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Research Article

Influence of Two Ceramic Systems on Acetal Resin Clasp Retention

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Abstract

The aim of the present study was to\assess the effect of full contour zirconia and PMF on the retention of Acetal Resin Maxillary class I Kennedy classification is composed of two typical educational acrylic resin models, with residual teeth stretching from the right first premolar to the left first premolar teeth. Porcelain fused to metal and full zirconia crowns, proximal guiding planes, and buccal undercuts of 0.50 mm were placed on both first premolar teeth of each cast. Based on the type of crown used, the casts were split into 2 groups. Each acrylic cast was reproduced to make refractory casts. The acetal resin samples were prepared according to the manufacturer's specifications. A wax pattern tegingue was utilized to fuse porcelain to metal, and a CADCAM machine was used to create a full zirconia crown. Buccal undercuts of approximately 0.50 mm and proximal guiding planes Based on the type of crown utilized, the casts were split into two groups. To manufacture refractory castes, each acrylic cast was replicated. The acetal resin samples were prepared according to the manufacturer's specifications. Each clasp and its model were tested using universal test equipment. The clasp's retention force was tested using a universal testing machine running at 5 mm/min and recorded by computer software. With an acetal resin clasp, both types of ceramic systems have retentive forces. The amount of retention was unaffected by any form of ceramic.

Keywords: Ceramic; Acetal Resin; Retention

Introduction

The rising popularity of all-ceramic materials as a replacement for metal-ceramic restorations is due to their greater esthetics, with dental ceramics offering the most natural-looking replacement material for missing tooth substance.. They are available in a range of shades and translucencies to achieve life like appearance. Chemical stability and biocompatibility [1]. All-ceramic restorations' surfaces do not release potentially dangerous materials, and they limit the likelihood of surface roughening and bacterial adherence to ensure great biocompatibility over time [2].

However, dental ceramics are inherently susceptible to fatigue and subsequent premature failure, especially when they are in moist environments, under high forces, and repetitive stresses during the chewing cycle. Clinically the fracture resistance of the ceramic may decrease and the restoration can fracture under normal loads. The performance of all ceramic systems remains less stable than that of metal-ceramic systems [3].

The best mechanical qualities have so far been found in zirconia. The positive outcomes of orthopedic operations inspired dental

professionals to use zirconia as a support material for cosmetic restorations and oral implants However, there were concerns about the correct interaction between the zirconia substrate and the cosmetic veneering porcelain, as well as long-term performance of veneered zirconia crowns and bridges [4]. As a result of its high flexural strength (1,000+ MPa), tooth color, little wear on opposing teeth, conservative tooth preparation, and potential for long-term clinical durability, newly designed full-contour zirconia crowns have been popular in recent years [5].

Materials and Methods

This *in vitro* study was done on an two standard educational acrylic resin models represents maxillary class I Kennedy classification with remaining teeth extending from right first premolar to left first premolar teeth.

Both first premolar teeth of each cast were prepared to receive porcelain fused to metal and full zirconia crowns, proximal guiding planes, and buccal undercuts at 0.50 mm.

The casts were separated into two groups based on the type of crown employed. Each acrylic cast was duplicated to make refractory castes.

The acetal resin samples were made according to the manufacturer's instructions (Thermoflex Acetal Resin Densply UK). The clasp's wax pattern was flasked with Class IV type plaster in a special aluminum flask (Thermopress flask, bredent GmbH, Germany) (Marble Stone, Pressing Dental San Marino, and Italy). The mold was injected with heated softened acetal resin, which was then cured at 215C0 for 25 minutes with a 4 bar injection pressure. After drying, the samples were deflasked, polished with thermal resin finishing burs (Abraso-Star K 50, Bredent GmbH, Germany) and pumice at low speed, and then buffed with a swans down mop for a fine shine.

The porcelain fused to metal made by wax pattern tegingue, and full zirconia crown made by CADCAM machine.

