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Review Article

Finishing in lingual orthodontics – A review

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ABSTRACT

An excellent orthodontic finishing is the goal of every orthodontist. A clear-cut vision of end goals should set the objectives of any orthodontic treatment sequence. The finishing procedures are considered from the beginning stages of the treatment, as a part of total scheme of treatment. Finishing and detailing is the last step in orthodontic treatment, before active treatment is discontinued. It is to ensure that the teeth and the related structures are positioned in such a way it will lead to a better retention and stability, enhancement of aesthetics, optimized functions of the stomatognathic system and an improvement of the health of the periodontium. Recently, lingual orthodontics is one of the emerging trends for adult patients as it increases their self esteem, so this review article highlights the finishing techniques in lingual orthodontics.

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1. Introduction

The secret for an excellent finishing in orthodontics is to "begin with the end in mind" which is necessary to achieve better esthetics, to improve the function of stomatognathic system and to achieve structural balance of skeletal, dentoalveolar and musculature of oro-facial region. Orthodontic finishing is about the perception for the small details that make the difference in the essence of finishing.[1] Finishing distinguish the true master of the profession from the average orthodontist. Finishing is the last step, before active treatment is discontinued, ensuring that the teeth and related structures are positioned in such a way it will lead to a better stability of results, enhancement of aesthetics, optimized functions of the stomatognathic system and an improvement of the health of the periodontium. The general objective of orthodontic treatment with any technique is to obtain a result that simulates normal occlusion in so far as practicable with the malocclusion at hand and the appliance employed for its correction. Lingual orthodontics is more popular due to esthetics among adult patients.

2. Lingual orthodontic appliance

In 1975, Dr. Craven Kurz of Beverly Hills, California created his own lingual appliances by modifying labial edgewise appliances, and utilized them on a limited basis in his practice. The unique feature of this appliance were a bite plane incorporated in the maxillary anterior brackets, mesh bonding pads designed to adapt to the lingual surface of the teeth, and pre-torqued arch wire slots based on a conversion of commonly used labial torque values.[2] The lingual appliance most widely used today is the generation VII appliance, developed in 1990 by Ormco Corp. The VII generation brackets are much refined, low profile, patient friendly brackets with horizontal slot of either 0.018" or 0.022" slot size. Customised brackets and archwires for lingual orthodontic treatment were developed by Weichmann et al in 2003.[3] In this technique, the processes of bracket fabrication and optimized positioning

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of the fabricated brackets on the tooth are fused into one unit. Each tooth has its own customized bracket; made with state-of- the-art CAD/CAM software coupled with high-end, rapid prototyping techniques.[3] There are various literatures for lingual bracket placement and lingual mechanics. Finishing in lingual technique is also equally important as in labial technique.

3. Finishing in Lingual Appliance[4,5]

Finishing and detailing stage is challenging when lingual appliances are used for treatment of malocclusion. Labial and lingual finishing techniques are almost similar in consideration with all dynamic, cephalometric, esthetic, and functional factors.

The advantage of lingual technique over labial technique is absence of gingival hypertrophy and so clear view of the labial surfaces without interference of archwires and brackets.

The difficulties encountered at the finishing phase of lingual orthodontics derive from the following main sources:

1. Patients' characteristics
2. Anatomy of the lingual surfaces
3. Mechanics of lingual treatment
4. Nature of malocclusion

In this review article, the steps involved in finishing and detailing like torque correction, settling the occlusion using elastics, detailing the occlusion using finishing bends are discussed.

4. Systematic Finishing Procedure[4,5]

After accomplishing the main treatment objectives, the case should be reevaluated giving due consideration to the initial goals with regard to esthetics, occlusion, periodontal health, root alignment, and stability.

5. Step I of Finishing Protocol

Since it is difficult to distinguish between torque problems and vertical problems, bracket positioning inaccuracy or treatment errors, each finishing problem requires a different approach, it is necessary to first eliminate the problems that derive from wire disengagement and again allow expression of bracket prescription by using a full engagement resilient archwire.

