DURATION OF FORCE WITH LAMINATED AND UNLAMINATED ORTHODONTIC ALIGNERS

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Introduction

Orthodontic aligners have increased popularity due to enhanced esthetics and ease of application by both general clinicians and specialists. Studies have demonstrated that aligners with lower modulus internal lining generate less localized stress to teeth and bone. Additional study concluded optimum aligner thickness for orthodontic movement is 0.5 mm. However, studies have not compared laminated and unlaminated aligners with respect to duration of force an aligner may exert on teeth.

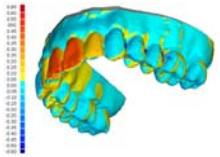
Purpose

The purpose of this study was to assess duration of force application with laminated and unlaminated orthodontic aligners.

Materials and methods

1. Photoelastic model of dentulous adult maxilla was fabricated using different teeth and bone simulants.
2. A polyvinyl siloxane (PVS) impression was taken and sent to CT scan for digital analysis.
3. Two unaltered models were fabricated from the CT scan using CAD/CAM technology to represent the photoelastic model.
4. An altered model was also fabricated by adjusting the original digital file incorporating the following lingual tooth movements: 0.2mm laterals and 0.6mm centrals.
5. Laminated and unlaminated aligners 0.5 mm thick were fabricated from altered model.
6. The aligners were inserted over the photoelastic model to assess stress distribution observed in the field of a polariscope.
7. Thereafter, the aligners were inserted over the unaltered model to assess force degradation.
8. The aligners were removed and reinserted after relaxing for a week. This procedure was repeated four times.

Photoelastic model prior to aligner insertion.



SCALE
0.1 = 0.1mm tooth movement

Figure 1 – Above right is a screen print of the CT scan of photoelastic model. Figure demonstrates orthodontic lingual movement of centrals by 0.6mm and laterals by 0.2 mm using OrthoMove proprietary reverse modeling software. *Image courtesy of NuBrace Inc.*

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Results

- Both aligners demonstrated mild stress to laterals and moderate stress to centrals. Unlaminated aligner demonstrated diminished stress after 2 weeks.
- Laminated aligner maintained stress concentration and intensity throughout the 4 week duration.
- The amount of stress outside of the maxillary laterals and centrals were minimal for both aligners tested.

UNLAMINATED ALIGNER

TIME = 1 WK

LAMINATED ALIGNER

Figure 2: Demonstrates the photoelastic model with the unlaminated aligner inserted at week 1. There is increased number of fringes associated to the centrals and compared to the laterals.

Figure 3: Demonstrates the photoelastic model with the laminated aligner inserted at week 1. Similarly there is greater fringe count to centrals compared to the laterals.

TIME = 2 WK

Figure 4: Number of fringes has decreased as compared to the preceding week.

Figure 5: Number of fringes and concentration of fringes have remained steady as compared to the preceding week.

TIME = 3 WK

Figure: 6 Further decrease in fringe count as compared to the preceding week.

Figure 7: Both number of fringes and concentration have remained steady as compared to the preceding week.

TIME = 4 WK

Figure 8: Significant depletion of fringe count and concentration of fringes is noted at week 4.

Figure 9: There has been minimal fringe reduction and concentration and concentration of fringes.

Discussion

- The reduction in number of fringes and concentration with the unlaminated aligner at weeks 3 and 4 indicates less force from aligner to the dentition.
- This study demonstrated that the laminated aligners may allow greater amount of force to teeth than the unlaminated aligner during the 4 week testing period.
- Clinician should consider using laminated aligners under conditions where a longer duration of orthodontic tooth movement is required.

Conclusion

- Results indicate potential for greater degree and longer duration of tooth movement by using the laminated aligner with the lower modulus internal lining.
- The results indicate that fewer aligners and, consequentially, fewer dental visits may be required to achieve similar results using laminated aligners compared with unlaminated aligners.

References

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