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Mode of Failure of All Ceramic Labial Veneer Retained Cantilever Fixed Partial Dental Prosthesis

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ABSTRACT

Anterior single tooth replacement is always a challenging condition for maintaining a minimal tooth reduction while achieving best esthetics and function. Labial veneer resin bonded cantilever bridge can mask discoloration of abutment tooth as well as enhance the esthetics outcome.

This study was designed to compare the failure mode of RBFPD replacing missing maxillary lateral incisor using maxillary canine as abutment and two all ceramic material :lithium disiicate and ultratranslucent zirconia.

introduction

Replacement of single anterior tooth is always a challenging condition especially in case of missing upper lateral incisor. Treatment options vary from orthodontic treatment, single tooth implant supported crown restoration, Resin bonded fixed partial dental prosthesis (RBFPD) or conventional 3 unit fixed dental prosthesis. Deciding which treatment is best for each patient depend on multiple clinical variable. Optimum treatment plan should be chosen according to the situation[1].

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Recently implant is still the treatment of choice when replacing missing single tooth and the surrounding teeth are considered healthy and structurally sound. However, such therapy always includes the need for surgical intervention in order to optimize the soft tissue. Implants replace a single tooth without sacrificing the health of neighboring teeth. However there are also many cases in which implant therapy either is not indicated, for example because of the patients' age or inadequate space between the adjacent teeth/ roots or is simply refused by the patient.

Restoring a missing tooth using a conventional 3-unit fixed dental prosthesis is non-conservative as it leads to loss of up to 73% of sound tooth structure thus increasing the potential for endodontic treatment specifically in young aged patients.

The standards of dentistry are being elevated, with a greater importance being positioned on esthetics in addition to functionality. Minimally invasive dentistry has become an critical component in creating restorations that are functional and have increased longevity especially after the significant developments in adhesive dentistry.

Cantilever all ceramic resin bonded fixed dental prosthesis (RBFDPs) present a minimally invasive, highly esthetic, treatment choice in restoring missing upper lateral; they offer additional advantages such as minimal tooth preparation, low cost, no risk of pulp irritation. Labial veneer retained fixed partial dentures (VRFPD) has been proposed for single tooth replacement with the same criteria of the RBFPDs. They are indicated in cases of single tooth replacement with the need of modification of the shape or masking minimal to moderate discoloration of the adjacent teeth However, due to insufficient studies, it could not be clinically advised.

RBFPDs concept was first introduced in the early 1970s and, in the intervening 40 years, have continued to evolve their design and luting protocols based on advancements in prosthetic materials and adhesive systems.

The concept of bonding a metal retainer to enamel by means of adhesive resin introduced by Rochette.

Livaditis and Thompson subsequently developed a method for etching non perforated , non precious metal alloy retainers that improved the longevity of the resin-metal retainer bond by protecting the resin interface from leakage or abrasion in order to avoid premature failure or unilateral debonding, designs for RBFPDs often promoted mechanical resistance with design elements such as rest seats, channels and/or slots, struts and grooves, Such preparation strategies, however, sac rificed additional tooth structure and often moved the preparation into dentin, making such a restoration significantly more invasive and potentially prone to developing caries if a retainer debonded.

A clinical trial was preformed by Hagiwara showing the use of modified metal ceramic resin-bonded fixed partial denture as a minimal invasive technique of small crescent shape wing other than wider lingual retainer for restoring a missing incisor to eliminate incisal discoloration. After a 3 year follow up, results showed excellent serviceability and no discoloration of the abutment.

The long term clinical survival of resin-bonded fixed dental prosthesis (RBFDPs) between a conventional two retainer design, and a cantilever single retainer design evaluated by Kern in 2005. The RBFPDs were made from the glass-infiltrated alumina ceramic In-Ceram. Designs were studied regarding the function and possible failures. It was concluded that the cantilever all ceramic resin bonded fixed partial denture made of high strength ceramic showed a good alternative to two-retainer RBFPDs in the anterior region.

Sailer evaluated a long term -6 years- clinical study replacing a single missing anterior or posterior tooth using a single-retainer cantilever glass ceramic resin-bonded fixed prosthesis. The study recorded the mode of failure in the form of fracture and/or chipping of the restoration, occlusal wear, marginal adaptation, marginal discoloration, shape, surface texture, and esthetic integrity. It was

concluded that glass-ceramic RBFDPs showed very good survival rate and low complication outcome.

Labial veneer retained fixed dental prosthesis

Several studies confirmed the excellent clinical performance of porcelain veneers which encouraged the fabrication and application of etch-retained porcelain laminate bridges to restore anterior missing teeth .Changing the color, shape, and alignment of the abutment teeth is possible. This provided an advantage over a lingual-retainer all ceramic RBFDP. Moreover, maxillary veneer FDPs would be exposed to less loading than a lingual-retainer FDP.

