



## **A Systematic Review: The Relationship between Fixed Prosthodontics and Dental Sensitivity**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Dental prosthetics that are permanently attached (fixed) to the teeth are called fixed prosthetics. Crowns, bridges (fixed dentures), onlays, inlays, and veneers are also referred to as indirect restorations. Professionals in prosthodontics have trained in this area from academic institutions. With fixed prosthodontics, a single tooth or multiple teeth can be restored over areas where teeth are missing. A common oral health issue is trauma-induced tooth hypersensitivity following preparation of the tooth. Dental hypersensitivity is caused by a sudden onset of sharp pain on contact with exposed dentin, usually in response to heat, evaporation, pressure, or cold and is not attributed to any other dental problem or condition." Despite a lack of literature on the subject, post-cementation sensitivity has not been definitively studied. When dentinal tubules are separated during the preparation of teeth, a certain degree of pulpal trauma will result. An important decision is whether to carry out elective endodontic treatment for the tooth's vital abutments or proceed with the pulp preservation procedure.

**Keywords:** *Fixed prosthodontics; prosthesis; dentin; tooth hyper sensitivity; dental restoration.*

## 1. INTRODUCTION

The specialty of prosthodontics is most commonly associated with replacing missing teeth. There are generally two types of prosthodontics: fixed and removable. Removable prosthodontics applies to treatments involving prosthetic devices that can be removed from the mouth for cleaning and maintenance. Fixed prosthodontics includes all kinds of treatment and procedures in which replacement teeth are permanently installed in the mouth [1].

In the United States, fixed prosthodontics has become a major element of general dentistry. Crowns and fixed prostheses offer predictability and reliability, and most dentists can place them with relative ease. It is often said that a crown or short-span fixed prosthesis will last for many years so that the expense will be worth it [2].

Direct prosthetic restorations offer two major advantages over fixed prosthetic restorations: superior strength and aesthetic appearance when large restorations are used. Besides the amount and type of an appropriate dental restoration material, it is important to consider the extent of destruction of an adjacent tooth, its position and orientation, and which teeth are adjacent to the one being restored.

Generally, dental hypersensitivity is found in canine and premolar teeth, at sites that are susceptible also to gingival recession. Sometimes, dentin can be irritated, but daily activities like drinking iced tea don't cause pain. It is more accurate to refer to dental hypersensitivity as sensitive dentin than dentin sensitivity [3].

Dentine hypersensitivity is subject to debate. In an attempt to explain dentine hypersensitivity, several theories have been proposed, including the "odontoblastic transduction theory", "neural theory", and "hydrodynamic theory". According to Brannstrom, the model most widely accepted is the hydrodynamic or fluid movement theory of [4]. This theory predicts that when the exposed dentine surface is exposed to temperatures, chemicals, tactile or evaporative forces, the flow of fluid within the tubules increases [5].

Preparation of the pulp is associated with pulpal damage depending on the amount of remaining dentin, the density of that dentin, methods used to construct provisional crowns, quality of the adhesives used for temporary and final

cementation and degree of marginal penetration [6]. The number and diameter of exposed and open dentin tubules strongly influence sensitivity. In spite of the fact that dentin hypersensitivity is a common complication in dentistry, it is rarely documented, and few epidemiological data are available [7].

A dentist's role in prosthodontics includes all phases of prosthesis fabrication. As part of this, all phases of preparation, fabrication, insertion, and even follow up are included, despite the fact that manufacturers of the prosthetics may not be able to handle certain phases [8]. It is common for dentists to neglect even the most basic principles of prosthetic construction, such as making a master cast and sending it to a lab for fabrication of removable prostheses without preparing the mouth beforehand or explaining the job to them appropriately [9].

A few studies reported the evidence that some risk factors related to postoperative sensitivity occurs in three stages of the dental prosthesis process; however, those findings do not provide conclusive information regarding its origin or prevention. Therefore, it is suggested that review studies be performed help us to understand the relationship between fixed prosthodontics and dental sensitivity.

## 2. AIM AND OBJECTIVES

The main aim of this study is to review the literature related to the dental sensitivity associated with fixed prosthodontics and understand the relationship between them.

### 2.1 Specific Objectives

1. To study fixed prosthodontics and the different types available.
2. Determining the significance of fixed prosthodontics in treating dental problems.
3. Carrying the online literature review using various databases to learn about dental hypersensitivity.
4. Performing a systematic review of all the articles understanding the relationship between fixed prosthodontics and dental sensitivity.

## 3. METHODOLOGY

An online based web search was made using databases like PubMed, Scopus, Google Scholar, Medline, and Cochrane electronic

databases. A systematic review of literature related to the relationship between fixed prosthodontics and dental sensitivity was carried out in English language. Initially no filters were applied to the search, and all the studies were available for successive screening. On further research, only adult studies and only human studies filters were added. The research was done in a time range of 6 months to study and review all the literature.

### **3.1 Dental Hypersensitivity and Fixed Prosthodontics**

In order to benefit patients, prosthetic treatments must provide comfort, function, and health. It is vital not to damage the periodontal structure. Prior to prosthodontic treatment, it is crucial that the dental tissues are strong and the dental sensitivity treatment may be required [8]. When periodontists and prosthodontists work together, the tooth or teeth that are being repaired can be cleaned in order to ensure that the prosthesis will last for as long as possible. Prosthetic outcomes are also dependent on healthy dentin. Periodontal treatment to reduce sensitivity may be required to promote this process [9].

