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Gain more with less loss: Decisive rehabilitation factors for ailing worn dentition

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Abstract

The management of tooth wear is more exacting due to its multi-factorial nature, variability in clinical presentation and its rising incidence in all the age groups which increases the demand on oral health professionals to provide a range of treatment options. So, the treatment approach for these patients can range from conservative minimally invasive restoration to full mouth reconstruction with crowns or complex dentures. The primary objectives of minimally invasive dentistry in worn dentition are recognition of early signs of wear, control of predisposing factors, stabilization of affected dentition and employ preventive measures and conservative treatment modalities to preserve what is remaining. The purpose of this article is to reveal those factors which help in deciding the treatment strategy either preventive and conservative minimally invasive approach or the conventional approach available for the cases showing tooth wear. These minimally invasive approaches are not only an economically viable solution, but also provide aesthetic and functional rehabilitation and maintain tooth structure as a precursor to more complex restorative options when required.

Keywords: Full moth rehabilitation, worn dentition, minimally invasive technique, conventional approach, conservative approach, adhesive restoration.

Introduction

Tooth wear is also often called non-carious tooth surface loss which can be pathological or physiological. Wearing of tooth is a normal physiological process and approximate vertical loss of enamel from physiological wear is about 28- 38um per annum which does not always necessitate treatment.[1] Pathological wear is happened if the rate of wear is greater than that of

patient's expected for the age and this uncontrolled wear leads to poor aesthetic, dentine hypersensitivity, functional problems- ultimate resulting in reduced quality of life.[20]

Tooth wear is multifactorial in origin and mechanism by which it occurs include attrition, abrasion, erosion and abfraction[21,22]. These mechanisms are difficult to distinguish because they seldom operate singly, and the overlap of two or more of them often at different times adds to the complexity of the phenomenon of wear.[2]

In the past, tooth wear was generally believed to be caused by attrition and abrasion but now a day's dental erosion is widely considered to be a major cause of tooth wear and its incidence is increasing more in young generation. For the rehabilitation of worn dentition, costly conventional fixed and removable prosthodontics was, and still is, considered the best definitive treatment option. But this approach is complex, irreversible, quite destructive and costly. In the recent time, due to advancement in adhesive technology and material there is a shift in restorative treatment protocols for the management of tooth wear towards minimum-intervention dentistry. However, the need for conventional approaches remains in some cases, but minimum-intervention approaches should be considered first. So, the driving force behind the concept presented in this article is to focus on those factors which help in deciding our treatment strategy either preventive and conservative approach or conventional approach.

Aetiology and clinical characteristics

Aetiology of tooth wear is subdivided into: - Erosion, Attrition, Abrasion and Abfraction.

1. Erosion - caused by chemical dissolution that causes demineralization of dental hard tissue which occurs following the drop in pH of the oral cavity below critical pH, i.e., 5−5.5. It is of two type-(a) extrinsic erosion and (b) intrinsic erosion.

In extrinsic erosion factors are

Acidic foods and drinks (carbonated and non-carbonated drinks, fruit juices, citrus fruits, and herbal tea) are the dominant cause of dental erosion in children and adolescents.

Medications (aspirin, transquillizer, anti-emetics, ant-histamines, iron tonics, chewable vit-c), Environment and activities like manufacturing battery acid, wine tasting, and swimming.

In extrinsic erosion- pattern is specified by scooped out depressions present on labial surfaces of maxillary anterior teeth**.**

Intrinsic erosion

Result from gastric content entering the oral cavity. This can be due to –gastroesophageal reflux, gastrointestinal disturbance, vomiting (due to pregnancy, as a side effect of medication, alcoholism), hiatus hernia and psychosomatic condition (like-bulimia or anorexia nervosa). In intrinsic erosion pattern is characterized by evident concave depressions where enamel appears thin and translucent. These are commonly exhibited on the palatal and occlusal surfaces of maxillary teeth as well as buccal and occlusal surfaces of mandibular posterior teeth.

Clinical Signs of erosion are – increased incisal translucency, wear on non – occluding surfaces, occlusal "cupping", incisal "grooving", "cratering" rounding of cusps and grooves, raised restoration, smooth silky shiny appearance and broad concavities within smooth enamel, preservation of enamel "cuff" in gingival crevice, no plaque and discoloration.

2. Attrition: Wearing a way of tooth substance (or restoration) due to tooth-to-tooth contact.

Causes are: - congenital abnormalities (gametogenesis imperfecta, dentinogenesis imperfecta etc), para functional habits like bruxism or clenching (triggered by emotional stress or occlusal interference), and tobacco chewing.

