

Nano-hybrid resin composite as a filling material in tooth-tissue supported overdenture - Case Series

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ARTICLE INFO.

Keywords:

Overdenture, Nano-hybrid resin composite, Amalgam.

Abstract

The idea of tooth tissue supported overdentures is considered as an alternative to extraction of remaining teeth. The difference in clinical outcome between amalgam and nano-hybrid resin composite as filling material for the overdenture abutments, yet has not been emphasized, thus further research is required to confirm the ideal filling material in prepared endodontically treated abutment teeth. This case series debates; functional, esthetic and biological rehabilitation using overdentures supported on abutments restored with nano-hybrid resin composite.

Three patients with few remaining teeth in the mandibular arch were enrolled in the study. Dome shaped preparations of the abutments and restoration with nano-hybrid resin composite was performed, then conventional steps of overdenture fabrication and insertion were accomplished. Patients were followed up for one year.

Functional and esthetic demands were restored successfully, using overdentures supported on abutments restored with nano-hybrid resin composite. Nano - hybrid resin composite can be used successfully as filling material for the overdenture abutments

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1. Introduction

The idea of using complete dentures over retained teeth was first proposed by Miller in 1958¹, but it wasn't until then that it truly caught on as a realistic alternative to extracting the remaining teeth. Since the 1960s, on examination of numerous long-term studies, which has demonstrated advantages of overdentures, including the prevention of increasing residual ridge reduction, improved denture stability, and better load transmission of the prosthesis²⁻⁷. There have also been reports of people experiencing psychological advantages as a result of not feeling toothless. This might play a significant role in upholding a more optimistic self-esteem⁸. According to some research, these people may still have some sensory feedback from the periodontal receptors of the residual roots,

which would give them the ability to discriminate oral textures more precisely than people who wear complete dentures⁹⁻¹¹. The teeth are retained to preserve residual bone around the overdenture abutments, thereby improving denture function¹²⁻¹⁴.

Total extraction now takes a more cautious approach as a result of the expanding emphasis on prevention in prosthodontic practice¹⁵. In contrast to traditional complete dentures, the preservation of natural tooth roots as abutments for complete overdentures is now more widely regarded as a better treatment choice¹⁶. According to studies, the least number of teeth needed for tooth supported overdentures is two abutment teeth¹⁷. Nevertheless, abutment teeth are reduced to a level that is 1-2 mm above the gingival margin as part of the treatment process, and then any caries that is already present is eliminated¹⁸. Cavities are prepared up to a depth of 2 mm while being maintained as tiny as possible¹⁹. The easiest and least expensive technique to make an overdenture is to seal the endodontically treated teeth with a filling material, as amalgam or composite resin. Amalgam, resin composite, and glass ionomer are the proposed restorative materials for sealing the root canal orifices¹⁹.

Special requirements for the restorative material are necessary due to the cariogenic environment that is likely to be present under an overdenture. In this regard, factors like fluoride release and microleakage may have an impact on the longevity of the treatment. Another issue is that patients frequently are not aware of restorative loss or leakage in endodontically treated abutment teeth, which can hasten the teeth's deterioration. According to (Ettinger, 1995) standard glass ionomer cement restorations have a lower survival rate than amalgam and resin composites because of their reduced solubility, which is also the cause for their failure²⁰.

Patients must keep regular recall appointments for maintenance, practice daily hygiene, and apply topical fluoride gel daily. Overdenture patients require regular recalls because they have ongoing maintenance follow ups that necessitate evaluation and long denture serviceability.

Numerous studies have shown that if patients are part of a frequent recall system and given sufficient maintenance instructions, such

abutment teeth can be kept for a long amount of time. However, few studies have documented overdenture-related issues, but even fewer have reported longitudinal data.

No doubt that dental amalgam as a filling material has been characterized by high compressive strength and longevity if put under ideal conditions and following strict oral hygiene instructions²¹. However, the immense difference in the thermal expansion coefficients of the amalgam and tooth structure, dimensional changes during setting, and other considerations hasten the sequelae of microleakage and subsequent tooth loss.

According to a 4-year clinical study (1999), it suggested that there were no statistical differences between the performance and survival rate of amalgam versus resin composite²². Therefore, the aim of this study was to assess nano-hybrid resin composite as filling material in tooth tissue supported overdenture with three different patients.

