



Defective Dental Restorations: Repair or Replace?

Authors

Pradnya V. Bansode¹, Seema D. Pathak², M. B. Wavdhane³, Hardik Rana⁴
Vaishali U. Bhalerao⁵

Dept. of Conservative Dentistry & Endodontics,
Government Dental College & Hospital, Aurangabad - 431001, Maharashtra, India

Abstract

Dental materials used for direct or indirect restorations of the defects of teeth are placed in the oral environment which constantly undergoes temperature, pH changes, etc. and hosts a variety of microbial flora. Also, these restorative materials have to withstand the constant cyclic occlusal loading when teeth are in function or parafunction. All these may lead to defects in the restoration or their complete failure over time. This article reviews the methods of identifying the defects that are seen in these restorations and criteria applied whether they will require monitoring, refurbishment, repair or replacement.

Keywords: *refurbishment of restoration, repair of restoration, replacement of restoration, amalgam, composite, ceramic, all ceramic, glass ionomer cement.*

Introduction

Replacement of dental restorations still plays a part in routine everyday dental practise. But with the advent of minimum intervention dentistry, the concept of repair of existing restorations is becoming popular. The advantages of repairing an existing restoration are, prevention of undue removal of tooth structure hence leading to less stress on the vital pulp tissue, time saving both for the patient and dentist, no pain as anaesthesia is not required most of the times, cost effective, good acceptance by the patient. Dental amalgam is one of the oldest used dental materials. Though its use has declined over the years, there is still a considerable amount of population having amalgam restorations in their oral cavity. These restorations may show deterioration over the years, and a complete removal for replacement of these also carry with them the disadvantages of being time consuming,

unnecessary removal of healthy tooth tissue, enlarging preparations and restoration sizes^[1, 2], the risk of converting the restoration to an indirect restoration, and the possibility of major injuries in pulp tissues^[3]. There has also been an increased use of dental materials which have proven to be more aesthetic, micromechanically or chemo mechanically bond to the tooth, release fluoride etc. These materials to undergo deterioration in the oral environment and may show localised or complete failure.

Definitions of Procedure

A deteriorating or faulty restoration may need glazing, sealing, refurbishment or repair. But, all these terms were not clearly defined in the literature. Hence, Setcos et al. published four clear structured terms and indications^[4] which were redefined by publishing the FDI criteria^[5,6].

There are in general four options how imperfect restorations can be handled:

1. *No treatment (monitoring)*: if only minor shortcomings, e.g. unfavourable colour/staining or sub-optimal margins are present, with no clinical disadvantages if untreated.
2. *Refurbishment*: can be done if shortcomings are adjustable w/o damage to tooth, e.g. removal of overhangs, recon touring the surface, removal of discoloration, smoothing or glazing of surface including sealing of pores and small gaps, which can be improved without adding new restorative material (except glaze or bonding)
3. *Repair*: is indicated mainly in case of localized shortcomings, which are clinically unsatisfactory and no longer acceptable. Repair is a minimally invasive approach that implies in any case the addition of a restorative material (not only glaze or adhesive), with or without a preparation in the restoration and/or dental hard tissues [6, 7, 8, 9].
4. *Replacement*: is indicated if generalized or severe problems and intervention are necessary, and a repair is not reasonable or feasible. Replacement is the complete removal of the restoration usually combined with more loss of tooth structure.

Assessment of Restorations

A dental restoration that needs to be assessed for any purpose either for its clinical condition or as part of any clinical trial can be graded according to the following criteria given by United Services Public Health Services/Ryge criteria [10].

Clinical characteristics	Alpha	Bravo	Charlie
Marginal adaptation	Explorer does not catch when drawn across the restoration /tooth interface	Explorer falls into crevice when drawn across the restoration /tooth interface	Dentin or base is exposed along the margin
Anatomic form	The general contour of the restoration follows the contour of the	The general contour of the restoration does not follow the	The restoration has an overhang

	tooth	contour of the tooth	
Surface roughness	The surface of the restoration has not any surface defects	The surface of the restoration has minimal surface defects	The surface of the restoration has severe surface defects
Secondary caries	There is no clinical diagnosis of caries	NA	There is clinical diagnosis of caries

After assessment through these criteria, a decision can be made regarding the further treatment of the restoration.

Amalgam Restorations

Dental amalgam has been one of the oldest used restorative materials. Due to its advantageous properties of high compressive strength, self-sealing quality, acceptable aesthetics etc. it has been in use for restoration of most of the defects of the teeth and specially class I & II restorations. Over the years its use has declined because of increased concern of mercury toxicity and the excessive removal of tooth structure to make specific cavity forms to make the restoration retentive. Newer and improved materials like composites are replacing the dental amalgam restorations. But, there is still a considerable amount of population having amalgam restorations in their oral cavity. Hence, when its necessary to analyse the existing restorations the USPHS/Ryge criteria can be applied and the restorations can be further managed accordingly.

