Author's response to reviews

Title: Bond strength between alumina substrate and veneering composites with various adhesive resin systems

Authors:

Yousef A AlJehani (aljehaniyousef@gmail.com)
Jagan K Baskaradoss (drjagand@gmail.com)
Amrita Geevarghese (dramrithag@gmail.com)
Marey A AlShehry (alshehrymarey@yahoo.com)
Pekka K Vallittu (pekval@utu.fi)

Version: 3 Date: 23 February 2015

Author's response to reviews: see over
Reviewer's report 1

Title: Bond strength between alumina substrate and veneering composites with various adhesive resin systems

Version: 2 Date: 3 December 2014

Reviewer: Paulo Francisco Cesar

Reviewer’s report:

1. This is an interesting paper dealing with the bond strength of indirect resin composites to alumina core. Though the introduction is very well written, with excellent English, it is not clear to me the clinical relevance of the work and I suggest the authors to add that to this part of the text.

Response: Thank you for the very positive feedback. The relevance of the study has been elaborated in the introduction section.

Text Change: "Reinforced all-ceramic crowns consist of a high strength porcelain core material, laminated with dentin and incisal porcelain. [6] The all-ceramic restorations should have excellent physical properties, strength, marginal fit, and aesthetics necessary for anterior, as well as posterior, restorations.[7] Successful performance and reliability of veneered ceramic prostheses may be limited by mechanical integrity and adhesion of the veneering porcelain to the ceramic substrates. The mechanical properties of core materials and veneering porcelains should match to a certain extent to achieve a durable bond.[8]"

"The ceramic-composite bond is susceptible to chemical [17], thermal [18], and mechanical [19] influences under intraoral conditions. The simulation of such influences in the laboratory is compulsory to draw conclusions on the long-term durability of a specific bonding procedure and to identify superior materials and techniques. Without documented evidence of the strength of the bond between the core and veneering porcelain, the profession must rely on manufacturers’ claims to judge which material is best for patients. The aim of this laboratory study was to evaluate the shear bond strengths of a range of prosthodontic resin composites bonded to all-ceramic core material using different adhesive resins."

2. My question is whether you are suggesting the application of indirect composites to alumina cores as a new treatment modality (e.g. an alumina core that is to be used with a veneering layer made of resin composite, like Belleglass, Sinfony, etc), or are you talking about using these materials to make repairs to the core? This last option seems improbable, since it will not be feasible intra-orally. So, I think it is important to clarify this issue in the introduction just so the reader understands the clinical scenario related to this in vitro work.

Response: Thank you for the comment. As included to the background section of the abstract and also to the introduction section of the manuscript, this in-vitro experiment only tries to assess the strength and durability of the prosthodontic resins when applied to alumina using different commercially available adhesive resins. This study neither proposes a new treatment modality not repair process. This has been addressed in the revision.
The ceramic-composite bond is susceptible to chemical [17], thermal [18], and mechanical [19] influences under intraoral conditions. The simulation of such influences in the laboratory is compulsory to draw conclusions on the long-term durability of a specific bonding procedure and to identify superior materials and techniques. Without documented evidence of the strength of the bond between the core and veneering porcelain, the profession must rely on manufacturers’ claims to judge which material is best for patients.

3. As to the abstract, is it possible to add the information that there was no effect of storage time and adhesive brand on bond strength? I believe this is an important finding and should be present in the abstract.

Response: This information has been included to the abstract.

The Weibull moduli were highest for BG, which was bonded by using Optibond Solo Plus adhesive resin at 24 h and 30 days. There was no effect of storage time and adhesive brand on bond strength.

4. Materials and Methods are very well described, though it is not clear, as said before, what is the clinical significance of testing indirect composites over alumina ceramics. The results section is also very clearly written and the statistical analysis is sound.

Response: Thank you for the encouraging comment. The authors have tried to emphasise the clinical significance of the study in the introduction section.