2. Case description and results

This case series has been described according to the 2013 CARE checklist for case report writing and publishing guidelines²³.

2-1 Patient Information

Three partially edentulous patients were selected from the outpatient clinic, October University for Modern sciences and Arts, patients were seeking the replacement of their missing teeth. Patients had two to three remaining teeth in their mandibular arches. They were medically free. The main complaint was that they couldn't eat properly because they only had a few teeth.

2-2. Clinical assessment

For all cases, firstly, primary impressions were made for upper and lower arches using a stock tray and alginate impression (Cavex, Netherlands) material to obtain a study cast and a diagnostic bite. For case I, clinical examination revealed multiple edentulous spaces, plaque-induced gingivitis, and the presence of plaque and calculus in teeth #11 #21 #34 #32 #42. Gingivitis and grade III mobility were present in teeth #11 #21 #32 #34 #42, with 3 mm clinical attachment loss measured from the cemento-enamel junction to the base of the sulcus, and grade I mobility in teeth #33 #35 #43 with a good periodontal support.

For cases II and III, patients were presented with edentulous maxillary arch and partially edentulous mandibular arch particularly with remaining #33 #43 and #34 #44 respectively beside, good periodontal support and grade I mobility.

2-3. Radiographic assessment

Panoramic radiographs were used to reassess the remaining dentition in terms of the prognosis of remaining teeth in Case I (#11 #21 #35 #34 #33 #32 #42 #43) Fig 1, Case II (#33 #43) and Case III (#34 #44) to reassure the absence of any bony lesions and to assess the bone support of the abutments.



Fig. 1: Panoramic x-ray for case I

2-4. Stage 1 preprosthetic phase

Regarding case I, the first step was the extraction of the last non-restorable teeth (#34 #32 #42). For all cases thereafter, root planning and supra- and subgingival scaling were carried out utilizing an ultrasonic scaler. The second step was to educate patients about the need of maintaining good oral hygiene practices, including cleaning their teeth three times per day. The patient's oral hygiene was then reevaluated after two weeks to make sure they were being followed by the patients.

For all cases, all teeth were cleaned, shaped, and obturated during the patients' first visit. Local anaesthesia was achieved by local infiltration with 4% articaine with 1:100,000 epinephrine (Laboratories Inibsa, Barcelona, Spain. After anaesthesia, an endodontic access cavity was established by using 014 round carbide and Endo Z burs (Dentsplysirona). Canals were prepared using the crowdown technique. A glide path was established with stainless steel hand instruments size #10. Patency was established and verified. The ideal working length was determined using an

electronic apex locator (Dentaport ZX, Morita, Tokyo, Japan) and periapical radiographs. The canals were cleaned and shaped using Pepsi Gold rotary system (PepsiGold,China). The final instrumentation size was determined as three sizes larger than the first file binding at the working length. Master apical files ranged from #25 to #50, depending on both root anatomy and initial diameter of the root canal. Irrigation was always performed with 5.25% NaOCl solution. Obturation using gutta-percha (Aceone-Endo, Aceonedent. Co. Geonggi-Do, Korea). AH Plus was mixed according to the manufacturer's instructions. The master gutta-percha cone was coated with AH Plus. Following core buildup with light cured Nano-filled composite body (3M Filtek Z350, Germany) and universal bonding agent, obturation was carried out utilizing the lateral compaction technique (bisco, USA). Then, by shaping abutment teeth into a dome shape and preparing them 2-3 mm above mucosal tissue with a reduction of 30 degrees from the buccal and 15 degrees from the lingual, a better prognosis and support are obtained (Fig 2, 3 & 4).



Fig 2: Case 1



Fig 3: Case 2



Fig 4: Case 3

2-5. Stage 2 Definitive Prosthetic Phase

For all patients, fabrication of new dentures was employed. With the aid of using medium rubber base impression material (Zhermack SpA, Italy) and a special tray, secondary impressions of the upper and lower arches were taken. Then, occlusal wax rims were used to register the bite, with the vertical dimension and centric relation being recorded. Denture stability, extension, retention, occlusal plane, vertical relation, centric relation, even bearing, speech, and tooth color and shape were assessed during the try-in stage. Heat cured polymethyl methacrylate material (beginor, China) has been used to create the final prosthesis (Fig 5)



Fig 5: Case 1

2-6. Results

All patients were followed up for one year. All cases with the tooth-tissue supported overdenture, were happy to masticate properly once more. Tooth tissue supported overdenture allowed the patient to achieve his functional, biological and aesthetic needs.

