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ORIGINAL ARTICLE

Dentofacial changes after anterior crossbite correction using a lingual arch with finger springs

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KEYWORDS
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Abstract *Background/purpose:* Anterior crossbite correction is common in orthodontic treatment; however, few studies have discussed the change with cephalometric measurements. The purpose of this study was to evaluate the dentofacial changes in anterior crossbite correction by using an upper lingual arch with finger springs.
Materials and methods: This retrospective study included 30 patients (13 female and 17 male). According to the number of crossbite teeth, the patients were divided into three groups. We used paired *t* test, Kruskal—Wallis test, Mann—Whitney *U* test, and multiple regression analysis to perform statistical analysis.
Results: According to overall treatment changes, the dental changes included overjet increase, overbite decrease, upper incisor proclination, lower incisor retroclination and intrusion, upper molar distal tipping with extrusion, and lower molar intrusion. These dental changes resulted in clockwise mandibular rotation and lip position change. Anterior crossbite correction did not require increasing bite appliances. According to multiple regression analysis, the change in overjet was associated with the position of the upper and lower incisor crown tips. The mean rate of upper incisor movement in the horizontal direction was 2.5 mm/mo. The treatment duration exhibited no significant difference among the three groups.
Conclusion: Lingual arch with finger springs was effective in anterior crossbite correction regardless of the number of crossbite teeth.

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Introduction

Most previous studies have introduced treatment methods for anterior crossbite only through case presentations concerning devices such as removable appliances,[1] bonded resin composite slopes,[2] and hexa helix,[3] but quantitative research about tooth movement is rarely reported. Mershon[4] first used the lingual arch in 1908. In the Mershon method, appliances were used at intervals throughout the growth period of a patient, producing changes as the child grows and develops, with frequent periods of rest during which the appliances are removed to allow natural adaptation of the teeth to their new positions. The lingual arch springs were soldered and bent for different uses. The author used the appliance for many types of orthodontic treatment, such as arch expansion, rotation correction, labial tooth movement, and tooth distalization. The lingual arch with finger springs (LAFS) was widely used for many years,[5] but no relevant reports about the effect and efficiency of the appliance and tooth movement have been published. The objectives of this study were: (1) to introduce LAFS, which was used for correcting anterior crossbite; (2) to evaluate the changes in and efficiency of anterior crossbite correction by using cephalometric analysis; and (3) to identify the factors associated with changes in crossbite correction.

Material and methods

Lingual arch with finger springs

Mershon[4] first used the lingual arch in 1908. The lingual arch springs were soldered and bent for different uses, such as arch expansion, rotation correction, labial tooth movement, and tooth distalization. In this study, a Mershon lingual arch was modified and used (Figure 1). This appliance was fixed and cemented on the upper first molars.

Patients

All samples were collected from Taipei Medical University Hospital, Taipei, Taiwan during 2011—2013. Ethical approval was obtained from the Institutional Review Board of Taipei Medical University. The inclusion criteria were as follows: (1) one or more incisors in crossbite; (2) no previous orthodontic treatment; (3) anterior crossbite corrected by using an LAFS; and (4) complete pretreatment and posttreatment orthodontic records. The exclusion criteria were: incomplete of treatment records and patients did not return for checkup on time. Initially, 52 patients were selected; however, 22 patients were excluded because of incomplete data or patient factors. Of the 22 patients, 19 did not have posttreatment cephalometric radiographs, two did not have initial cephalometric radiographs, and one did not return for treatment on time. According to the number of crossbite teeth, the patients were divided into three groups: Group 1 comprised eight patients with one tooth in crossbite; Group 2 comprised nine patients with two teeth in crossbite; and Group 3 comprised six patients with three teeth in crossbite and seven patients with four teeth in crossbite. The patients in Group 3 all had functional shift with edge to edge incisor relationship.

All correction appliances, namely, LAFS, were constructed by one of the authors. In our clinic, after the appliances were delivered, the patients were examined and the appliances were adjusted every 3 weeks or 4

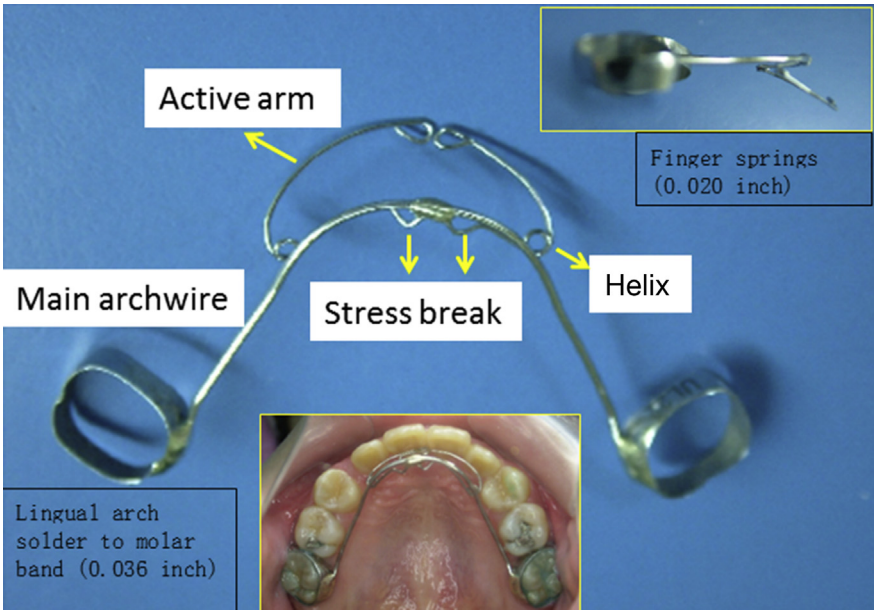

Figure 1 The appliance components were a lingual arch (0.036 inch), molar band, and finger springs (0.020 inch). The lingual arch was adapted to the linguogingival surfaces of the teeth. The finger springs comprised stress break, helix, and active arm components. The stress breaks absorbed force and prevented the breaking of wire from the soldering site. The helices were bent for increasing the resilience of the wire. The active arms were placed on the gingival side of crossbite teeth.