMP) had a high anti-erosive potential, a safer alternative to a conventional 2% NaF gel.

In the study by Moretto et al (2013), the authors demonstrated that the action of a fluorinated varnish was potentiated by the use of sodium trimetaphosphate (TMP) on enamel wear.

Several authors have tested the laser effects on eroded teeth. The studies of Jordão et al (2016) and Lepri et al (2015) complement each other on the fact that CO2 laser irradiation did not improve the ability of fluoride varnish to reduce wear enamel. While the study by Alencar Nemezio et al (2015) shows that the Ed: YAG laser potentiates the action of fluoride varnish by controlling the permeability of

eroded dentin. However, because of the limited data available so far, the final conclusions about the effectiveness of the laser application on dental erosion cannot yet be drawn. Further studies are needed to clarify this topic.

At home, use of a non-abrasive fluoride toothpaste and mouthwash is recommended. For toothpastes, its abrasiveness is determined by the size and amount of abrasive particles, pH, buffer capacity and fluoride concentration. The Creeth et al (2015) study shows that fluorine concentrations of 1150ppm are sufficient to increase enamel resistance to acid and that there is no significant difference between toothpastes of 1150 and 1426ppmF. Overall, the effectiveness of fluoride toothpaste does not increase with the concentration of fluoride in toothpastes containing more than 1000 ppmF. Thus, fluoridated toothpastes can not only reduce erosive demineralization, but also reduce the abrasion of eroded tissues.

Studies by Hall et al (2017) and Sullivan et al (2014) have studied the effects of anti-hypersensitivity toothpaste composed of 8% arginine and calcium carbonate. According to Hall et al (2017), toothpaste has provided similar benefits to the daily use of 5% calcium phosphosilicate toothpaste. And according to Sullivan et al (2014), toothpaste with 8% arginine, calcium carbonate (Pro-Argin Technology) and fluoride at 1450ppm, as sodium monofluorophosphate (MFP), has improved teeth protection from erosive challenges compared to the silica-based control dentifrice and contained 1450ppm fluoride as MFP. The few studies we have do not allow conclusions to be drawn.

To maximize the potential for remineralization and minimize the risk of demineralization, the authors recommended daily use of a neutral mouthwash containing 0.05% fluoride and a 1.1% fluoride toothpaste. Other authors recommend the combination of calcium lactate pre-rinsing followed by sodium fluoride rinsing to reduce the erosive process and increase the protection of sodium fluoride against erosive wear. In the study by Stenhagen et al (2013), the authors recommend the use of daily rinsing with solutions of stannous tetrafluoride or titanium because the protective effect of these products would be promising on the wear of the erosive / abrasive enamel.

On the other hand, saliva appears to play an important role in minimizing the wear of enamel and dentin in erosive / abrasive attacks due to its buffering and demineralization capabilities as well as the ability to train a protective film layer on the hard dental tissues. In patients with xerostomia or hyposialia, reduced salivary flow is associated with low salivary pH and decreased buffering capacity. Low salivary flow and low buffering capacity have been shown to be strongly associated with dental erosion. Prestes et al (2013) and De Alencar and (2014) showed that saliva stimulated by the use of sugar-free chewing gum with CPP-ACP (casein phosphate - amorphous calcium phosphate) would promote action of demineralization in erosive phenomena, especially on initial lesions.

In addition, saliva is responsible for the formation of the acquired film, which is a physical barrier that protects the tooth against erosive attacks. It is composed of a layer of protein formed on the surface of the tooth, acting as a diffusion barrier or permeability membrane. This selective barrier prevents direct contact between acids and the surface of the tooth, thereby reducing the dissolution of hydroxyapatite. The protection of the tooth surface by the acquired film is well established in the literature and has been demonstrated by several studies. For example, Delecrode et al (2015) suggested the use of dental products with proteins extracted from acid-resistant acquired film to prevent carious and erosive lesions. It can also be concluded that since tooth brushing can partially eliminate the salivary film, patients at risk of tooth erosion should reduce the frequency of tooth brushing and use a low abrasively toothpaste to avoid damaging the teeth. Acquired film (RDA = Relative Dentine Abrasion <40).

