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Research Article

Statistical Analysis of Bond Strength Evaluation of the Cementation of IPS Empress II (e max) with Tooth Dentine

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Abstract

The evaluation of the bond strength of the cementation of IPS Empress II (e-max) with tooth dentine of real extracted teeth using modern resin cements with light curing polymerization in addition with chemical polymerization, wherever we could have a combination of polymerization characteristics, is the cause of this research. For that cause we used the all-ceramic system IPS Empress II (e-max), generally used nowadays for veneers, inlays, on-lays and full ceramic crowns and bridges, which is one of the best all-ceramic system worldwide, well known for its fine microstructure and stable chemical behavior and stability in clinical dentistry.

Keywords: *IPS Empress II (e-max); Bond Strength; Tooth Dentine*

Introduction

Surface treatment of ceramic part and dentine strongly influence the cementation of these parts in clinic dentistry. The bond strength of the cementation is highly related with the surface treatment. The statistical analysis of the parameters that characterize the bond strength of every protocol such as the deformation of the bond, the tensile forces that we have used and the time that passes up to the breaking point of the bond are the subject of this research just to reveal the mathematical correlation among them in a "powerful" way.

Materials and Methods

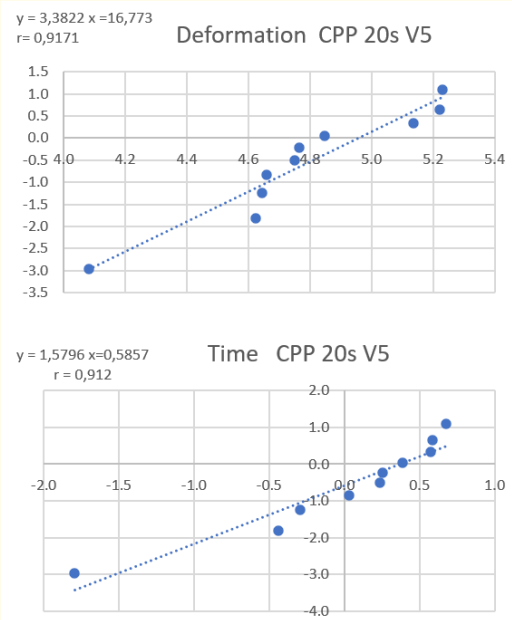
Using a tensile forces device to calculate the bond strength of the cemented IPS Empress II (e-max) specimens with tooth dentine, we actually found how the tensile forces react to the bond strength thru time and how they affect to the deformation of the cementation under the same parameters before the cracking point of the bond. We resolute the behavior of the bond thru tensile forces for four cementation protocols using one silane agent, Ceramic Primer Plus (Kuraray, Japan), hereafter called as CCP and two resin cements, Panavia V5 (Kuraray, Japan) hereafter called as V5, Panavia F 2.0 (Kuraray, Japan) hereafter called as F2.0, as a third cementation factor we used HFO Enamel Plus flow resin (Micerium, Italy) with the additional use of Optibond FL primer/adhesive system (Kerr, Germany), hereafter called as HFO. The exact protocols we followed are:

1. 30s HF acid, Ceramic Primer Plus 20s cemented with Panavia V5
2. 30s HF acid, Ceramic Primer Plus 20s cemented with Panavia F 2.0
3. 30s HF acid, Ceramic Primer Plus 20s cemented with HFO Enamel Plus/ Optibond FL
4. 30s HF acid, Ceramic Primer Plus 20s cemented with Panavia V5/No primer treatment of dentine.

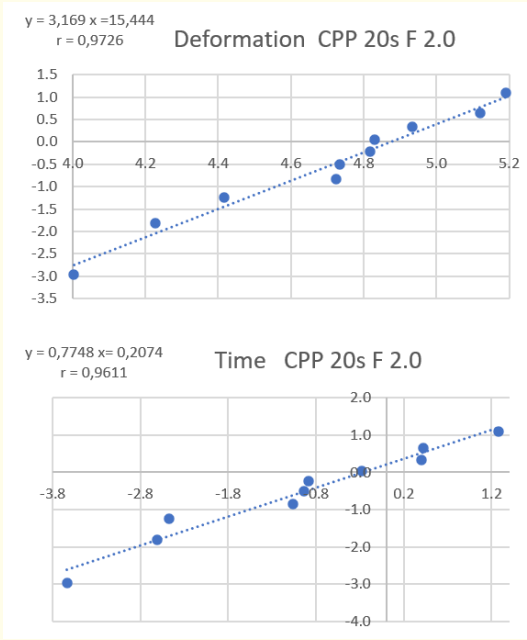
We cemented thirty-eight IPS Empress II (e-max) specimens with tooth dentine of natural 3rd molars and put them under tensile force vertically to the base level of the bond with steady raise of the force thru time, until the breaking point of the bond. Actually, thirty-six of the specimens achieved to accomplish the cementation process of all protocols and two collapsed before that. Each cementation protocol separately and specifically scored as named bellow:

1. 10 specimens to 10 for Ceramic Primer Plus/Panavia V5
2. 10 specimens to 10 for Ceramic Primer Plus/Panavia F 2.0
3. 9 specimens to 10 for Ceramic Primer Plus/HFO Enamel Plus
4. 7 specimens to 8 for Ceramic Primer Plus/Panavia V5/No dentine primer.