5. The discussion section is interesting, as the authors discuss the shear bond strength test and its limitations. In addition, a thorough discussion about the failure modes is made, and it should be noted that carrying out the Weibull analysis in this type of data adds important insights to the work.

Response: We respect the comment of the reviewer and appreciate their insight.

6. The reasons for the differences among resin composites are discussed. However, the sentence in line 10 is misleading. The authors state that the tests “revealed considerable variations in the SBS among different composites and adhesive resins”; however, in the results section you state that the “bonding resin” factor was not statistically significant. Please revise this part accordingly.

Response: We respect the comment of the reviewer and appreciate their insight.

None
7. Additionally, the Weibull statistics and the lack of effect of storage time is discussed. Excellent job!

Response: Thank you for the comment

Text Change: None

8. I think that the conclusion should be expanded in order to indicate the lack of effect of factors “adhesive resin” and “storage time”. Also, it would be nice to add something about the reliability of the adhesive joints based on the results of the Weibull analysis.

Response: The conclusion has been revised to include the suggested informations

Text Change: "Within the limitations of this study, the shear bond strengths of composite resins to alumina substrate are related to the composite resins. However, there was no effect of storage time and adhesive brand on the bond strength. The use of Weibull distributions were for evaluating the fracture behavior of the tested materials."
Reviewer's report 2
Title: Bond strength between alumina substrate and veneering composites with various adhesive resin systems
Version: 2
Date: 11 February 2015
Reviewer: Rafael Moraes
Reviewer's report:
Major compulsory revisions
1. The structured abstract indicates that a background should be detailed, but it seems the authors have addressed the objectives of the study.

Response: We thank the reviewer for the valuable comments and excellent review of the manuscript. The background information has been included to the abstract.

Text Change: "Background: With the increase in demand for cosmetics and esthetics, resin composite restorations and all-ceramic restorations have become an important treatment alternative. Taking into consideration the large number of prosthodontic and adhesive resins currently available, the strength and durability of these materials needs to be evaluated. This laboratory study presents the shear bond strengths of a range of veneering resin composites bonded to all-ceramic core material using different adhesive resins."

2. I believe the short title should be revised to better convey what was evaluated in the manuscript.

Response: The short title has been revised accordingly.

Text Change: "Shear bond strengths of veneering resin composites bonded to all-ceramic core using different adhesive resins."

3. Specimens tested at 24h were dry-stored after bonding. The rationale for that procedure should be addressed since this is not a clinically relevant scenario.

Response: All the specimens (24h and 30 days) were stored under water at 37°C. This information has been made more clear in the methodology and discussion sections of the manuscript.

Text Change: "The mounted alumina specimens were randomly assigned to three groups. Each of the groups include 10 specimens water stored for 24 hours and 10 specimens water stored for 30 days and the temperature was maintained at 37°C."

4. The temperature the specimens were stored should be mentioned in the Materials and Methods chapter; only in the discussion the authors indicate the temperature was 37°C.
Response: The authors thank the reviewer for pointing out this oversight. The text has been revised accordingly.

Text Change: "The mounted alumina specimens were randomly assigned to three groups. Each of the groups include 10 specimens water stored for 24 hours and 10 specimens water stored for 30 days and the temperature was maintained at 37ºC."

5. When mentioning materials, it is preferable to address types and/or characteristics of each material rather than their commercial brands/names. If necessary, acronyms might be used to refer to specific materials tested.

Response: The authors are of the opinion that identifying the resins by characteristics or type would not be suitable taking into consideration the similarities between the materials used in this study. However, the names of the prosthodontic resins have been abbreviated.

Text Change: "Group 1: The adhesive resin was applied to the bonding surface of alumina, followed by the application of BelleGlass® (BG) via the hole in the Teflon mold...
Group 2: The adhesive resin was applied to the bonding surface of alumina, followed by application of the prosthodontic composite Sinfony® (SF) via the hole in the Teflon mold....
Group 3: The adhesive resin was applied to the bonding surface of alumina, followed by application of the composite resin GC Gradia® (GCG) via the hole in the Teflon mold...."