- Restorations with clinically diagnosed secondary caries or under contoured anatomical form defects will need repair or replacement of the restoration.
- Restorations with over contoured anatomic form, luster, or roughness defects will require refinishing or no-treatment.
- Restorations with marginal defects will need repair, refinishing, replacement, or no-treatment [3].

Materials used for repair of Amalgam Restorations.

The primary reason for replacement of amalgam restorations are secondary caries and restoration failure. The complete replacement of restoration leads to significant removal of tooth structure and may decrease the longevity of the restoration. Hence, whenever possible, an attempt should be made to repair an existing amalgam restoration and the materials that can be used for repairing are either amalgam itself, resin based composite materials, glass ionomer cements or resin modified glass ionomer cements. The ditched margins are prepared to receive the repair material, and if a resin based composite material has to be used, the conditioning of the prepared tooth has to be done with etch and rinse adhesives, self-etch adhesives or air abrasion. The prepared tooth surface is then restored.^[11]

Resin Based Composite Restorations

The reason for replacing or repairing a composite resin restoration are fracture of the restoration or secondary caries. The vast variation in the chemical composition of the resin based composite materials was earlier a concern regarding the materials used for repair. According to Baur V & Illie N generally advisable but not compulsory to combine identical resin-based composites^[12]. The composite restorations can be repaired by use of either resin based composite or non-methacrylate organic matrix like the silorane based composite^[11]. The methods used for conditioning of the substrate to enhance mechanical retention are roughening the surface with a coarse diamond bur, silicon carbide grinding paper or rotary cutting instrument, air abrasion (Al_2O_3), laser (erbium:yttrium-aluminium-garnet) or etching with hydrofluoric acid.^[13]

After conditioning of the substrate, an appropriate bonding system is used and the restoration is repaired using methacrylate matrix based composite resin material, or non methacrylate based composite resin material.

The silorane-based composite Filtek Silorane has been acknowledged as the repair material with the

highest bond strength value, when used to repair materials of different categories (microhybrid, nanohybrid and packable) with different monomer matrix (methacrylate, ormocer or silorane).^[12]

Glass Ionomer Cement Restorations & Its Modifications

Glass ionomer cement restorations can be repaired by a layer of glass ionomer cement over the existing restoration. Before repair the surface of the existing restoration has to be roughened first and then conditioned with phosphoric acid for 20 seconds. Or the surface can be only conditioned with phosphoric acid.

The repair of Resin modified Glass Ionomer Cement restorations is said to be clinically unpredictable. But whenever required the surface of the existing restoration has to be conditioned with maleic acid and resin restoration done.

For compomers, the technique is conditioning with maleic acid, air abrasion, polyacrylic acid or abrasion. Post conditioning the restoration is repaired with a low viscosity resin composite material.^[13,14,15,16,17,18]

Metal Ceramic & All Ceramic Restorations

The causes for repair or replacement of these restorations are fracture or chipping of the ceramic material or secondary caries.

Heintze and Rousson^[19] have given treatment recommendation for chipped porcelain restorations and Blum et al^[20] has given classification of fractures of the metal ceramic restorations.

The grades and the recommended treatments proposed by Heintze and Rousson for all ceramic restorations are as follows:

Grades	Description	Recommended treatment
Grade 1	Small veneer chippings	Polishing of the existing ceramic restoration
Grade 2	Moderate veneer chippings	Repaired with resin composite material
Grade 3	Severe chippings	Replacement of the entire restoration

The criteria for replacement of the ceramic restorations are proposed by Anusavice KJ^[21]:

1. The fracture surface extends into a functional area and repair is not feasible.
2. Recon touring will result in a significant unacceptable alteration of the anatomic form from the original anatomy.
3. Recon touring will significantly increase the risk of pulptrauma by the generation of heat.
4. Repair with a resin composite will result in aesthetic changes that are unacceptable to the patient.

According to Blum et al the fractures of metal ceramic restorations can be classified as simple and complex. The simple fractures are those that involve only the porcelain and the complex fractures involve the exposure of the metal substructure.

The management of the defective ceramic or all ceramic restorations has to be planned based on the above mentioned recommendations. Several manufacturers provide kits for repair of ceramic restorations. One such example is the Co Jet Repair Kit (chairside silica coating with 30 μ m SiO₂, silanisation and adhesive).^[22]

Conclusion

With the increase in awareness of dental hygiene and treatment of dental diseases the number of restorations placed by a dental practitioner is bound to increase. This will in turn lead to an increase in the defective restorations that the practitioner will have to deal with. Though repair of restorations is being taught in many universities, there are still a considerable amount of dental practitioners and students around the world who are not aware of these alternatives and feel that replacement of the restoration is the only alternative available for a defective or failing restoration, and think that repairing a restoration is a form of a patchwork. It is time that this view be changed and it be reinforced that a complete replacement will cause more damage than good to the tooth. Due consideration should be given to no treatment, refurbishment or repair before completely replacing an existing restoration.

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