

Intrinsic Dental Erosion: Review of Dental Management

Mohammed Sulaiman Alruthea^{1*}

1. Department of prosthodontics, Dental College in AlRass, Qassim University, Kingdom of Saudi Arabia.

Abstract

Intrinsic dental erosion can result due to various pathological processes in the human body. Symptoms associated with medical problems can result in unpleasant taste, altered salivary flow and dental erosion. Dental complications include loss of vertical dimension, pulpal pathologies and sensitivity of the tooth. The review focuses the various methods and techniques used by clinicians in rehabilitating the compromised occlusion and restoring the lost function. The studies indicate the importance of detailed medical history, dental history and a careful diagnosis can facilitate to outline appropriate treatment modalities in various phases during the management of intrinsic dental erosion.

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Introduction

Loss of tooth substance is a major problem worldwide affecting at different age. This dilemma may result from a pathological situation or mechanical causes (abnormal attrition / abrasion) or chemical erosion process or combination of these causes.^{1,2} The chemical erosions process was divided into extrinsic or intrinsic erosion. The intrinsic erosion can be caused by medical problems such as, anorexia, bulimia, or gastroesophageal reflux disease (GERD).³ The regurgitated acid as a result of GERD increases the pH of saliva. This acidic environment in the oral cavity will initiate the process of dental erosion by releasing calcium ions from the tooth enamel.⁴

The most common symptoms associated with intrinsic dental erosion are oral Ulcers, halitosis, unpleasant taste, alteration of salivary flow, and dental erosion.⁵ Many complications may be associated with dental erosion that include but not limited to, teeth sensitivity, pulpal pathologies, loss of occlusal vertical dimension, compromised esthetic and occlusal function.⁶ The complications of the acid reflux in GERD can

extend to the middle-ear and can worsen the prognosis in chronic suppurative otitis media.⁷

Epidemiological studies in overseas and Saudi have clarified the prevalence for GERD, for example the GERD prevalence among population range from 8.7-33.1% in the Middle East 9, 2.5-7.8% in Eastern Asia 8, and 45% among surveyed Saudi cohort.¹⁰

Multiple methods that utilize various materials and techniques to treat the intrinsic dental erosion were described in the literature; but Unluckily, there are no evidence-based guiding principle are obtainable to assist clinicians to select the suitable treatment.¹¹

The aim of this review is to categorize treatment options available for advanced intrinsic dental erosion in accordance with modern dental materials and techniques, and find common denominators that have been used to treat such cases, through the conventional treatment plan phases, and formulate a guide for treatment plan based on evidence.

Materials and methods

Search & selection methodology

The relevant studies were searched through the database of the Qassim University Library according to specific criteria shown in (Table 1), using the following terms: dental erosion / therapy.

*Corresponding author:

Mohammed Sulaiman Alruthea
Assistant Professor, Department of prosthodontics, Dental
College in AlRass,
Qassim University, Kingdom of Saudi Arabia
E-mail: m.alruthea@qu.edu.sa

Content type:	Journals article
Publication date:	30/12/01 – 31/12/17
Discipline:	Dentistry
Subject terms:	Dentistry Teeth humans
Language:	English
Total results:	1461 Articles

Table 1. Search criteria.

1. Related to the topic.
2. Case report
3. Intrinsic dental erosion.
4. Generalized dental erosion.
5. Moderate to severe.
6. Phasing treatment plan.
7. Restoring esthetic and function.
8. Adaptable.

Table 2. Inclusion criteria.

Review	Acceptance criteria	No. of Results
Titles	Related topic and Case report	102
Abstracts	kind & severity of the erosion	30
Full text	Remaining acceptance criteria	9

Table 3. Chosen method during information gathering.

To accept studies that reported modern adhesive materials with their application for treatment of intrinsic dental erosion, Inclusion criteria utilizes (Table 2). According to that, the study has been accepted if it was a case of generalized moderate to severe intrinsic dental erosion, treated by removal of a little healthy tissues and use suitable restoration as conservative approaches. Addition to restoring the aesthetic and functional features, through taking medical history, dental history, examination, diagnosis, removal/control of causes, and final treatment with maintenance as phases through worthwhile steps that can be adapted to deal with other cases.