Clinical signs of attrition are – shiny facets, enamel and dentine wear at the same rate, matching wear on antagonistic occluding surfaces, possible fracture of cusps or restorations, impression in cheeks, tongue and /or lip.

3. Abrasion: -Wear process involving foreign objects sliding or rubbing against the tooth surfaces.

Causes are: -tooth brushing with abrasive tooth pastes, improper use of interdental cleaning aids, unglazed porcelain, or pt habits such as nail biting, pen chewing, tongue piercing. Teeth most commonly affected are premolars and cuspids.

Clinical signs of abrasion are –usually located at cervical areas of teeth and lesions are more wide than deep.

4. Abfraction: - Tooth wear located in cervical area caused by flexure forces during function and parafunction.

Clinical signs are- enamel at the cementoenamel junction (CEJ) shows V-shaped depression on one side (due to tension) and C-shaped depressions on the other side (due to compression).

Diagnosis

Making an accurate diagnosis is the pre-requisite for successful management of worn dentition which aimed at identifying the etiology of the tooth wear and then deciding the treatment strategy which may be most effective.

Determine the chief complaint of the patient

It helps in determining what are the expectations, demands, behaviour, attitude, willingness and why the patient is presenting for oral health care services. Most common complaints of the patient having worn dentition are the aesthetic impairment, difficulties with function, discomfort due to pain and sensitivity. So, the patient's input is an important factor in planning treatment strategy for the worn dentition.

Identification of causative and modifying / aggravating factors

Although aetiology of worn dentition is usually involved a combination of factors, but whenever feasible in most cases try to identify a perceived major factor. For this require appropriate diagnosis which relies on detailed history taking and clinical examination of the patient. Assessment of etiological investigation includes - Medical history (ie, bulimia nervosa, gastric reflux, hiatus hernia, medications), , diet (e.g. coarse and acidic substances), local risk factors such as bruxism (awake and sleep) and other parafunctional habits, abnormal occlusal conditions, patterns of mandibular movement (e.g. canine guidance, anterior guidance or group function), reduced occlusal tactile sensitivity, high bite force and increased endurance time, salivary factors(composition, buffering capacity, flow), occupational environment (e.g. air- borne abrasives, acid, etc.), oral hygiene habits and various aspects of the modern lifestyle have been shown to be correlated with worn dentition[16]. Based on the diagnosis, management should be directed towards the elimination of the aetiological factor and strengthening of modifying factors.

Factors that help in deciding treatment strategies (i.e. preventive, minimally invasive or conventional full mouth reconstruction) for the management of worn dentition are:

- **Evaluate the accuracy of chief complaint –** whether the patient is symptomatic or asymptomatic. All the occlusal wear does not need to be restored. Even

penetration into dentine may not need restorative treatment.

(A) Preventive, monitoring and counselling is sufficient- if the patient is asymptomatic**,** well adapted to his dentition and dentist feels that treatment will not become complicated by delay in restoring the worn dentition.

(B) Restorative treatment is required- when patient is symptomatic, complain of esthetic and difficulty in mastication and it is relatively certain that restoration will eventually be required in future. For restorative treatment first approach should be reversible and additive conservative technique. This approach is especially used in cases where patient is asymptomatic, does not need any treatment but on clinical examination clinician sense that lag in restorative treatment leads to further progression of wear.

- **Timing of recognition of sign of wear** – In the early recognition of the sign of wear preventive strategy is used as a first line of management to control the further progression of the tooth wear. Conservative treatment approach seems to be preferable if the cause of the worn dentition is interrupted at an early stage. More late recognition of condition leads to more complicated treatment planning. So, early recognition of wear help in carrying out timely preventive and conservative treatment strategy as well also improve the lifespan of the teeth.

- **Type of wear (pathological/ physiological)** - Physiological tooth wear is an age related phenomenon and it is a lifelong continuous process. While pathological tooth wear is atypical to the age of the patient, causing pain or discomfort, functional problems, or deteriorations in aesthetic appearance, which, if progressing, may give rise to undesirable complications of increasing complexity.[20] Smith and co-workers initially gave the term unacceptable levels of wear and later re-defined it as pathological tooth wear.

- **Identify the status of tooth wear (active/ passive)** - status of tooth wear means is the causative factor still active, or it has already run its course in producing its effect. This can be determined with the help of number of clinical indicators and it should be assessed prior to commencement of any restorative treatment. Clinical indicators for showing active tooth wear status are -

(A) Complain of tooth sensitivity after having acidic food and beverages due to dissolution of any protective smear layer and the opening of dentine tubules, thereby allowing tubular fluid flow causing sensitivity to stimulus. This shows demineralization process removing the surface protection on dentine.[23,24]

(B) If worn dentition patient shows absence of calculus on the lingual surface of lower incisor teeth may be an indicator of unsaturated saliva with insufficient ability to mineralize.