Sensitivity to fixed dental prosthetics is caused by exposed dentinal tubules after the prosthetic is placed. The permeability of dentin increases with deeper preparations and more exposed surface area [10]. Dental sensitivity has to be prevented by several methods. A technique called "immediate dentin sealing" (IDS) involves applying an adhesive system immediately to the dentin and photo polymerizing it, before an impression is taken. In this way, the dentinal tubules are closed, and bacterial invasions and dentin circulation are stopped, resulting in pain. It has been reported that this procedure decreases infection risk and reduces postoperative sensitivity and adhesion strength [11].

There is evidence that provisionalization increases pulp chamber temperature, which may be the main cause of postoperative sensitivity. It has been demonstrated<sup>24-25</sup> that polymethylmethacrylate (PMMA), polyethylmethacrylate (PEMA), polyvinyl methacrylate (PVMA), and Bisacryl resin cause temperature increases. In research studies, self-curing sets have demonstrated a lower thermal change than dual curing sets and the latter results in a lower temperature rise [12].

A dentin sensitivity is caused by acid etching because it removes the smear layer, which allows bacteria to infiltrate the dentinal tubules. The exposure of collagen by mineralized dentin and resin infiltration can also lead to dentin sensitization. Therefore, self-etching cements should be used in order to avoid removing the smear layer [13]. The pH value affects dental sensitivity as well. In comparison to resin cements, glass ionomers and zinc phosphate have an inverse correlation between pH value and the compound. In Lam and Wilson's findings, the removal of the smear layer can lead to significant increases in pressure transmission to the pulp chamber. Immediate dentin sealing (IDS) is a technique for creating a barrier after adhering the smear layer to the dentin.

The mechanism involved in dentin hypersensitivity is explained by several theories like: Neural theory, Odontoblastic transduction theory, hydrodynamic theory. In accordance with nuclear theory, the connection between pulpal nerve endings and dentine tubules may cause direct stimulation of nerve endings in dentine tubules. A theory related to odontoblast transduction states that odontoblasts function as receptor cells, transmitting synaptic impulses to nerve terminals that produce a sensation of pain due to nerve endings located at the pulpodentine border. The hydrodynamic theory, proposed by Brännström in 1964, is currently accepted as the explanation for dentine hypersensitivity [14]. Theoretically, when the surface of the exposed dentin is exposed to thermal, chemical, tactile or evaporative stimuli, then the flow of fluid within the tubules of the dentine will increase. Fluid movement affects the pressure in dentine tubules, which in turn activates pressure-sensitive nerve receptors. The response of excited pulpal nerves, especially those in the intradentine fibers, will be determined by the intensity of pain stimuli. Exposed dentine in all cases is not sensitive. Dentine Hypersensitivity is the result of lesion localization. Upon the removal of the protective covering of the smear layer, the dentinal tubules become exposed.

The composition of provisional restorations, preparation under high volume spray and tooth reduction were considered to have significant impacts on the incidence of dentin sensitivity. In order to reduce postoperative sensitivity, several methods have been used, including the choice of operative technique and plentiful use of water cooling before and after tooth extraction [12].

In order to achieve optimal seal and adhesion, dentin surfaces must be thoroughly cleaned. Clean and freshly cut dentin is more likely to be susceptible to resin infiltration. Dentin is protected by immediate sealing from contamination caused by bacterial leakage or remnants of expired temporary cements [15]. It is possible to eliminate gap formation and ill-fitting restorations by including the hybrid layer in an impression. A new approach to dentin sealing is called immediate dentin sealing (IDS), in which the dentin is sealed immediately after preparation of the tooth and prior to impression taking. In scanning electron microscopy, the continuity between the hybrid layer and dentin appeared more evident when the dentin was sealed with a dentin bonding agent.

To reduce the risk of vital abutment sensitivity, the exposed dentin can be desensitized with desensitizing agents after tooth preparation and before restoration cemented. Desensitizing agents have been found to reduce dentin sensitivities when they are used on vital abutment teeth to receive full coverage restorations. Desensitizers occlude the dentinal tubules on the surface and under the surface, therefore decreasing pain by counteracting the hydrodynamic mechanism of dentinal hypersensitivity. An important decision is whether to carry out elective endodontic treatment for the tooth's vital abutments to proceed with the pulp preservation procedure. When dentinal tubules are separated during the preparation of teeth, a certain degree of pulpal trauma will result.

#### 4. CONCLUSION

Occasionally, increased sensitivity to hot or cold stimulation can be a perplexing result of a newly cemented crown or fixed partial denture. There is no way to completely avoid sensitivity. Despite a lack of literature on the subject, post-cementation sensitivity has not been definitively studied. Management of post cementation hypersensitivity can be improved by better understanding the causes and precautions.

#### CONSENT

It is not applicable.

#### ETHICAL APPROVAL

This is a systematic review of the relationship between the fixed prosthodontics and dental sensitivity.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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