Information collection and analysis

1461 titles of the studies were reviewed in terms of relevance to the topic, 102 titles were

matched the topic. The abstracts of 102 titles were obtained and evaluated for the type and severity of the dental erosion; thirty abstracts were met acceptance criteria no. 3 in table 2.

Then, the full texts of thirty studies were obtained and evaluated according to the other acceptance criteria (Table 3). Nine studies published between 2003 and 2017 of intrinsic dental erosion treatments were accepted for analyzing the five different treatment phases: History, examination, diagnosis & prognosis, acute phase, disease control phase, re-evaluation phase, definitive treatment phase, and maintenance care phase. These phases were selected because they offer the essentials steps of treatment. Each phase was analyzed through asking questions, fifteen questions were asked for each study in accordance with the five treatment phases, as illustrative in (Table 4).

Results

The results of the five-treatment phase's analysis and possible likeness between the therapy options by following the specific analysis questions were demonstrated in (Table 5).

History, examination, diagnosis & prognosis: All nine studies identified the cause of the intrinsic dental erosion that produce generalized dental erosion. Seven cases of them had been checked for their dietary history.

Acute Phase:

Eight cases accompanied with the symptoms either caries, root canal treatment, temporomandibular joint problems, or orofacial pain were dealt with them before starting the treatment phase.

Control Phase:

All studies have dominated the medical problem, and have addressed risk factors that may obstruct treatment before starting the treatment phase.

Re-Evaluation Phase:

Five cases re-evaluation the procedures provided with varying periods of time ranging from 3 to 6 months.

Treatment Phase:

Diagnostic wax was used in all studies for construction of templates for interim and as a guide for the definitive restorations, while the

centric relation was chosen as the occlusal treatment position. The vertical dimension was verified before treatment and was raised in eight cases for a period of one to six months. Two case used crown lengthening procedure with increasing the vertical dimension and one case used crown lengthen.

Different materials were used in the interim stage; composite was used in one case, metal with acrylic in one case, and acrylic with six cases. Multiple materials were used in the definitive restoration; one case used porcelain fused to metal and gold, three cases used Composite, two cases used ceramic and gold, two cases used porcelain fused to metal, one case used Ceramic, porcelain fused to metal and gold, and one case used ceramic. In all cases, incisal guidance in addition to occlusal plan were corrected.

Maintenance:

Seven studies have used a protective splint, while two studies have no mention of the protective splint; five studies recalled patients between 3 -6 months, while five studies did not declare the recall. The follow-up period ranges from 6-36 months in six studies while no result confirmed with the remaining studies.

Discussion

This review aimed to categorize treatment options available for advanced intrinsic dental erosion in accordance with modern dental materials and techniques, and find common denominators that have been used to treat such cases through the treatment plan stages. Phasing treatment plan was used in this review because it facilitates the diagnosis, organize treatment, and prediction for the dentist.

In addition, it simplifies the treatment plan presentation for the patient, thus easier to be understood and accepted.

Cases reports have been used to prepare this review according to a certain acceptance criteria as observational studies for the material used and the treatment steps that followed for these cases.

History, examination, diagnosis & prognosis: The common denominators between the studies in the examination stage, is determining the etiology of dental erosion and the

predisposing factors. To understand the pathological processes and their relation to the predisposing factors that led to the dental erosion.

Acute Phase:

The common denominator between the studies is that they began to deal with acute symptoms before embarking on the definitive treatment phase. Usually patients have several short- and long-term expectations. However, the most common short-term aim is to resolve the chief complaint, which is often pain. As soon as the symptoms resolve, comfort is felt by the patients, and this subsequently encourage completion of the remaining part of the treatment plan.

Control Phase:

The common denominator between the studies is that they have controlled probable causes of disease, eliminate active disease, and eradicate situations preventing maintenance. All of this are aiming alleviate patient's dental health condition.

Re-Evaluation Phase:

The common denominator between the studies is that they re-evaluated the procedures provided to assess the success or failure of a disease control phase, and facilitate the prediction of the final result for the dentist.