Replacement of upper lateral incisor using a new design named laminate fixed partial denture (LFPD) where a metal framework bar was used to fabricate a pontic was seated in shallow class III cavities prepared on the abutments after standard laminate preparation done by Pahlevan in 2006. Porcelain laminates was attached to the extension of the pontic bar and the prosthesis was bonded using dual cured resin cement.

The clinical outcome of 35 patients replacing a missing anterior tooth using cantilever veneer-retained fixed partial denture (VRFPDs) fabricated with IPS e-max press evaluated by Sun in 2013. The evaluation included the integrity of the VRFDPs, proximal contacts, occulsal relationships, pulp vitality and tooth mobility. It was concluded that cantilevered IPS e.max Press VRFPDs should be considered a minimal invasive, single tooth restorative treatment in anterior or premolar area.

The use of lithium disilicate glass-ceramic veneer-fixed dental prostheses in replacing congenitally missing maxillary lateral incisors reported by Bissasu and Al-houri in 2014. The clinical case followed up for 18 month and showed no complications.

Material and Methods

In this study twenty single retainer labial veneer resin bonded bridge were fabricated from two different all ceramic material in purpose to replace missing maxillary lateral incisor.

The specimens were divided in to 2 groups, first group fabricated from lithium disilicate and the second one fabricated from Ultra-translucent zirconia

The preparation was done on the labial surface of upper maxillary canine of a typodont model in a window style not covering the insical edge, then impression was taken and poued with epoxy resin material. Cast duplication was done by using silicon mold. Twenty epoxy master dies duplicated for both materials.

Epoxy master cast Prosthesis designing on Exocad program final prosthesis on the cast

Lithium disilicate prosthesis were designed using CAD-CAM , a PMMA blank was milled ,then PMMA pattern was heat pressed to produce lithium disilicate prothesis. Ultra-translucent zirconia prosthesis was designed and milled using CAD-CAM technology .

Then all the specimens were bonded to its corresponding epoxy dies with Panavia F 2.0 dual cure cement. Fracture resistance test were performed to all specimens after aging with thermocycling 1000 cycle (500-550) and 150000 cycles in chewing simulator test. Data

were collected and statically analyzed by t-test and Chi square test.

Results

It was found that e.max group recorded statistically non-significant ($p = 0.4144 > 0.05$) higher mean value (176.21 ± 40.57 N) than Zr group mean value (161.86 ± 36.12 N) as indicated by unpaired t-test.

Column chart comparing fracture resistance

results mean values for both groups after thermo-mechanical aging

Stacked column chart comparing failure mode frequency between both groups

Discussion

The study performed to compare the mode of failure of cantilever Labial veneer retained resin bonded bridge made from two different material, lithium disilicate and ultra-translucent zirconia.

Cantilever resin bonded bridge considered the most conservative bridge design to restore a single missing tooth especially in anterior region which require minimum tooth reduction. Many literatures showed the survival rate of cantilever resin bonded bridge design instate of conventional resin bonded bridge.

Porcelain laminate veneer designed to overcome the esthetic problem , many in vivo and in vitro studies show the high survival rate of it. Therefore , a labial veneer retained resin bonded bridge may be indicated in cases when the abutment need esthetic enhancement.

Result of this study detect that the lithium disilicate recorded a higher mean value (176.21 – 40.57 N) than the Ultra-translucent zirconia (161.86 – 36.12 N). the difference between them was statistically non-significant as indicated by unpaired t-test.this may be due to the higher bonding strength of lithium disiicate ater prpoer bonding protocot to the substrate.

Conclusion

no sinificance difference in both material , however the lithium disilicate presented with higher fracture resistance as it has better bonding strenth than zirconia.

References

(Endnotes)

1 Kern M. **Clinical Long-term Survival of two-retainer all-ceramic resin-bonded fixed partial dentures**. Quintessence Int 2005;36:141-147

Sailer I, Bonani T, Brodbeck U, Hammerle C. **Retrospective Clinical Study of single retainer cantilever anterior and posterior glass-ceramic resin-bonded fixed dental prostheses at a mean follow-up 6 years**. Int J Prothodont 26:443-45

Bissasu S, Al-houri N.**Replacement of missing lateral incisors with lithium disilicate glass-ceramic veneer-fixed dental prostheses**: a clinical report.Clinical Case Reports 2(4): 128–132.(2014)

Pahlevan A. **A New Design for Anterior Laminate Fixed-Partial dentures**; PTU Type I. Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran 3:1(2006)

Pahlevan A. **A New Design for Anterior Laminate Fixed-Partial dentures; PTU Type I.** Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran 3:1(2006)

Sun Q, Chen L, Tian L, Baohua. **Single-tooth Replacement in the Anterior Arch by the Means of a Cantilevered IPS e.max Press Veneer-Retained Fixed Partial Denture: Case Series of 35 Patients.** Int J prothodont 26:181-187.(2013)

Bissasu S, Al-houri N.**Replacement of missing lateral incisors with lithium disilicate glass-ceramic veneer-fixed dental prostheses: a clinical report.**Clinical Case Reports 2(4): 128–132.(2014).