EFFECT OF ORTHODONTIC ALIGNER LAMINATE THICKNESS ON STRESS PRODUCTION
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Presented at: International and American Dental Research Meeting (IADR / AADR) Miami Apr 1-4, 2009

Introduction
Orthodontic aligners have increased popularity due to enhanced esthetics and ease of application by the general practitioner. A primary concern of orthodontic treatment is root shortening and bone resorption. Studies have demonstrated that inclusion of a lower modulus laminate on the internal aspect of aligners allow less localized stress to teeth and bone. Additional concern is supereruption during aligner use as there is limited tooth to tooth contact. This is as a result of an approximate 3:1 differential between anterior and posterior teeth. Therefore, an equal distance of super eruption may alter centric relation. Thinner aligners may minimize super eruption. As a result, question is raised as to optimum aligner thickness required to exert sufficient load for orthodontic movement while minimizing the potential for super eruption.

Purpose
The purpose of this study was to assess stress production as a function of laminated aligner thickness.

Materials and methods
- Photelastic model of dentulous adult maxilla was fabricated using different teeth and bone simulants.
- PVS impression was taken of the photelastic model for CT scan and an “altered” model was fabricated using CAD/CAM technology to alter the position of the centrals lingually by 0.6mm and the laterals linguall by 0.2mm.

Results
1. All laminated aligners demonstrated mild stress to laterals and moderate stress to centrals.
2. The number and proximity of fringes associated with the thick (0.75mm) and medium laminated (0.50mm) aligners demonstrated similar results.
3. Both thick and medium laminated aligners demonstrated greater concentration and intensity of stress than the thin laminated (0.25mm) aligner.
4. The amount of stress outside of the maxillary laterals and centrals were minimal for all aligners tested.

Figure 5.  THIN ALIGNER  0.25mm
Above is the photelastic model with the thin aligner (0.75mm) inserted. Notice that the stress distribution in both number of fringes and proximity of fringes to the central incisors are greater from the lateral incisors which required less movement.

Discussion
1. This study demonstrated that the thick (0.75mm) and medium (0.50mm) aligners may allow greater amount of force to teeth than the thin (0.25mm) aligner.
2. Considerations for orthodontic tooth movement are:
   - Sufficient force to move teeth.
   - Minimal aligner thickness to minimize supereruption and enhance patient comfort.
3. Given that the thick and medium aligners demonstrated similar stress patterns, the medium aligner may allow for less supereruption.
4. Clinician should consider using the medium thickness laminated aligner (0.50mm) as it allows for similar stress patterns as the thicker aligner (0.75mm), but may allow for less supereruption.

Conclusion
1. Results indicate potential for greater degree of tooth movement and longer duration of tooth movement by using the thick (0.75mm) and medium (0.50mm) laminated aligner.
2. The clinical implications of this study are that faster orthodontic movement may be achieved by using the thick and medium thickness laminated aligners as compared to the thin (0.25mm) laminated aligner.
3. Follow up study is presently underway to assess stress patterns on an ongoing timeline by various aligner thicknesses.

References
5. Skelet, P.: Altered model and the resulting stresses observed in the field of polariscope and digitally photographed. (photo above). Stress data for the three aligners were analyzed using a computer graphics program to quantify stress intensity by fringe number counting.

Acknowledgement
We would like to take this opportunity and thank Dr. Patrick Turley, former Professor and Chairman UCLA Orthodontics, Shellcase for aligner fabrication, Joseph Marje, currently present. Their contributions to this digital field will always be remembered. We would like to thank Dr. Arnold Bisch, Associate Dean Retina UCL Biomedical Science for his continued support.