THE UNIVERSITY OF ADELAIDE

# THE INFLUENCE OF COMPRESSIVE CYCLIC LOADING ON THE RETENTION OF CAST CROWN COPINGS CEMENTED TO IMPLANT ABUTMENTS

**A thesis submitted in partial fulfillment for the Degree of Doctor of Clinical Dentistry (Prosthodontics)**


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# LAYOUT OF THIS THESIS

This thesis is presented in two sections:

**Section 1:** Thesis as detailed in Contents

**Section 2:** Article submitted and accepted for publication in the Australian Dental Journal 2008; 53(4)

# SECTION 1

# CONTENTS

# STATEMENT

This thesis is submitted in partial fulfillment for the requirements for the Degree of Doctor of Clinical Dentistry (Prosthodontics) at the University of Adelaide. This work contains no material that has been accepted for the award of any other degree or diploma in any university or other tertiary institution, and to the best of my knowledge and belief contains no material previously published or written by another person, except where due reference is made in the text of the report.

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James Dudley

September 2008

# Summary


## *Background*

The cementation of crowns to dental implant abutments is an accepted form of crown retention that requires consideration of the properties of available cements within the applied clinical context. Most current dental cements were developed primarily for use with natural tooth crowns, but must act in a different manner with implant components. Cements are exposed to a number of stressors that may reduce crown retention in vivo, not the least of which is occlusal loading. This study investigated the influence of compressive cyclic loading on the physical retention of cast crown copings cemented to implant abutments.

## *Method*

Cast crown copings were cemented to Straumann synOcta titanium implant abutments with three different readily used and available cements. Specimens were placed in a humidifier, thermocycled and subjected to one of four quantities of compressive cyclic loading. The uniaxial tensile force required to remove the cast crown copings was then recorded.  Data analysis was conducted using two-way ANOVA and paired post tests.

## *Results*

Statistical analysis arising from post tests following two-way ANOVA testing revealed the mean retention values for crown copings cemented with Panavia-F cement (5.103, 2.681, 3.178, 2.986MPa) were statistically significantly greater than both KetacCem (0.646, 0.701, 1.083, 0.914MPa) and TempBond non–eugenol (0.074, 0.181, 0.190, 0.303MPa) cements at each compressive cyclic loading quantity. KetacCem and TempBond non–eugenol cements produced relatively low mean retention values that were not statistically significantly different at each quantity of compressive cyclic loading. Compressive cyclic loading had a statistically significant effect on Panavia-F specimens alone, but increased loading quantities produced no further statistically significant difference in mean retention. Compressive cyclic loading had no overriding statistically significant effect on the retention of all specimens as a population.

## *Conclusions*

Within the limitations of the current in vitro conditions employed in this study, the retention of cast crown copings cemented to Straumann synOcta implant abutments with Panavia-F, KetacCem, and TempBond non-eugenol was significantly affected by cement type but not compressive cyclic loading. Panavia-F is the cement of choice for the definitive non-retrievable cementation of cast crown copings to Straumann synOcta implant abutments out of the three cements tested. The implications of these results relate to the choice of cement to provide the desired crown coping retention.

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# Abbreviations

Ave – average

CAD-CAM – computer-aided design / computer-aided manufacture

CTE – coefficient of thermal expansion

Hz - Hertz

IRM – Intermediate restorative material

ISO – International Organization for Standardization

kg – kilogram

MDP - 10-methacryloyloxydecyl dihydrogen phosphate

mm - millimetre

MPa – MegaPascals

N – Newtons

no. – number

SA – surface area

SD – standard deviation

SEM – Scanning Electron Microscopy

TempBond NE – TempBond non-eugenol

VBATDT - 6-[N-(4-vinylbenzyl)propylamino]-1,3,5-triazine 2,4-dithione

# SECTION 2

**Article submitted and accepted for publication in the**

**Australian Dental Journal 2008; 53(4)**