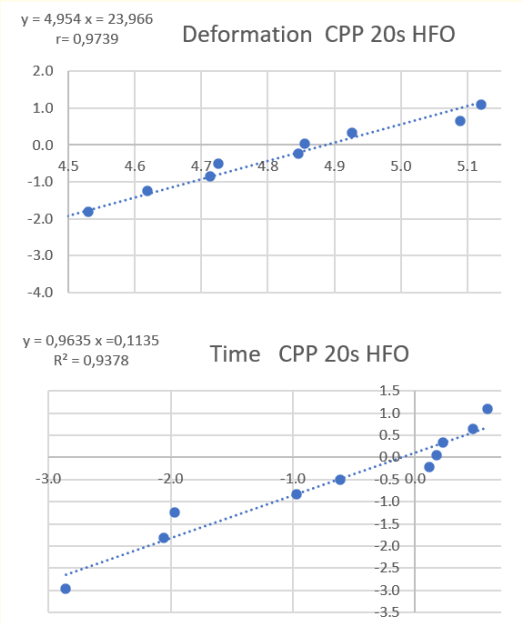
The following graphs show the score for each protocol.



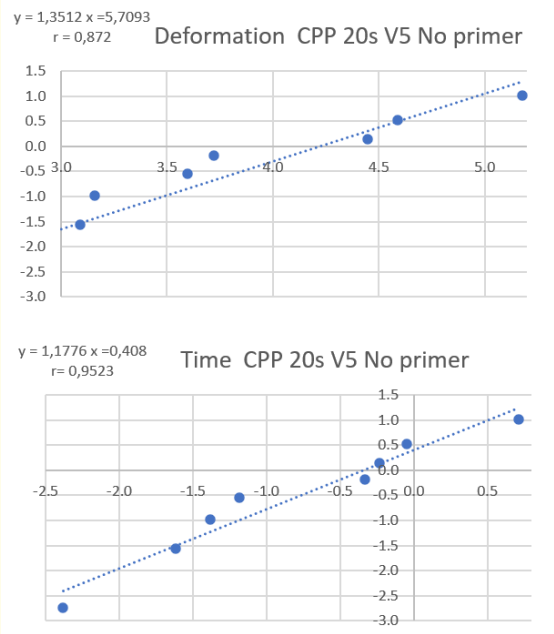
Graph 1



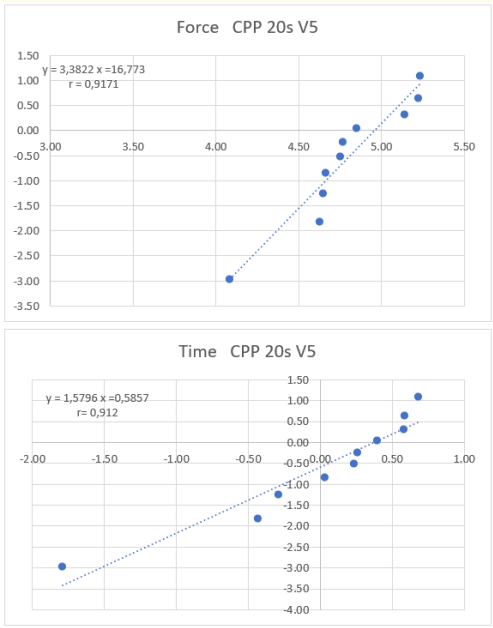
Graph 2



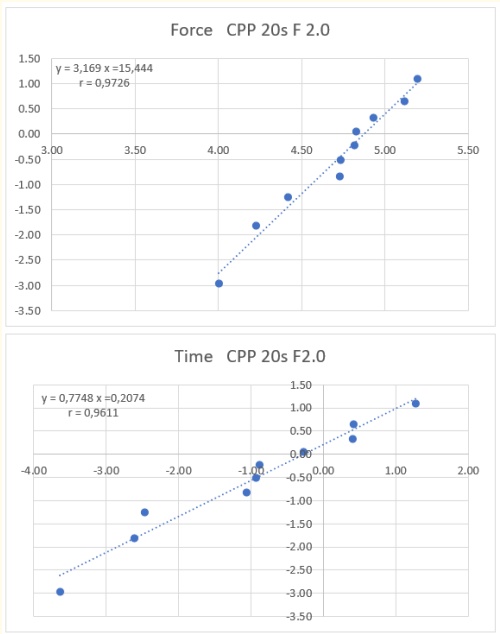
Graph 3



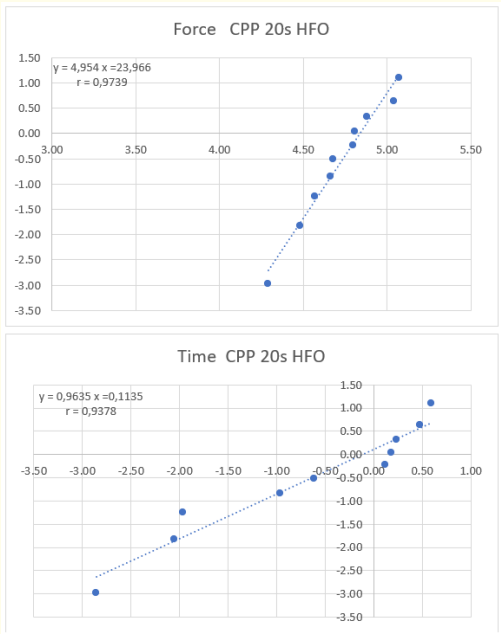
Graph 4



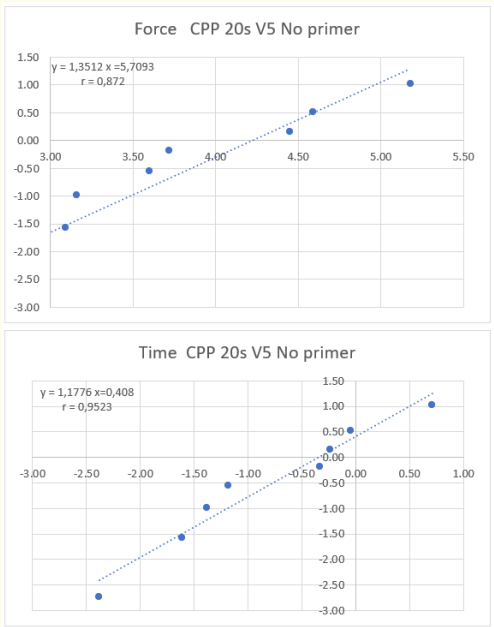
Graph 5



Graph 6



Graph 7



Graph 8

Results/Analysis

1. Since the linear relation between the deformation and the cementation protocol is close to r= +1 explains the reason that these two parameters have a correlation in a "powerful" way between them.

2. Since the linear relation between the force and the cementation protocol is close to r= +1 explains the reason that these two parameters have a correlation in a "powerful" way between them.

3. Since the linear relation between the time that the force is provided and the cementation protocol is close to r= +1 explains the reason that these two parameters have a correlation in a "powerful" way between them.

4. The fact that all the prices of coefficient of linear relation r by Pearson are close to r= +1 reveals that the two parameters each time have a normal distribution that puts the score of each protocol to an order accordingly to the precise measurement scale.

5. The fact that all the prices of coefficient of linear relation r by Pearson are close to r= +1 shows a very "powerful", almost perfect positive relation between the two parameters every time to each experiment procedure.

Discussion