Treatment Phase:

All the studies have used diagnostic wax up before starting therapy, so this step was accepted as a common denominator. Because this method allows the dentist to preview the results of the treatment while still possible modifications; and it aids to construct the templates that will be used during teeth preparation and fabricate of provisional restorations. Furthermore, promoting the communication process between the dentist-patient and dentist-dental technician from the other part.^{21, 22} Raising costs and time is drawback of this step.²³

CR was used in all studies as treatment position, so it was accepted as a common denominator. Even though utilize of CR may aid the dentist in the treatment, some believe it is difficult to determine CR, because it contains an unfavorable molar occlusion, resulting in an unnecessary excess in horizontal overlap.¹⁹ On

the other hand, CR is mostly recommended due to reproducibility.²⁴ Modification in the scheme of occlusal does not cause temporomandibular joint disorder when there are no exist for the symptoms before treatment.²⁵

The VDI was checked prior starting therapy in most studies in most studies (seven studies); this step was accepted as a common denominator. As stated by previous studies, The VD assessment is needed when the residual interocclusal rest range after repair is less than 2-3 mm.^{6,23} Moreover, some says that increasing the vertical dimension is a safe procedure and well accepted up to 5 mm.^{23,24} Fixed provisional restorations were the assessment criteria used in those studies. Abduo²⁴ concluded that "testing patient adaptation with a fixed method is more predictable than with a removable method". Test periods differed between studies (ranging from 3 to 6 months), but previous studies have confirmed that the least duration to be tested the IVD was at least one month for 24 hours a day.^{25, 26, 27}

The advantages of this step create an opportunity for gradual treatment and assessment of aesthetic and functional aspects before the definitive treatment phase begins.²² Most of the studies were used an indirect restorative material (acrylic) as provisional restoration during the transition. The modern literature recommends utilization of indirect materials the moment that VDI exceeds 2 mm because of the difficulty of restoring aesthetic and functional aspects by direct materials.^{18, 23, 28, 29}

Three studies used crown lengthening and were not considered as a common denominator; However, they were mentioned to highlight its indication. This procedure utilized when there is a need to increase the abutment axial wall height, or to decrease the amount of vertical dimension that desired to be restored, or to improve the gingival symmetry. But before proceeding, the root ratio to the crown must be assessed.^{12,17,20}

The studies contained in this review used assorted types of materials for final restoration. According to the literature, some factors must be considered when selecting a dental material for restoration which include aesthetic aspects, wear resistance, non-iatrogenic impairment to the opposing teeth, and reasonable cost.^{13, 17, 19}

In the studies that were used in the composite resin, the patient's financial situation was taken into consideration. Van Nieuwenhuysen et al.,³⁰ in a long-term assessment of restorations from 1982 to 1999, concluded that the composite resin usually lasts 8 years before failure. Studies that used ceramics were focused on the aesthetic interest, the porcelain has the best resistance to damage, moreover it is the best aesthetically.³¹

The studies that used porcelain in the anterior teeth, PFM and gold in the posterior teeth, according to literature, are a fairly optimal option if the cost is not an obstacle.^{12, 14, 17-20}

Maintenance Phase:

The night guard was used in seven studies and was considered a common denominator, to shield teeth that were restored at night from undesirable habits.^{15, 19, 29} The patients were recalled after treatment in six studies with follow-up periods ranging from 6 months to thirty-six months and were considered a common denominator. Without a plan to re-evaluate the patient periodically and provide supportive care, the patient's oral status may be reversed and the disease may recur.^{14, 16, 23}

Conclusions

Within the limits of this review, it can be conclusively concluded that the similar steps within the different treatment stages that have been followed are useful for the dentists in treating such cases, especially as they correspond to the strategies developed by Donovan and Swift.³² The currently accessible evidence advises using DW and CR is recommended for rehabilitation protocol. It is also recommended to test VD with a fixed device and use a temporary phase before final treatment with regular follow-up evaluation. Regarding the materials used in the definitive restorations, the current proofs is not sufficient to draw firm conclusions.

