Cad/Cam Conic Crowns To Obtain A Predictable Retention In Implant Prosthesis: An In Vitro Study

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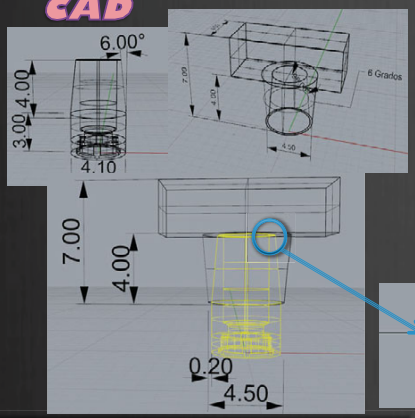
Aims

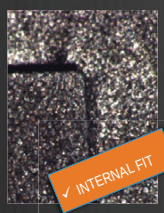
- ✓ Compare the retention strength of conic crowns CAD/CAM-designed and fabricated in fixed implant-supported prosthesis, depending on their cone angle.
- ✓ Build models to predict retention from cone angle and vice-versa in such crowns and initiate a line of research on implant-supported conic crown systems.

Material and methods

CAD



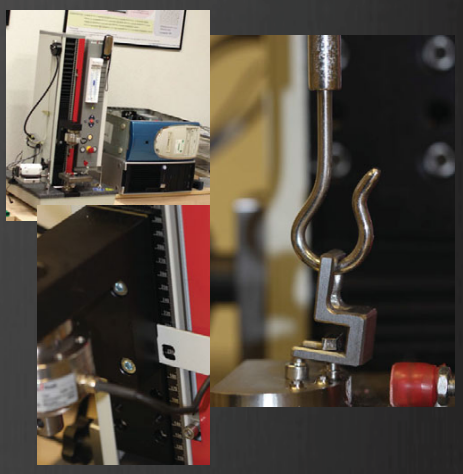
- ✓ Design with Rhinoceros v. 5.0 (McNeel & Associates, EE.UU.).
- ✓ *8 equal samples with the only difference of cone angle (1º-8º).*
- ✓ Intimate contact between surfaces.



CAM

- ✓ Milling strategy with CAM Sum3D v. 2013.
- ✓ Titanium type V block (Zenotec Ti Disc, Wieland Dental, Alemania).
- ✓ Milling machine C20U (Hermle, Alemania).
- ✓ 5 specimens per cone angle. Total 40 especimens.

MEASUREMENTS

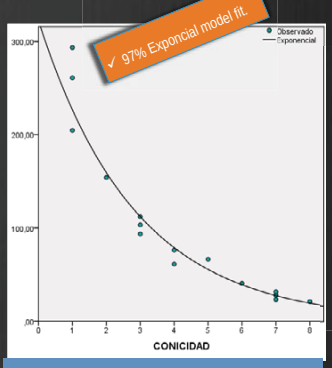


- ✓ Static testing machine Zwick/Roell BT1-FR2.5TS.D14 (nº serie 179392).
- ✓ *Tensile test. Measuring time of breaking matches with the separation of anchoring elements.*
- ✓ Preload 0,5N; Speed 1mm/min.
- ✓ 5 measurements in Newtons per specimen. Total 200.

Results

CONE ANGLE	RETENTION FORCE (N)		
8º	21,02		
7º	23,16	28,00	31,40
6º	40,46		
5º	66,36		
4º	61,23	76,12	
3º	93,44	103,21	112,04
2º	154,20		
1º	204,47	261,00	293,40

RETENTION FORCE/ CONE ANGLE



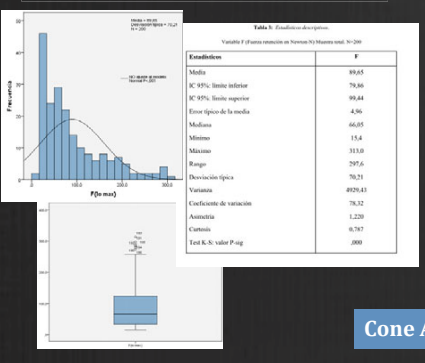
RETENTION FROM ANGLE

F = 322,235 X $e^{0,352 x Cone Angle}$

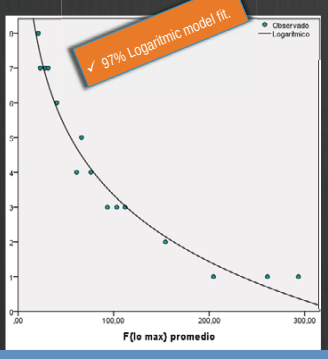
STATISTICAL ANALYSIS

- ✓ Exploratory and descriptive analysis of quantitative variables with classic test of goodness of fit to the normal Gaussian model (Kolgomorov-Smirnov and Shapiro-Wilk).
- ✓ Box plots for the detection of outliers.
- ✓ Significance tests of mean difference.
- ✓ Anova test of multiple contrasts with a posteriori Tukey.
- ✓ Estimation of predictive regression models, estimating parameters, and goodness of fit R2.

- ✓ Categorical variable with 5 levels (specimen number).
- ✓ 2 quantitatives variables:
  - ✓ Dependent: Holding Force.
  - ✓ Independent: Angle cone.



ANGLE FROM RETENTION



Cone Angle = 9,455 – 0,098 x F + 0,0004 x F – 5,4 x 10^{-7} x F

Conclusions

On the grounds of the present findings, and given the limitations inherent in the present in vitro study, the conclusions drawn were as follows: in conic crowns CAD/CAM-designed and manufactured in fixed implant-supported prostheses, the smaller the cone angle, the higher the retention strength; predictive models can be developed to obtain cone angle from retention strength and vice-versa; and lastly, this study initiates a promising line of research on implant-supported conic crown systems.