Testing conditions

A Universal testing machine (Instron® 3345, InstronCo. Ltd, Norwood, MA) was used to test each clasp and its model. This equipment was used to measure the retention of each clasp at pre-test (Baseline) by withdrawing force at a rate of 5 mm/min.

ROBOTA chewing simulator integrated with thermo-cyclic protocol driven on servo-motor (Model ACH-09075DC-T, AD-TECH TECHNOLOGY CO., LTD., GERMANY) was utilized to perform the fatigue test by removal and insertion cycling, as illustrated in figure (2). The machine simulates the placement and removal of a PRDP by allowing the clasp to be placed to its specified terminal position and then removed from the abutment crown. The chewing simulator was used to test the models with crowns. Each clasp specimen was then placed on the appropriate abutment crown and secured to the machine's upper section with a vertical rod. The temperature of the test was kept at ambient temperature (25 2 C).and wet condition. To replicate the fatigue resistance test, clasps were removed and inserted for 360, 730, 1080, 1440, 2116, and 2880 cycles (equivalent to 3,6,9, 12, 18, and 24 months of simulated clinical use of an RPD) [12]. At 360, 730, 1080, 1440, 2116, and 2880 cycles, the clasp's retention force was tested using a Universal testing machine running at 5 mm/min and recorded by computer software (Bluehill, Instron instruments).

Statistical analyses

The two group were subjected to analysis using one –way ANOVA and Mann-Whitney testes.

Discussion

Dental ceramics are appreciated as highly esthetic restorative materials with optimal esthetic properties that better simulate the appearance of the natural dentition. Translucence, fluorescence, chemical stability, biocompatibility, high compressive strength, and a coefficient of thermal expansion akin to tooth structure are all desirable characteristics [6]. One of the most critical elements determining the clinical success of removable partial dentures (RPDs) is adequate retention.

Many research have looked into how clasp design affects retention force [7,10]. Clasp components are inserted into undercuts on abutment teeth to keep RPDs in place. When a natural undercut cannot be seen with a surveyor, it can be intentionally made using crowns, a class V repair, enamel recontouring (dimpling or changing the height of the contour), or composite resin recontouring.

The conservative partial-coverage porcelain laminate offers an undercut for RPDs that is both aesthetically beautiful and minimally intrusive [11-14]. Some authors [15]. used a cast gold crown to fit the RPD clasp, while others [16] fabricated a ceramic-metal crown to fit the RPD direct retainer.

	PMF				Full contour zirconia			
ACETAL RESIN	MEAN	SD	Min	Max	Mean	Sd	Min	Max
ACETAL RESIN	4.15	1.35	1.44	7.30	4.17	1.30	1.47	7.45

Table: Retention force results.

Acetal resin is formed by the polymerization of formaldehyde and is a thermoplastic technopolymer with a monomer-free crystalline structure. Which of the following has a high proportional limit and little viscous flow (allowing it to behave elastically over a large enough range to be employed as a clasp construction material)? [17]. Acetal resin also has a lower modulus of elasticity (2.9 to 3.5 kN/mm2) than Cobalt-Chromium alloys (Elastic modulus: 22.43 kN/mm2), permitting it to be used in bigger retentive undercuts [18]. This may be advantageous in clinical situations in which aesthetics and/or periodontal health are priorities [19].

In comparison to traditional Cr-Co alloys, thermoplastic resins have a lower modulus of elasticity, allowing for more flexibility [20]. The gradual deterioration of mechanical properties over repeated loads is a significant factor to consider when selecting materials. Although, clasp fatigue is based on recurrent deflection by repeatedly inserting and removing the prostheses [21].

Conclusions

Within the limitations of this *in vitro* study, the following conclusions can be drawn:

- Both types of ceramic system have retentive forces with acetal resin clasp.
- The amount of retention was unaffected by either form of ceramic.
- Need more study TO detect effect of actal resin clasp on surface of zirconia by time?

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