THE INFLUENCE OF ORTHODONTIC BRACKET BASE DIAMETER AND MESH SIZE ON BOND STRENGTH

By:

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DECLARATION

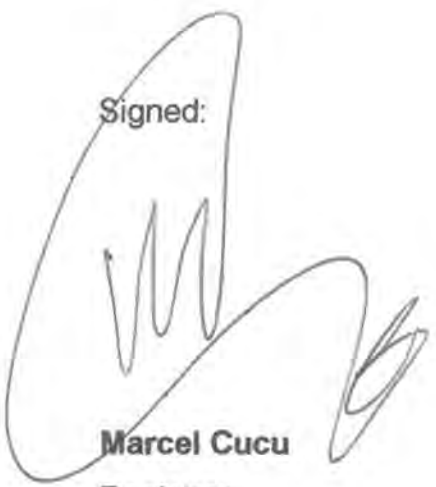
STATEMENT BY THE CANDIDATE

I, Marcel Cucu, hereby declare that the work on which this dissertation is based, is my own work and has not been presented for any other or similar degree at another university.

The work reported in the dissertation was performed in the Department of Orthodontics, Faculty of Dentistry, University of Pretoria, Pretoria, Republic of South Africa.

All opinions or statements expressed in this dissertation do not necessarily reflect that of the University of Pretoria, the supervisor of the dissertation or the external examiners.

Signed:



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SUMMARY

The directly bonded bracket is the most widely used orthodontic appliance. Previous studies have shown that the size of the foil mesh and surface area of the bracket base has a correlation with bond strength. The purpose of this study was to investigate the *in vitro* shear bond strength (SBS) of orthodontic brackets with 80 and 100 gauge mesh bases as well as mini and standard size bases.

Eighty discarded human premolar teeth were randomly allocated into four groups of 20 teeth each. Premolar brackets (*Ormco Corp., Glendora, California, USA and A Company, Amersfort, the Netherlands*) of different mesh and bracket base area sizes were allocated to each of the four groups. Prior to bonding with a conventional 'two paste' orthodontic bonding agent (*Concise, 3M Corp., Dental Products Division, St. Paul, Minnesota, USA*), the enamel surface was etched with 37% phosphoric acid for 60 seconds, rinsed and dried. The SBS was determined using the Bencor Multi-T testing device (*Danville Engineering Inc., San Ramon, California, USA*) in a Zwick (*Zwick GmbH & Co, Ulm, Germany*) Universal Testing Machine with a load cell of 10kN and a cross-head speed of 0.5 mm/min. The bond failure sites were assessed visually under a light-optical microscope (*Nikon SM2-10, Tokyo, Japan*) as well as in the scanning electron microscope (*JEOL, JSM 840, Tokyo, Japan*). A one way ANOVA and an unpaired t-test were used to determine if the differences were significant at the 0.05 level.

The mean SBS were 9.97±2.94MPa and 10.72±2.54MPa for 80 gauge mini and standard size respectively, and 10.45±3.27MPa and 11.39±3.32MPa for 100 gauge mini and standard size.

The findings revealed that the SBS of the 80 gauge mini and standard size brackets were not significantly different ($p<0.05$) than for the 100 gauge mini and standard size brackets. There was also no significant difference ($p<0.05$) between brackets with the same surface area size, but of a different gauge

mesh size. Bond failure occurred in all groups primarily at the bracket/adhesive interface. There was no statistically significant difference ($p<1.00$) at failure sites between the four groups when employing the Kruskal-Wallis test.

OPSOMMING

Aanhegtings wat direk op die tande geplaas word is die mees algemene ortodontiese apparate in gebruik. Vorige studies het getoon dat die grootte van die bladmetaal maas en oppervlakte van die basis van die aanhegting korrelasies toon met bindsterkte. Die doel van hierdie studie was om die *in vitro* skeurbindsterkte (SBS) van ortodontiese aanhegtings met onderskeidelik 80 en 100 fynheidsgraad maas basisse, sowel as mini en standaard grootte basisse, te ondersoek.

Tagtig menslike premolaar tande is lukraak in vier groepe van 20 elk verdeel. Aanhegtings met verskillende maas en aanhegting basis groottes is aan elk van die 4 groepe toegesê.

Voor bondering van die aanhegtings met 'n konvensionele "twee-pasta" ortodontiese bindingshars (*Concise, 3M Corp., Dental Products Division, St. Paul, Minnesota, VSA*) is die glasuur oppervlak geëts met 37% fosforsuur vir 60 sekondes, afgespoel en drooggeblaas.

Die Bencor Multi-T toestel (*Danville Engineering Inc., San Ramon, Kalifornië, VSA*) in 'n Zwick (*Zwick GmbH & Co, Ulm, Duitsland*) toets-apparaat met 'n lading van 10kN en 'n breekspoed van 0.5mm/min is gebruik om die SBS te bepaal. Beide die glasuur oppervlak en die basis van die aanhegtings is hierna onder die lig-optiese mikroskoop (*Nikon SM2-10, Tokyo, Japan*) en die skandeer elektron mikroskoop (*JEOL, JSM 840, Tokyo, Japan*) geëvalueer. 'n ANOVA en ongepaarde t-toets is gebruik om te bepaal of die verskille beduidend is op die 0.05 vlak.

Die gemiddelde SBS was 9.97±2.94MPa en 10.72±2.52MPa vir 80 fynheidsgraad mini en standaard grootte onderskeidelik, en 10.45±3.27MPa en 11.39±3.32MPa vir 100 fynheidsgraad mini en standaard groottes.

Die bevindings het getoon dat die SBS van die 80 fynheidsgraad mini en standaard grootte aanhegtings nie beduidend verskil ($p<0.05$) van die 100 fynheidsgraad mini en standaard grootte aanhegtings. Verder is ook gevind dat daar geen beduidende verskil ($p<0.05$) was tussen aanhegtings met dieselfde grootte basis oppervlakte maar verskillende groottes van die maas fynheidsgraad.

Bindingsfraktuur het in al vier die groepe primêr tussen die aanhegting en bindingshars plaasgevind. Kruskal-Wallis ontleding het verder bevestig dat daar geen statisties-betekenisvolle ($p<1.00$) verskil bestaan tussen die areas van debondering van die vier groepe nie.

DEDICATION

To my wonderful parents Magdalena and Vasile,
who gave me an excess of love,
high morals and guidance in every way.
My lovely, supportive sister Beatrice,
who has always believed in me,
and "knew" why I had to come to South Africa.
And most of all,
I dedicate this to my fantastic wife Leoné,
who constantly supported me with her smile and never-ending love,
thus showing me
to work, love and live
in the glory of GOD.

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" All for one and one for all! "

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