Therapeutic strategies of dental erosion

The clinical situations can be very different and the age of the patients must be taken into consideration. Management differs depending on the severity of the lesions, starting with fluorizations to a complex prosthetic treatment plan. Given the various possibilities offered by biomimetic materials and techniques for the restoration of eroded teeth, and in keeping with the current trend which favors the

least invasive approach to dentistry using adhesive materials, it is If possible, preserve the natural structure of the tooth. Therapeutic measures must therefore adapt the restoration to the tooth and not the opposite.

In our studies, we distinguished direct technique restorations from indirect techniques

Restorations in direct, semi-direct technique

1) Lesions in cups at the end of the cusps and minor abnormalities of the contour can be corrected with adhesive resins directly after surface preparation. The choice of color must be made before preparation, as well as the determination of the shape of the restoration.

In the case of maxillary anterior wear, it is suggested to begin by adding the resin at the level of the cingula maxillary canines, then the patient is guided in closing in the uncured resin leaving a space available for the reconstruction material. Once the DVO is validated, the composite is light cured. The remaining teeth are reconstructed by adding composites (dentin and enamel) using the canine as a reference occlusal stop. A silicone wrench can be used to control dimensions and mass thicknesses.

2) The restorations are made by molding the composite using a thermoplastic splint made on the basis of the wax-up. Thus, once positioned in the mouth, there is a vacuum corresponding to the volume of lost dental tissue, clearly visible in the form of a vacuum in the occlusal region between the transparent resin of the splint and the remaining dental structures. Under a dike, after surface treatment, and insulation of the underside of the miniplast splint using a water-soluble gel, the splint loaded with a hybrid micro-fissured composite is placed in position by applying a uniform pressure, and then the composite is photopolymerized therethrough. After gross adjustment of the reconstituted teeth, the remaining teeth are reconstructed. With this technique, and a decline of 5 1/2 years, there are some edge deterioration, marginal staining, and slight changes in surface texture and anatomical shape, fractures or adhesion failures. This technique can restore aesthetics and occlusion with good results. However, it can be considered that this technique corresponds to medium-term rehabilitation.

3) Dahl's approach

In the study by Milosevic and Burnside (2016), the authors followed over 8 years the survival of hybrid composite direct restorations on maxillary frontal teeth in patients with severe attrition and erosion. They concluded that this material was appropriate for this type of wear but that it should be associated with posterior occlusal support to optimize restorative survival. They used the Dahl approach which is to create an interocclusal space to restore anterior teeth that have lost their substance, causing posterior teeth to emerge and anterior teeth to intrude. The procedure can be done in one or two steps. In one stage, definitive restorations are posited from the outset, in over occlusion, which leads to occlusal instability initially and often involves a posteriori corrections. This can lead to risks with respect to the restoration (embrittlement, loss of substance, perforation). This is why the two-step procedure is recommended. In two stages, there is first a phase of DVO augmentation using transient overcclusion restorations. Only once the expected increase in DVO has been achieved will definitive restorations be put in place.

4) In a recent study, Ramseyer, Helbling, and Lussi (2015) followed erosive cases where the eroded posterior teeth were reconstructed by the "Stamp Technique" technique. This technique uses individual molds cut from silicone wrenches. This allows 1) to easily and accurately transfer the occlusal rehabilitations to the molars and premolars from the wax-up, 2) to reproduce the shape of the tooth, and 3) to shape the fiber-reinforced bridges directly on the patient. The goal of this technique is to transfer a planned occlusion of the model into the mouth in the least aggressive and accurate manner possible. In conclusion, this technique is part of the current concept of tissue economy, while being fast, easy and relatively inexpensive. On the other hand, cases of total rehabilitations using direct composites are rare. The difficulties lie in the collage on the eroded dentine.

Indirect technique restorations

1) Anterior teeth

The Sandwich or Bilaminar approach described by Vailati, Gruetter and Belser (2013) is a very promising ultra-conservative approach.

The tooth is prepared so that the remaining tooth structure is preserved between two restorations of different and independent nature and whose axes of insertion are different. This technique allows the preparation of the most conservative tooth possible. The palatal surfaces of the anterior teeth are restored in composite while the vestibular surfaces are covered with feldspar ceramic facets.

The palatal surface is first restored with direct technique composites if the inter-occlusal space is less than 1 mm or with indirect palatal composite onlays if it is greater than 1 mm. In case of insufficient space, the preparation is succinct and the only imperative is to keep the enamel frame as much as possible.

