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A MODIFIED OF CLEAR RETAINER FOR FRACTURE PREVENTION
การประยุกต์รีเทนเนอร์แบบใสเพื่อลดการฉีกขาด

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INTRODUCTION

Clear retainer was first introduced as an alternative to the traditional removable retainer in 1971 by Ponitz.[1] It has been gaining popularity in orthodontic practice due to many advantages such as better esthetics,[2] inexpensive,[2] easy fabrication,[3,4] and able to correcting minor tooth discrepancies.[2,3] It also can be inserted on the day the fixed appliance is removed.[4] Nevertheless, from a clinical perspective, clear retainer has the limitation related to its material properties. Since it was made from plastic, one of its disadvantages is a short lifespan, prone to wear and crack and needs replacement at least annually[5-9] Therefore, a retainer's cost-effectiveness should be considered along with failure rate and survival time.

According to Sun et al.[8] in a randomized trial, crack or fracture was the most-often-cited reason for failure in maxillary and mandibular clear retainer. Lindauer and Shoff [5] found that clear retainers became cracked after placement in the 6-18 months during the follow-up period. Furthermore, Campbell et al.[6] showed that 38% of the patients with clear retainers needed replacing because the retainer had been worn out over a 1-year period. These previous studies reflected the main problem of the clear retainer. Therefore, it would be the benefit for patient if the clear retainer could be modified to reduce the crack or fracture during their usage. One of possible cause of this problem was the frequent stress that placed on the retainer edge while patient take it off by using finger or fingernails lifting the edge of clear retainer.[10] The clear retainer would deform seriously to overcome the undercut and the force that patient apply to the edge of retainer might cause the crack. Then the fracture would finally occur after long-term usage.[8]

The crack problem is also affected by the final inclination of the teeth. The excessive proclination or retroclination of the anterior teeth and the increased buccal root torque of the posterior teeth might enlarge

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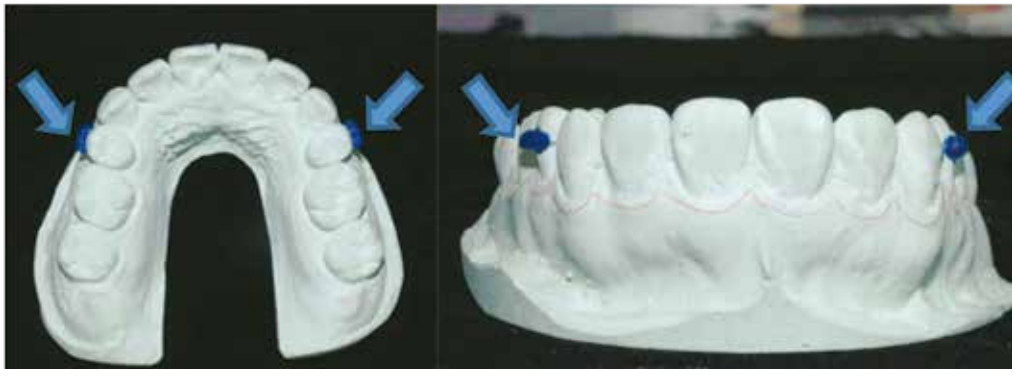

Figure 1. The rectangular shape of wax at the middle buccal surface of posterior teeth on both sides.

the undercut and difficulty to take the retainer off[8]. Furthermore, the difference in thickness, materials' type of the retainer and the parafunctional habits affected this problem too.

In the previous study, Ahn et al[11] tried to increase the survival time of clear retainer by developed a new type of clear orthodontic retainer that incorporates multi - layer hybrid materials to improve mechanical strength and rate of water absorption of the original clear retainer. It consists of three layers; an outer polyethylenterephthalate glycol modified hard - type polymer, a middle thermoplastic polyurethane (TPU) soft - type polymer, and an inner reinforced resin core. The total thickness of the appliance was less than 3 mm. This new type of vacuum - formed retainer showed improved mechanical strength but the fabrication technique required more time, more additional materials and more cost from the original technique. Moreover the increased thickness may cause the bite plane effect that impede the settling of the posterior teeth after debonding fix appliance.