In addition to meeting biological and aesthetic requirements, all patients regained their self-confidence and their capacity to smile.

2-7. Patient Perspective

The patients were satisfied from the final result. They have become more able to chew

well, speak and smile with confidence. The only disadvantage was the timeline of the treatment plane.

3. Discussion

Studies proved that tooth tissue supported overdenture is a smart treatment modality, particularly with patients having few remaining teeth in the arch²⁴. Three materials were suggested to deal with sealing the orifice of endo treated teeth, which are glass ionomer, amalgam and resin composite. But no definite guideline is crystally clear reviewed as the ultimate material to implement with sealing endodontically treated orifice together with tooth tissue supported overdenture. There has been a paradigm shift recently towards materials that closely resemble natural teeth in both function and esthetics due to the emergence of biomimetic approach²⁵. In contrast to amalgam restoration, resin composite encourages conservative cavity preparation, hence lowering the risk of creating cracks or fracture related to the restored tooth²⁶.

It must be noted that mechanical resistance and retention forms inside the tooth structure must be included in the design of amalgam cavities. The primary goal is to correctly seal the opening of the endodontically treated tooth. Consequently, this is not immediately accomplished with newly amalgam filled tooth due to the variations in the thermal expansion coefficients of the amalgam and tooth structure, dimensional changes during setting.

Accordingly, the issue of microleakage jeopardizes the amalgam in terms of restoration's durability²⁷. Another issue is that patients frequently do not notice restorative leakage in endodontically treated abutment teeth, which can hasten tooth decay and affect the apical periodontal health after root canal therapy. Coronal seal is crucial to the success of the tooth tissue supported overdenture. Unfortunately, failure to obtain ultimate coronal seal may result in tooth loss and extraction²⁸.

Recent advances in nanotechnology have led to a gross leap in the resin matrix's characteristics as a result of the employment of nanoparticles. Mechanical, physical, and optical qualities were improved using nanoparticles. The compressive strength of resin composite was increased by nanoparticles (ZrO₂, TiO₂, and SiO₂), which in turn made it possible to restore posterior teeth with resin composite²⁹. Thanks to nanoparticles, resin material has owned greater strength, wear resistance, flexural strength, and surface hardness, low abrasion resistance, biocompatibility and desired optical properties. Resin composite is bonded to enamel and dentin surfaces of teeth through micromechanical retention, which aids a biomimetic method for creating conservative cavities, which is bonded to tooth structure³⁰. Moreover, nanofillers have enhanced the resin composite's mechanical qualities in terms of polymerization shrinkage, resulting in minimal or no leakage along the interfaces of tooth and restoration. Resin composite restoration repair is significantly more feasible than amalgam restoration repair. Beside that resin composite, depending on the degree of defectiveness, may not require complete removal of the old composite restoration³¹.

4. Summary and Conclusion

Even with the lack of evidence, this case series represents a stepping-stone and proof of concept that supports the routine clinical use of Nano hybrid resin composite together with tooth tissue supported overdenture treatment modality. Further randomized clinical trials with an increased number of participants and longer follow up -period are still needed to evaluate the different clinical aspects of Nano hybrid resin composite as a filling material implemented within abutment tooth.

Authors' Contributions

DE managed the conceptualization, Methodology, Writing – Original draft, Resources.

HE supervised the endodontic work ,managed the writing

WI managed the writing – review and editing, supervision.

MA managed the application of the materials and wrote the manuscript.

Informed consent

The three patients accepted and signed a written informed consent to this treatment protocol.

Conflict of interest

The authors declare that they hold no competing interests.

Funding

The research study was self- funded by the authors

Acknowledgement

The authors would like to thank **Salma Mustafa** and **Manar Mahmoud** for their participation in the clinical work.

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