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Review

In-house Aligners: Why We Should Fabricate Aligners in Our Clinics?

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Main Points

- As the availability and efficiency of aligner fabrication technology evolves, and with the increasing demand of patients, it seems that most orthodontists are going to use aligners in everyday operations.
- In-house production of aligners has 3 big advantages for the clinician: price, delivery timing, and doctor's time.
- A large amount of time-consuming tasks in producing aligners may be delegated to a dedicated dental staff.

ABSTRACT

As digital dentistry is evolving, contemporary orthodontics is embracing clear aligners as a tool more than ever before. On the other hand, aligners are being marketed to patients by aligner companies in every way that is possible. The demand of the end user and the pursuit of the orthodontist toward less chair time has made aligners popular in the last decade. As the price for having all machinery needed to fabricate aligners has decreased, orthodontists may choose to fabricate aligners in-house. In-house fabrication will bring advantages in the price, delivery time, and doctor's time if it is done correctly.

Keywords: Clear aligners, 3D printing, fabrication

INTRODUCTION

As we are all being educated on esthetics by all kinds of media, there is an increasing demand for esthetic corrections of the face and teeth. Besides the demand for esthetic teeth, there is also a demand for more esthetic options in orthodontic corrections. With the help of recent advances in dental technology, orthodontic treatment of mild to moderate degree can be performed successfully with clear aligners. As dentistry and orthodontics go digital, the methods used to design and fabricate aligners have changed drastically, including the utilization of new CAD-CAM technology to make production easier. On one hand, the availability of 3D technology has increased, while on the other hand, the price for the 3D technology utilized for the production of aligners has decreased, so much so that the aligners can be produced in-house or, in other words, in our own clinics.

IN-HOUSE PRODUCTION STEPS: FILAMENT VS. RESIN

A 3D model can be obtained using either a filament or a resin material. When using the filament, models are produced using FDM (Fused Deposition Modeling) printers. The main advantage of the filament model is that it is 10 times more economical than the resin model.[1] Another important advantage of the filament model is that it can be used immediately after the printing process. As for the resin models, postprocessing is needed after the printing process. It includes alcohol washing and light curing of the model. Resin models are built with resin rising in a resin tank, and because of this, the surface of the model is covered with resin following the procedure. Washing

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removes the resin from the outer surface of the 3D model, which takes approximately 15 minutes. A clinician may do the cleaning in 3 ways: she/he may rinse the model manually by using a plastic box to shake the model in a rinsing solution, with the cap tightly closed. Second, she/he may use an ultrasonic cleaner manufactured for the dentistry or jewelry industry. Third, she/he may use a cleaner manufactured specifically for aligner production. All 3 methods can be utilized for successful cleaning.

Curing and Labeling

The resin model is built by light curing of the resin, layer by layer. Therefore, following the printing process, the resin model is not absolutely cured. There is a need for a final light curing. For final curing, the models should be cured for approximately 30 minutes under ultraviolet light. After final curing, the models are ready for the aligner forming procedure. All models should be labeled before exporting the STL files from the software because models at different stages of treatment of various patients may be printed on the same table simultaneously. Labeling is an easy procedure: a custom text is placed in a convenient site on the model to be embossed or engraved at a chosen depth and font size with the help of the software. However, the formed aligners would not have labels if the labeling number were not on the teeth; so while trimming and polishing, there is a risk of putting the aligner in the wrong box. (The clinician may put the label on a surface of a tooth, but this causes difficulty while removing the aligner and may also cause discomfort because of the irregular surface of the label.) Therefore, the person trimming the aligners should put the aligners on the models that they belong to but should not totally fit the aligner to the model. Fitting and removing the aligner multiple times on the model before packaging may deform the aligner.

Plastic Foils to Fabricate Aligners

There are a few types of plastic foils fabricated for aligner production. These are polyurethane derivatives, PET (polyethylene terephthalate), and PET-G derivatives. Companies are focused on improving the qualities of the plastic foils in terms of elasticity, durability, and resistance to coloring and microcracking under force and oral environment. There is no consensus among the orthodontists regarding the number of days before the patient begins to wear the next aligner. Some orthodontists claim that they use some kind of tooth movement acceleratory device or method to enable their patients change aligners every 3 days.[2] Some ask their patients to change the aligners every 7, 10, or 15 days depending on their daily wear time. Studies confirm that the aligners exert force on the teeth for 48 hours, and after that, the force decreases rapidly to a minimum. When the patient changes the aligner, the same cycle continues. The elasticity of the material is experimented in vitro in many studies.[3,4] However, till now there is no study in the literature that compares the effect of material composition of the plastic foil on treatment efficiency or treatment duration.

In-house production of aligners has 3 big advantages for the clinician: (1) price, (2) delivery time, and (3) doctor's time.