6. The content of Table 2 can be mentioned in the Materials and Methods chapter.

Response: The content of Table 2 has been briefly included to the methodology section.

Text Change: "Bonding procedures
The procedures for materials handling and application were performed at room temperature and 50% humidity. All the adhesives and materials were applied to the alumina surface. The information on the organization of the specimens for different prosthodontic resin composites are shown in Table 2. The groups were as follows:"

7. Why cohesive failures within the test substrates were not excluded from the analysis? If cohesive failures are not discarded the authors might be actually not measuring “bond strengths” between the substrates. This is really controversial and requires attention.

Response: Authors thank for this critical aspect. We do agree that in the case of cohesive failures, it is not exactly question of bond failure. However, this is generally adopted way to describe the “bond strength” between dental materials and the term “bond strength” is actually meaning durability of attachment rather than interfacial adhesive failure. We have determined the “bond strength” as a measure for durability of attachment in the Materials and methods section.

Text Change: "To measure the shear bond strength, which was the measure of durability of adhesion between the materials regardless of the location of the failure, the bonded specimen was mounted in a jig attached to a 500-N load cell in the testing machine."
The Materials and Methods chapter logically leads the reader to believe two factors were tested in the study: composite resin (3 levels) and adhesive (4 levels). This is corroborated with passages where the authors state, for instance, that “bond strengths were affected by the brand of veneering resin composites”. It is logical to expect a two-way ANOVA is used, but this was not the case. Please consider re-running the statistical analysis as indicated. Alternatively, the authors could calculate 95% confidence intervals for each group.

Response: The authors thank the reviewer for highlighting this typographical error. Two way analysis was carried out for comparing the effect of the two factors. This was followed by the Scheffe’s multiple comparisons, then results of which has been presented in the revised Table 4. The 95% CI has also been included to the Table 4.

Text Change: "Refer Table 4"

8. It seems the authors have calculated Weibull moduli based on a sample size of 10. This is also controversial and should be addressed in your Discussion chapter and supported by previous studies indicating this sample size is appropriate for that analysis.

Response: It is true that sample size of ten was somewhat limited for the Weibull moduli calculation. Limitation of this has been added to the discussion section.

Text Change: "However, it have to be highlighted that the sample size of this study limits the reliability of the Weibull analysis and therefore results can only be considered as indicative only."

9. Table 3: load data (N) is meaningless, it has to be adjusted to the bonded area for calculating strength. Please remove.

Response: The load data has been deleted. Thank you for the advise.

Text Change: "Refer Table 3"

10. Table 4: It would be preferable to have statistical grouping indicated in Table 3 if possible.

Response: The scheffes multiple comparison was carried out to detect the difference between the three prosthodontic resin composites. The additional information, like the mean difference, p value and the 95% CI has been included to the table.

Text Change: "Refer Table 4."

11. Table 5: Weibull modulus data should be accompanied by respective 95% confidence intervals for comparisons across groups. Note that the 95% CIs should be calculated
according to the estimation method used in the Weibull analysis (e.g. maximum likelihood).

Response: The 95% CI has been included to the table.

Text Change: "Refer Table 5"

12. Figures 7 and 8: The shape of the distribution of failure probabilities seems not to fit well a 2-parameter Weibull analysis, indicating multiple failure modes, although this was not observed in the failure analysis. This should be addressed in the revised manuscript particularly having in mind the small sample size used.

Response: The figures were mixed-up while uploading. This has been rectified and the authors would like to thank the reviewer for identifying this error.

Text Change: "Refer Figures 7 and 8"

13. Figure legends: not all figures have associated legends. Minor essential revisions

Response: The revised figure legends have been included to the manuscript.