With the intention to increase the survival time of clear retainer by facilitate the way for retainer removal and reducing fracture, the purpose of this article is to demonstrate the appliance design and fabrication of a modified clear retainer for fracture prevention.

STEP OF DESIGN AND FABRICATION

After obtaining a dental cast, the outline of clear retainer was formed. The buccal and lingual margin of the retainer should extend 3 - 4 mm from the cervical and should be curved in the area of frenum.[2] Then the

Figure 2. A. The vacuum thermoforming machine and B. the forming clear retainer.

Figure 3. Trimming the clear retainer according to the outline.

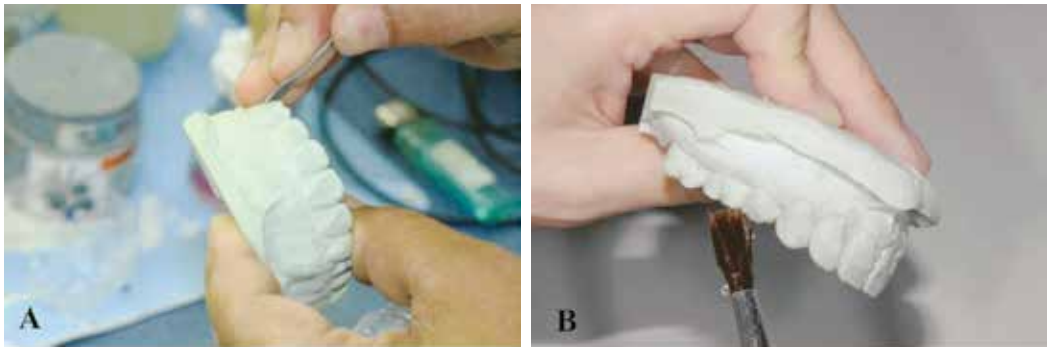

Figure 4. A. Rectangular - shaped wax was removed
B. the separating media was applied to the dental cast.