The ceramic vestibular facets are secondarily prepared with an overlap of the free edge to more easily manage the hue without placing the boundary of the facets in the palatal concavity. Indeed these are placed in the volume of the palatal composite onlay.

Another approach is the "Full Veneers". This technique makes it possible, thanks to a minimal preparation of the tissues through the masks, to preserve the enamel as much as possible by producing ultra-thin restorations between 0.2 and 0.8 mm thick, this is made possible thanks to the disilicate of lithium (E.max®). In addition, it allows restoring a remarkable aesthetic and a single restoration is necessary to replace all the palatal and vestibular faces. However, it has the disadvantage of having a single insertion axis (coronary) and is therefore slightly less economical in tissue. Moreover, by using the CAD-CAM, the treatment time is shorter, and this makes it possible to obtain a digital preoperative wax-up.

2) Posterior teeth

Initially, the peripheral crown was for a long time the solution of choice to restore worn teeth. No longer responding to modern biological imperatives, this solution is rarely used today, except in the case of re-intervention (renewal or repair of a previous crown).

Overlays in ceramic or composite laboratory have been proposed in recent years and had the advantage of less tissue mutilation with very simple peripheral limits and well above the usual margins. However, these have a major disadvantage, namely, the destruction of the proximal ridges. In order to ensure the mechanical foundation and to respect the recommendations of the manufacturers, significant thicknesses of reduction of the order of 1.5 to 2 mm were required. Despite the strict respect of the latter, it has been observed on medium and long term follow-ups of cosmetic or material fractures in the proximal region.

New ultra-dandruff restorations used in the posterior areas, called by some "table top" are based on a new approach of controlled preparations associated with a simplified cavity architecture, where the preservation of marginal ridges becomes a priority.

In the case of multiple lesions (palatal and / or vestibular) associated with occlusal wear, on the premolars and the molars, it will be necessary to realize two distinct parts taking care to leave a "band of enamel" between them, acting as resistance beam connecting the two proximal ridges. Thus, the practitioner finds himself resorting to the "sandwich" technique described at the previous level in the posterior sector. The premolars are reconstructed by adding a vestibular facet and an occlusal onlay in order to restore the initial volume of the tooth.

To summarize in later sectors and to meet the requirements of tissue economy and biomimetics, two materials are distinguished by their high mechanical strength but also their aesthetic properties. Lithium disilicate enriched ceramics (e.max®) and machined nanohybrid composites seem to be well suited for minimally invasive restoration of posterior teeth.

3) Generalized wear

The three-step technique of Francesca VAILATI and Christoph BELSER is the best-known technique for the rehabilitation of generalized erosion. It proposes a quadrant rehabilitation approach transforming a global restoration into several partial restorations. This is characterized by an alternation of 3 laboratory sessions and 3 clinical sessions in the chair.

- 1st step: aesthetic evaluation to evaluate the position of the occlusal plane
- 1st stage of laboratory: realization of maxillary vestibular wax-up
- 1st clinical stage: evaluation of the occlusal plane thanks to vestibular mock-up
- 2nd step: recovery of the posterior sectors

with an increased DVO

- 2nd laboratory stage: wax-up of the occlusal surfaces of the posterior teeth
- 2nd clinical stage: production of provisional posterior composites. A stable posterior (provisional) occlusion is reestablished; however the increase in DVO also caused an earlier open bite.
- 3rd step: restoration of the previous guide thanks to the "sandwich" technique.

Once the previous guide has been restored definitively, the posterior teeth are restored definitively in a second time after removal of the transient posterior composites.

Conclusions

The prevalence of erosion is now more important because of changing dietary habits, due to the increase in eating disorders.

The successful treatment of dental erosion requires early diagnosis, in-depth patient sensitization and an individualized treatment protocol.

Providing dietary advice and oral hygiene is essential for patients with erosive lesions of extrinsic origin, while it is advisable to refer to a specialist (treating physician, gastroenterologist, and psychiatrist) people undergoing intrinsic acid attacks.

Secondary prevention methods in cases of proven erosive damage are strongly recommended.

Currently, many "minimally invasive" therapies can be respected and applied to total occlusal rehabilitation and have a good aesthetic and functional prognosis, while being much more conservative in terms of tissue preparation than traditional restorations.

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