Both the above situations show that there is a shift in oral balance from remineralization to demineralization. So, the evaluation of salivary flow, viscosity, pH and buffering capacity becomes critical in these cases, not just for the clinician, but for the patient to assist them in developing an understanding of the risks present.[23, 24]

Placement of any restorations in an oral environment where there are uncontrolled risks and active disease are present will undoubtedly lead to early restoration failure especially with adhesive restorative material because adhesion with acid etch composite resin, glass-ionomer cements and resin-reinforced glass-ionomer cements can only be achieved when an adequately mineralized enamel surface is present.

In active erosion patient, first start preventive regimes that should include reduction of acids and underlying

risk factors where possible, and the inclusion of various remineralization agents. So, clinician and patient compliance is necessary to wait for the stabilization of the oral environment and remineralization of the tooth structure because success of adhesive restoration oral environment depend on the be stabilization of the oral environment and mineralized tooth surface.[16, 25] While conventional and complex restoration may be considered when the patients are not willing to wait for a long time and unable to afford the cost associated with this extensive work.

- **Assessment of the rate of progression of tooth wear-** the progression of tooth wear is measured during a specific time interval with the help of different techniques which are ranging from sophisticated optical or laser scanning methods to relatively simple ordinal scale[5,6]. Scale used for scoring the progression of occlusal/incisal wear[4] is -

Grade 0 - No visible change.

Grade 1 - Visible change, such as increase of facet areas, without measured reduction of tooth length; occlusal / incisal morphology changed in shape compared to the first examination.

Grade 2 - Measurable reduction of tooth length, <1 mm

Grade 3 - Marked reduction of tooth length, >1 mm.

If the tooth wear is occurring at a relatively slow rate, in those cases preventive and conservative approaches can be successfully implemented.

- **Severity of tooth wear**. Severity of tooth wear is measured at specific time and number of systems for the classification and measurement of occlusal and incisal tooth wear have been presented in the literature[7, 11, 12]. According to JOHANSSON et al in 1993 Ordinal scale used for grading severity of occlusal wear is-

Grade0 - No visible facets in the enamel. Occlusal/incisal morphology intact .

Grade1- Marked wears facets in the enamel. Occlusal/incisal morphology altered.

Grade2 - Near into the dentine. The dentine exposed occlusally/incisally or adjacent tooth surface. Occlusal/incisal morphology changed in shape with height reduction of the crown.

Grade 3 - Extensive wear into the dentine. Larger dentine area (>2mm^2) exposed occlusally /incisal or adjacent tooth surface. Occlusal/incisal morphology totally lost locally or generally. Substantial loss of crown height.

Grade 4 - Wear into secondary dentine. In 2010, Bartlett[7] the index known as BEWE (Basic Erosive Wear Examination) was construct for the recording the severity of wear on a scale from 0 to 3 for each sextant, score 0 (no wear), score 1 (initial loss of enamel surface texture), score 2 (hard tissue loss < 50% of the surface area) and score 3 (hard tissue loss > 50% loss of surface area). On completion of the BEWE, an aggregate score is reached for all sextants. The latter score can be used as a guide to the clinical management of the patient concerned. Restorative treatment is not always indicated, even for patients with severe tooth wear. If intervention is required in severe worn dentition, then irrespective of the severity of the tooth wear it is recommended to use minimally invasive and adhesive restorative technique whenever possible especially in patient's required increased vertical dimension.[26]

Whether the wear is localized or generalized

If the localized wear is present then the management strategy should be confine to the worn dentition only and avoid it being disproportionately broadened. For the generalized wear, on the other hand, will require a re-organized approach with or without an increase in OVD. So, a relatively conservative treatment modality should

be considered in localized wear as compared to generalized tooth wear.

Location of tooth wear

It is generally found that in both arches anterior teeth exhibit significantly greater wear than posterior teeth.[5] Maxillary anterior teeth are relatively more affected by the process of erosion than the mandibular anterior dentition. This may be due to intrinsic acids being held by the tongue against the palatal surfaces of anterior maxillary teeth, while the lower teeth are buffered in secretions from the sub mandibular and sublingual salivary glands and posterior teeth are protected by secretions from the parotid glands. For restoring severely worn dentition of anterior segment the most commonly used approach is adhesive restoration which followed to respect the principle of minimally invasiveness. But when the loss of tooth structure is present both in the anterior and posterior region then restoring such patients with conservative technique becomes a challenge.

- **The amount of tooth wear and restoration size in posterior segments-**

For posterior teeth - the management technique is guided by the amount of tooth wear and size of existing restorations[6].