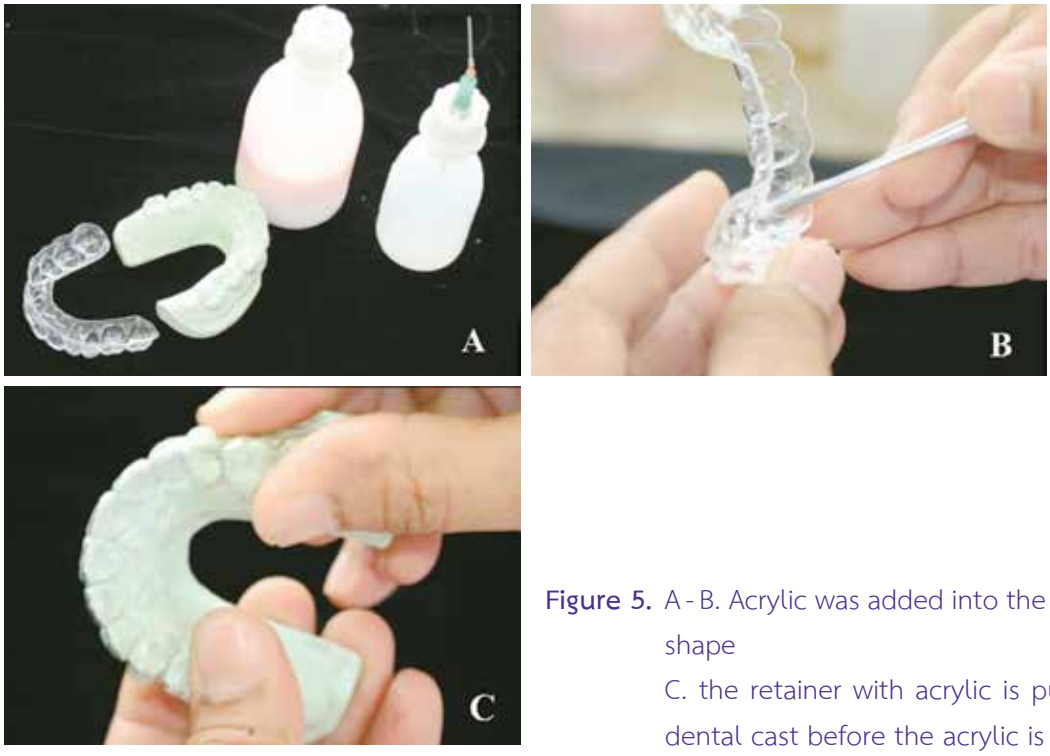

Figure 5. A - B. Acrylic was added into the rectangular shape
C. the retainer with acrylic is put over the dental cast before the acrylic is cured.

rectangular shape of wax was built up at the middle buccal surface of posterior teeth on both sides. (Fig. 1)

The clear retainer was formed over this dental cast using a sheet of thermoplastic material usually polyethylene or polypropylene that is 0.75 mm thick and a vacuum thermoforming machine. This created the customized shape for the clear retainer and the adjustment was not usually needed. (Fig 2.)

After the clear retainer was formed, the excess thermoplastic material was trimmed away according to the outline. (Fig.3)

After that the acrylic was added into the rectangular shape on both sides of buccal surface of posterior teeth to fill the space and strengthen them. This procedure enhances the patient to put the finger under the rectangular shape and remove the clear retainer easily. To prevent the excess acrylic in the rectangular shape, the template for the rectangular shape (wax) was removed from the dental cast and the separating media was applied. When the acrylic was added into the rectangular shape, the retainer could

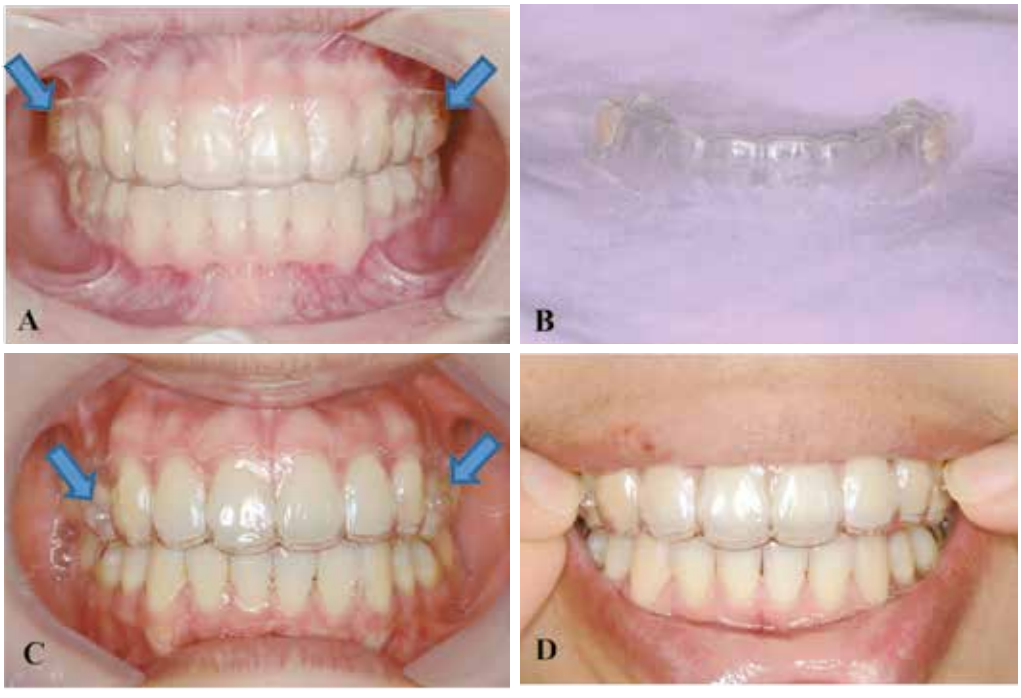

Figure 6. The modified clear retainer. A - B. Pink acrylic were added into the rectangular shape on both sides. C. Clear acrylic was added into the rectangular shape. D. The patient can use finger to remove the retainer on the rectangular shape at the buccal of posterior teeth.