Text Change: "Figure Legends
Figure 1: Probability of failure versus shear stress for different composites bonded to alumina substrate using Scotchbond Multipurpose (Storage time 24 h)
Figure 2: Probability of failure versus shear stress for different composites bonded to alumina substrate using Scotchbond Multipurpose (Storage time 30 days)
Figure 3: Probability of failure versus shear stress for different composites bonded to alumina substrate using Prime & Bond NT (Storage time 24 h)
Figure 4: Probability of failure versus shear stress for different composites bonded to alumina substrate using Prime & Bond NT (Storage time 30 days)
Figure 5: Probability of failure versus shear stress for different composites bonded to alumina substrate using OptiBond Solo Plus (Storage time 24 h)
Figure 6: Probability of failure versus shear stress for different composites bonded to alumina substrate using OptiBond Solo Plus (Storage time 30 days)
Figure 7: Probability of failure versus shear stress for different composites bonded to alumina substrate using Stick resin (Storage time 24 h)
Figure 8: Probability of failure versus shear stress for different composites bonded to alumina substrate using Stick resin (Storage time 30 days)"

14. Appropriate decimal figures should be used for shear bond strength values, e.g. 24.2 instead of 24.17.

Response: All the numerical data have been rounded to 1 decimal place.

Text Change: "Refer all Tables."
15. I believe it is not necessary to educate the reader in the Introduction chapter about the shear bond strength test. This chapter should be use to state and contextualize the problem under investigation.

Response: The paragraph on Shear strength has been removed from the Introduction section.

Text Change: "Deleted text from Introduction"

16. The meaning of “adhesive loosening of restorations” in page 3 line 21 is unclear. Please clarify.

Response: The sentence has been modified accordingly to make the meaning more clear.

Text Change: "Adhesive failure between the framework and the luting cement has been reported in all-ceramic inlay-retained fixed partial dentures. [14]"

17. Was this a hypothesis-driven study? If so, please state the hypothesis tested.

Response: The null hyposthesis has been included to the introduction section.

Text Change: " The null hypothesis states that there is no difference in the shear strength when different prosthodontic resins are bonded to alumina using different adhesive resins."

18. Table 3: Please consider another manner to indicate the groups tested. It is not reader-friendly as it is.

Response: The Table has been modified accordingly.

Text Change: "Refer Table 3"

19. I don’t see the need for including Figure 1 in the manuscript.

Response: Figure 1 has been deleted from the manuscript.

Text Change: "Figure 1 deleted."

20. Discussion: implications of the findings were only marginally addressed as well as limitations of the methods.

Response: Authors have now tried to evaluate critically implications of the results in the Discussion section and made minor changes to the text.

Text Change: Revisions in the discussion and results section
21. Conclusion: I think this chapter should be revised as the polymerization temperature of the composite resin was not actually tested in the study.

Response: The conclusion has been revised to include the suggested revisions.

Text Change: "Within the limitations of this study, the shear bond strengths of composite resins to alumina substrate are related to the composite resins. However, there was no effect of storage time and adhesive brand on the bond strength. The use of Weibull distributions were for evaluating the fracture behavior of the tested materials."

Discretionary revisions

22. The term “veneering composite” in the title is controversial. Some of the materials tested are not used only for veneering purposes.

Response: The title has been revised accordingly

Text Change: "Shear Bond Strength between Alumina Substrate and Prosthodontic Resin Composites with Various Adhesive Resin Systems"

23. Page 4, lines 9-10: Please mention that combinations between restorative composites and adhesive systems were tested.

Response: The sentence has been modified accordingly.

Text Change: "The aim of this laboratory study was to evaluate the shear bond strengths of a range of prosthodontic resin composites bonded to all-ceramic core material using different adhesive resins."

24. Numbering groups (1, 2, 3…) is not reader-friendly as one might have to go back to the text to understand what are the differences between groups when any mention is done in the Results or Discussion sections. This is particularly relevant when you have subgroups, which is the case here.

Response: The authors have tried to use the acronyms (BG, SF and GCG) where ever found suitable throughout the manuscript and tables.

Text Change: "Text revised throughout the manuscript and Tables."