According to the statistical analysis we found out that the tensile forces to the base level of the cemented IPS Empress II (e-max) with dentine, are related first of all, with the time that the force it's has been provided, in statistical important way. Secondly the bond strength and the resistance to the deformation due to the application of the tensile forces, depends on to the cementation protocol that has been

used in a statistical important way. Finally, the level of forces that we had to provide until the breaking point is highly attached to the cementation protocol that we provide each time to the cemented specimens. Specifically, the breaking point is highly influenced to the cementation process each time in a statistical important way.

The protocol with no primer use scored the lowest levels among all the others since it's out of the manufacturer instruction about cementation.

Comparing the score of each protocol we found out that protocol 3; 30sec HF acid 10%, Ceramic Primer Plus 20sec cemented with HFO Enamel Plus/ Optibond FL, provides the highest score about resistance of the bond against the tensile forces and the highest stability against deformation in a statistically important way. Secondly protocol 1; 30sec HF acid 10%, Ceramic Primer Plus 20sec cemented with Panavia V5 provides high score about resistance of the bond against the tensile forces and a high stability against deformation in a statistically important way [1-10].

Conclusion

At the 21st century that everything is going too fast, as far as the cementation process of IPS Empress II (e-max) it is concerned, we must be accurate and precise to each careful step giving respect to the time limits without hesitating according to the cementation protocol we choose to perform, for long term stability of our restorations.

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