be placed into the dental cast to make sure that the acrylic was fitted to the buccal surface of the teeth. According to the color of acrylic, it would be seen easily by the patient. However, the clear acrylic might be used in case of patient concern about esthetic. (Fig. 4 - 5)

The final polish was done by using an acrylic bur and pumice. It was cleaned by the antiseptic solution and was ready to be inserted in patient mouth. (Fig. 6)

DISSCUSSION

Clear retainer is one of the common uses for orthodontic retention in the present day. This type of retainer becomes popular due to many advantages. However, some weaknesses were still present. There are several articles that demonstrate the modification of clear retainer to better utilization. For example, Pithon[12] suggested a modified thermoplastic retainer by cutting off the plastic in the region of incisal and

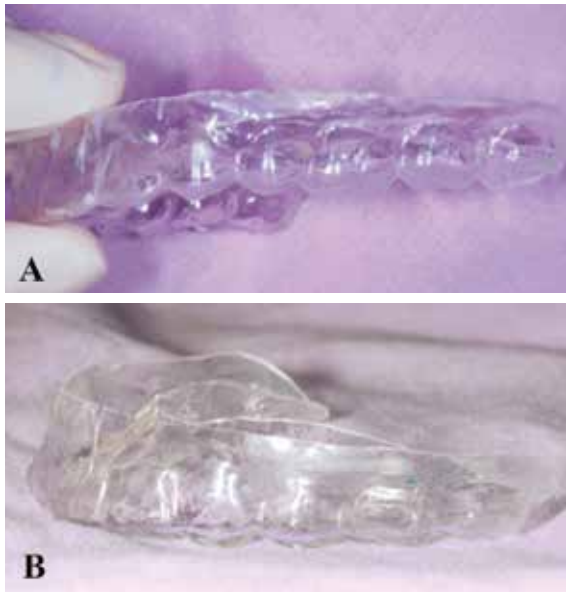

Figure 7. A - B, The fracture and the crack of clear retainer after long - term usage.

occlusal portion of teeth. This would allow relative vertical movement (settling) of the posterior teeth after debonding fix appliance. Ahn et al[11] developed a new type of clear orthodontic retainer that incorporates

multi - layer hybrid materials to improve mechanical strength and rate of water absorption of the original clear retainer.

As mentioned above, one of the most common failures of clear retainer is fracture or crack. And the most common fracture location is between the lateral incisors and the canines, especially in the mandibular retainers, as patients often remove retainers using these places.[10] (Fig.7)

Patients usually take the clear retainer off by lifting it at the edge. Every time patients remove retainer with this way, the crack might happen at the edge of retainer. Accordingly, clear retainer is modified by created the rectangular shape as in Fig. 6 on both sides of retainer to enable patients to grasp the retainer and remove it more easily. These could prevent the fracture at the edge of clear retainer during removal.

Even though this article had the intention to increase the survival time of clear retainer like the study of Ahn et al[11] (as previously mentioned), the techniques were different. The fabrication technique in this article is more simple, lower cost, fewer additional materials and little time are required. Despite the fact that the fabrication technique in this article can use with any thickness of thermoplastic material, the 0.75 mm thick which is the most popular thickness of clear retainer was chosen. While the modified clear retainer of Ahn et al was about 3 mm that may cause the bite plane effect which impede the settling of the posterior teeth after debonding fix appliance.

However, this article is just the clinical tips to introduce the appliance design and fabrication technique of a modified clear retainer for fracture prevention. Further studies are necessary in order to assess the failure rate and survival time of this modified clear retainer.

CONCLUSION

This modified clear retainer can be one of the choices to facilitate longer time usage of clear retainer. By using this technique to modified clear retainer, the patient can put their finger or fingernail on the rectangular shape which are added on the surface of the clear retainer at the area of posterior teeth instead of put on the retainer edge that could make the retainer start to crack and finally bring to the fracture and failure.

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