Effect of degree of Taper and Type of Cement on the Marginal Fit and Fracture Resistance of Two All-Ceramic Crowns

Thesis

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By

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بسم الله الرحمن الرحيم

(ويسألونك عن الروح قل الروح من

أمر ربى وماأوتيتم من العلم ألا قليلا)

صدق الله العظيم

سورة الأسراء(ألايه ٨٤-٨٥)

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Dedication

This work is dedicated to

My Family, for their great care, support and guidance all the way in my life.

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Due to the increasing interest in esthetics and the high concerns about the toxic and allergic reactions to certain alloys, patients and dentists have been looking for metal-free tooth colored restorations. For years, the traditional porcelain jacket crown provided dentistry with the (ultimate) esthetic dental restorations. This full-crown restorative material failed unfortunately to maintain its appeal mainly because of the lack of resistance to fracture. Despite that, dental ceramics are known for their natural appearance and their durable chemical and optical properties. The main advantages of porcelain responsible for its wide acceptance are its excellent esthetics properties, durability, and biocompatibility. Porcelain jacket crowns were limited to anterior teeth because of its low tensile strength due to presence of flaws.

The replacement of traditional metal-based fixed partial dentures (FPDs) with all-ceramic crowns and bridges has been driven by the improved esthetics and excellent tissue compatibility achieved using tooth-colored, metal-free systems.

Dental clinicians have remained suspicious about the structural longevity, potential abrasiveness and accuracy of fit of ceramic restoration. These concerns have directly influenced the development of new materials and laboratory processing systems. The recently introduced ceramic materials were claimed to possess high strength properties thus allowing the fabrication of anterior and posterior all ceramic crowns.

Introduction

Review of literature

Historical prospective

Approximately in 1774, a Parisian dentist **Nicholas Dubois de chemant,** made the first successful porcelain dentures at the Guerhard porcelain factory, replacing the stained ivory prosthesis of Duchateau. Dubois de chemant continually improved porcelain formulations, which were awarded both French and British patents, and fabricated porcelain dentures as part of his practice. In 1808, individually formed porcelain teeth that **G. Fonzi** intrduced in Paris contained embedded platinum pins. **Fonzi** called these teeth "terro-metallic incorruptibles" and their esthetic and mechanical properties provided a major advance in prosthetic dentistry. [1]

Improvements in translucency and color of dental porcelain were realized through the development that ranged from the formulations of **Elias Wildman** in 1838 to the vacum firing in 1949. Glass inlays were introduced by **Herbst** in 1882 with crushed glass frit fired in molds made of plaster and asbestos. [1, 2]

Feldspathic dental porcelain was adopted from European triaxial whiteware formulation (clay-quartz-feldspare), nearly coincident with their development. After decades of effort, Europeans mastered the manufacture of fine translucent porcelains, comparable to porcelains of the Chinese, by the 1720's. The use of feldspar to replace lime (calcium oxide) as flux, and high firing temperature were both critical developments in fine European porcelain(1)

A noteworthy development occurred in the 1950’s with the addition of leucite to porcelain formulations that elevated the coefficient of thermal expansion to allow their fusion to certain gold alloys to form complete crowns and fixed partial dentures. Refinements in metal-ceramic systems dominated dental ceramics research that resulted in improved alloys, porcelain- metal bonding and porcelains. The introduction of shrink free all-ceramic crown system(Cerestore, Coors Biomedical, Lakewood,Colo) and a castable glass ceramic crown system(Dicor, Dentsply/York Division, York, Penn) in the 1980s provided additional flexibility for achieving esthetic results, introduced advanced ceramics with the innovative processing methods, and stimulated a renewed interest in all-ceramic prostheses.[1,2]

A high-alumina ceramic for the fabrication of FPD pontic structures was first introduced by **McLean** in 1967. He introduced in 1982, the platinum-bonded alumina FPD to reduce the problem of fracture through the connector area while eliminating the traditional cast-metal framework.[3] However, this restorative option was not feasible due to a high rate of failure at the connector sites.

The Procera All Ceram Bridges system (Nobel Biocare,Goteborg, Sweden) uses a densely sintered high-purity aluminum-oxide framework. The framework is waxed-up as two single copings on the abutment teeth and a central pontic, which are then scanned and milled individually then fused together with a special veneering ceramics at the connector. The transverse flextural strength of the framework material ranges between 500 and 650 MPa with minimal critical connectors dimentions of 3 mm occluso-gingivally with surface area of 6 mm2. [4- 7]

Continous developments in dental ceramics have led to the introduction of new systems for all-ceramic FPDs. In 1988 the In Ceram alumina system (Vita Zahnfabric, Bad Sackingen, Germany) which uses high temperature, sintered-alumina glass-infiltrated copings, was introduced for the fabrication of three unit anterior FPDs with transverse flexural strength of about 446 MPa and minimal critical connectors dimensions of 4mm occluso-gingivally and 3mm bucco-lingually. [8- 11]

IPS Empress (Ivoclar Vivadent)

Is a leucite-reinforced glass ceramic core material. The framework can be fabricated either with the lost wax and heat-