Declaration of Interest

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	Phase description	Asked questions
Treatment phases	History, examination, diagnosis & prognosis	A full evaluation of the patient's health history, examination, investigation, diagnosis, and any essential precaution to be taken before or through dental treatment.
		<ul style="list-style-type: none"> - Was the case generalized dental erosion? - Has the cause of dental erosion been identified? - Was the dietary history checked?
	Acute Phase	Deal with symptomatic problems, which the patient may indicate.
		<ul style="list-style-type: none"> - Did the caries, endodontic, TMD or orofacial pain accompany symptoms of the GERD?
	Control Phase	To control or eliminate infection and active oral disease, and deal with any risk factors that cause or accelerate the oral problems.
		<ul style="list-style-type: none"> - Has a medical consultation been conducted? - Has there been a control or elimination of risk factors and active oral disease?
Re-Evaluation phase	Evaluate the procedures that has been done to the patient and their outcome	
	<ul style="list-style-type: none"> - Were the procedures re-evaluated in the previous phase? 	
Treatment Phase	Restore the patient's oral condition and comprises steps that improve appearance and function.	
	<ul style="list-style-type: none"> - Was the diagnostic waxing used in the planning and treatment? - What was the occlusal position that was used for treatment? - Was the vertical dimension elevated? - What kind of the materials were used for Interim phase? - Was the Crown lengthening preformed? - Was the incisal guidance and/or occlusal plane corrected? - What kind the final restorative materials were used? 	
Maintenance Phase	An extremely personalized plan that attempts to preserve the patient in best oral health.	
	<ul style="list-style-type: none"> - Was the patient given protective splint? - Was follow-up done, and for how long? 	

Table 4. Analysis questions.

Author	ROEKEL ¹²	AZIZ ¹³	HAYASHI ¹⁴	MACHADO ¹⁵	CENGIZ ¹⁶	KOIS ¹⁷	GUO ¹⁸	Metz ¹⁹	CHRONOPOULOS ²⁰		
Year	2003	2005	2007	2007	2009	2009	2011	2015	7017		
Case report	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
examination, diagnosis & prognosis	GDE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	CAUSE	GERD	GERD	Anorexia nervosa	GERD	GERD	GERD	GERD	Barrett's oesophagus	GERD	GERD
	DH	*	Yes	Yes	Yes	Yes	Yes	Yes	*	Yes	*
Acute Phase	CA EN	Yes	Yes	*	Yes	*	Yes	Yes	Yes	Yes	Yes
	TMD OFFP	*	*	*	Yes	*	*	Yes	*	*	Yes
Control Phase	MC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	RF	*	*	Yes	Yes	Yes	Yes	*	Yes	Yes	*
Re-Eval	Length of VDI	*	*	6 M	3 M	3 M	*	*	3 M	4 M	6 M
	DW	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Treatment Phase	TOP	CR	CR	CR	CR	CR	CR	CR	CR	CR	CR
	VDI	Composite	*	Acrylic, metal	Acrylic OS	Acrylic	*	Acrylic	Acrylic	Acrylic	Acrylic
	Interim	Composite	*	Acrylic, metal	Acrylic OS	Acrylic	Acrylic	Acrylic	Acrylic	Acrylic	Acrylic
	CL	Yes	*	*	*	*	Yes	*	*	Yes	*
	IGC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	OPC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Definitive	PFM, Gold	Composite	Ceramic, Gold	Composite	PFM	Ceramic, PM, Gold	Ceramic, Gold	Composite	PFM	Ceramic
	Protective splint	*	Yes	Yes	Yes	Yes	Yes	Yes	*	Yes	Yes
Maintenance Care Phase	Recall every	*	*	3 M	*	*	*	6 M	3 M	6 M	4 M
	Follow up period/M	*	*	12 M	24 M	24 M	*	*	6 M	36 M	24 M

GDE, generalized dental erosion; **GERD**, gastroesophageal reflux disease; **DH**, dietary history; **CA**, caries; **EN**, endodontic; **TMD**, temporomandibular joint pain and dysfunction; **OFFP**, orofacial pain; **MC**, medical consultation; **RF**, risk factors; **DW**, diagnostic waxing; **TOP**, treatment occlusal positioning; **CR**, centric relation; **IVD**, increase vertical dimension; **CL**, Crown lengthening; **IGC**, incisal guidance correction; **OPC**, occlusal plane correction; **PFM**, porcelain fused to metal; **OS**, Occlusal splint; **M**, month. * No result confirmed.

Table 5. Overview of treatment steps.

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