- With minimal tooth wear and no restoration – Preventive treatment strategy and direct restorations are considered. The benefit of using a direct approach is obvious since no marginal preparation or occlusal re-duction are needed, and allow restorations to be placed in a limited inter- occlusal space.
- With moderate tooth loss and medium size existing restorations - a mix of direct and indirect composite restorations is preferred and
- With advanced tooth wear and large/ metal-based restorations - mainly indirect restorations will be chosen. The more tissue is lost, the more treatment is complicated. The traditional restorative treatment for greater amounts of tooth loss is the fabrication of indirect restorations and onlays instead of the use of direct approaches.

Age of the patient- Today, dental erosion is most common among children and young people. The young child with eroded primary teeth is a challenge. It may, however, give an opportunity for preventing erosion in the permanent dentition. Preventive advice and information about dental erosion at the right time can, in many patients, fully or partly, prevents the further damage. In children when wear affects the permanent teeth in the mixed dentition, resin- based restorations are the restorative option of choice. A conservative approach seems to be preferable especially if relatively young patients are involved.

Psychology of the patient: A poorly motivated patient or one with negative views towards dental care or indeed a phobic patient may not be the best candidate at first instance when considering complex treatment planning. Since patient compliance and maintenance of oral health is paramount in the longevity of any restorative procedure. So, patients having behaviour (like uncooperative, apprehensive, anxious, chronic complainer, obsessive, frightened) should not be favoured with any type of restorative intervention. For such patient's preventive strategy, counselling and monitoring will be the gold standard. There is evidence that those patients having concern for their dental health when adequately informed about the conservative treatment, most of the times they willingly choose this treatment option.

Knowledge of the material and technique

The treatment planning of worn dentition not only based on general principle but it should be modified on the individual basis. An optimal restorative choice is usually

based on a pre -existing dental condition (presence of decay, restoration, vital or non-vital status), the position within the dental arch and the quantity of remaining tissue. Various materials available to restore the worn dentition are :

1. Conventional restorations such as conventional cast gold onlays, partial and full veneer crowns or metalloceramic crowns.

2. Adhesive restorative material include –

(A) Direct composite resin restorations

(B) Indirect composite resin restorations

(C) Cast adhesive alloys (metal palatal veneers and metal adhesive onlays)

(D) Adhesive ceramic restorations.

With the recent advances in materials and techniques makes the conservative approach a good treatment modality for restoration of worn dentition as well as it also allows all other complex treatment options to be considered at a later date. So, wherever possible, an adhesive, 'additive' approach should be recommended, as the conventional restoration are complex, aggressive, extensive, time consuming, and expensive both financially and biologically.

Direct composite resin restorations can be used for the immediate management of functional and aesthetic concerns of the patient and as an intermediate restorative option among cases with tooth wear[2]. Indirect restorations seem to be more helpful in situations where large surface area is worn and in the interproximal areas. The success of direct and indirect resin restoration in posterior region is questionable due to inadequate wear resistance. With the advent of chemically active resin luting cements such as 4-META or dimethacrylate, Superbond, Panavia. It has been possible to form a bond between 'cast adhesive restorations and the dental hard tissues with a high level of predictability. It reduced the need for aggressive tooth preparations thereby preserving the residual tooth structure (which would be necessary to obtain adequate retention and resistance form). These cast adhesive restorations are suitable for the posterior restoration among parafunctional habit. Adhesive Ceramic restorations due to superior aesthetic and good abrasion resistance mostly used in anterior region.

Conclusion

The accurate diagnosis is the primary requirement for successful prevention and management of worn dentition. Preventive strategies are the essential first line of treatment protocol to control the further progression of tooth wear. Now a days due to advancement in materials and techniques there is a paradigm shift in the management of worn dentition from invasive conventional full mouth reconstruction to biologically sound conservative minimally invasive restoration. Restoration is not necessary in every case of worn dentition. Patient who is well adapted to his dentition is the one with no complain of pain and sensitivity, Unesthetic appearance and difficulty in mastication. In such cases prevention, monitoring and counselling is quite sufficient. The decision of restoration arises when the patient's needs the severity of the wear and the potential for progression may affect the prognosis of the tooth. The goal during the management of worn dentition should be directed towards the detection of this condition in early stage and employ preventive measures and minimally invasive treatment modalities whenever possible to protect what is remaining. A conservative minimally invasive approach seems to be most preferable in certain situations like localized wear mostly affecting anterior segment, in stabilized oral environment, when severity and progression is mild, young patients and when dentist have good knowledge

of materials and techniques. However, ultimate need for conservative approach is still needed in specific situations of generalized severe tooth wear or in cases where conservative treatment is not feasible or successful.

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