THE FIRST ADVANTAGE OF IN-HOUSE ALIGNERS

When the clinician produces her/his own aligners, the price of the aligners is very economic compared with the price of the aligners bought from companies. If the clinician is producing her/his own aligners, the cost of 1 single aligner comprises the cost of a 3D model print plus the plastic foil cost. When it comes to costly software, the numbers of software to be used for the purpose of aligner fabrication are increasing, which means that prices are going to decrease rapidly in the near future. Furthermore, besides buying a license for a year, monthly or case-based choices for payment are available. Also, the prices of 3D printers are more attainable every year, again due to an increase in the availability of 3D printers. Besides expensive printers, there are a vast number of more reachable models. Lastly, the thermoplastic aligner forming machine is already present in a lot of clinics, where the orthodontists are already into fabricating orthodontic appliances.

THE SECOND ADVANTAGE OF IN-HOUSE ALIGNERS

Duration is the second advantage, which means that the clinician can deliver the aligners very fast. After the digital scanning of patients' teeth, digital setup takes approximately 30 minutes for a moderate case. In an easy case where the molars do not move, it takes about 15 minutes for setup.

The advantage of the procedure is that some of the most time-consuming steps can readily be delegated to a staff member, following a short education. There is an increase in the number of software available in the market. The principles and work sequence are nearly the same for all these software packages. The first step is the preparation of the model, which includes loading of the models, orientation, cutting excess data, filling the gaps in the models, and marking the teeth. This is a procedure that should always be carried out in the same way, without any need for orthodontic expertise by dental staff. The second step is the digital setup where the clinician constructs the treatment plan (aligns the teeth on the arch form suitable for the patient, determines the movement sequence and speed, puts the necessary attachments, and determines the need for IPR, elastic wear, etc.). The last step is the exporting of the digital setup models, which includes labeling and deciding the height of the models, which can also be done by a dental staff. As technology evolves, in the upcoming versions of the aligner software, the first and third stages, carried out in the same way, such as model preparation and exporting will be done by the software. In the near future, besides self-segmentation and exporting, autoalignment is going to be a new feature of the aligner software.

With the use of a DLP printer, it takes approximately an hour to get 3 models at a time. Postprocessing takes about 30 minutes. Vacuum or pressure forming of the aligners takes about 5 minutes for each aligner. To summarize, a clinician can deliver the aligners to patient in the same day taking impressions.

THE THIRD ADVANTAGE OF IN-HOUSE ALIGNERS

Contrary to general belief, when aligners are fabricated in the clinic, the clinician spends less time compared to ordering the aligners from a company. When produced in-house, it takes a total clinician time of 15 to 30 minutes for obtaining the series of digital setup models for the case. Next is the printing of the 3D models and the forming of the aligners from thermoplastic foils, which will be handled by the clinic staff. Forming and trimming of the aligner from the plastic foil is a standard procedure, which can be easily done successfully by an educated staff member. 3D printers have user-friendly manuals, and the printing procedure can also be done by the staff. When compared with the aligners produced by a company outside of the clinic, 1 big advantage of in-house aligners is that the clinician quickly makes the aligning and staging which is in his mind instead of writing a recipe to the company technician, who is most of the time not even a dental technician. Depending on the company, sometimes this technician may not even know the basic rules of dental alignment. If the clinician is making her/his own digital setup, there will be no digital setup evaluation process sent by the company or modifications that should be evaluated repeatedly. Another big disadvantage when working with companies is that the clinician cannot decide when the digital setup would be ready for a submitted case. Even if the company has a message system that alerts the clinician that the digital setup plan is ready to be evaluated, it may not be a suitable time for the clinician. Also, it is not guaranteed that the digital setup treatment plan sent by the company will be the final one. As a whole, the clinician has a complete time control on the procedure when an in-house aligner system is used.

While constructing a system for fabricating the aligners in-house, for the safety of all the steps and for the continuity of the system, the clinician should learn and practice all the steps in detail—including the tips and tricks—and have full control on the procedure. At any stage of the fabrication, when something does not work, it should be the clinician who will be diagnosing and solving the problem in order to conduct a healthy procedure.

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REFERENCES

1. Groth C, Kravitz ND, Jones PE, Graham JW, Redmond WR. Three-dimensional printing technology. *J Clin Orthod*. 2014;48(8):475-485.
2. Ojima K, Dan C, Kumagai Y, Schupp W. Invisalign treatment accelerated by photobiomodulation. *J Clin Orthod*. 2016;50(5):309-317.
3. Kwon JS, Lee YK, Lim BS, Lim YK. Force delivery properties of thermoplastic orthodontic materials. *Am J Orthod Dentofacial Orthop*. 2008;133(2):228-334. [CrossRef]
4. Gerard Bradley T, Teske L, Eliades G, Zinelis S, Eliades T. Do the mechanical and chemical properties of InvisalignTM appliances change after use? A retrieval analysis. *Eur J Orthod*. 2016;38(1):27-31. [CrossRef]