The first step in the finishing stage is therefore to reuse the initial resilient rectangular archwire for a period on 3 to 4 months (copper NiTi 0.017 × 0.017 inch for 0.018 inch brackets), after steel ligating across the extraction spaces. This will regain control by full bracket engagement of the wire. Problems deriving from treatment errors, such as torque of the incisors, expansion, and some of the rotations will be corrected with this procedure (Figure 1).

Fig. 1: Torque and incisal level of the left central incisor, expansion and anterior open bite were corrected by full archwire engagement (0.017×0.017 inch copper Niti, followed by 0.0175 ×0.0175 inch TMA). Midline deviation was improved.

The typical vertical bowing effect shown in (Figure 2) was adequately corrected by regaining control with the correct archwire. At the end of this step it may be necessary to reposition brackets, but normally any necessary bracket repositioning should have been done earlier in treatment, at the alignment and leveling stage.

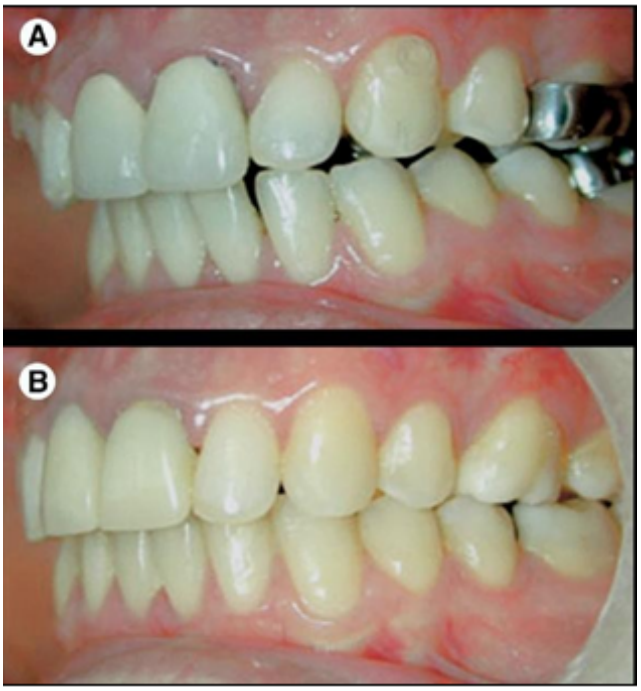

Fig. 2: (A) Vertical bowing effect at the completion of space closure with Class II elastics from lower molar labial cleat to upper labial clear button. (B) After correction by regaining control with a TMA 0.0175×0.0175 wire.

6. Step II of Finishing P rotocol

The second step in finishing a case is settling in the occlusion, with the establishment of correct interdigitation, correction of minor midline, anterior- posterior, and vertical discrepancies. When rectangular wires have been in place for a long time, the teeth are often unable to settle into an ideally finished position. Settling in the occlusion is

done by using a lower stabilizing arch, stainless steel or 0.0175 × 0.0175- inch TMA (titanium molybdenum alloy; Ormco Corp), and an upper 0.014 inch round sectional wire from canine to canine or lateral incisor to lateral incisor.[4] The posterior segments are ligated with figure-eight steel ligature wire to avoid accidental swallowing of brackets. This is accompanied by vertical elastics tied to lingual brackets or to clear labial buttons. If the teeth have settled correctly after 4 to 6 weeks, then the final stage of detailing bends is done. If the teeth are not correctly positioned, then revert to the previous stage with heavier archwires. There are different applications of elastic wear for specific situations. Anterior vertical elastics from labial to labial clear buttons is preferred for Class I and II cases.

Anterior vertical elastics from lingual to lingual brackets are preferred for open bite cases since it avoids tongue interposition (Figure 3A). Anterior vertical elastics from upper lingual brackets to lower labial clear buttons are preferred for Class III cases, as they enhance overjet correction (Figure 3B).

Anterior cross-elastics are used to correct center line discrepancies when the discrepancy occurs primarily in the anterior segments. The elastics are worn usually from upper lingual brackets to lower labial clear buttons. Posterior vertical elastics, short Class II or Class III elastics, are worn from lingual to lingual brackets or from clear buttons bonded on the labial surface (Figure 3 C, D).

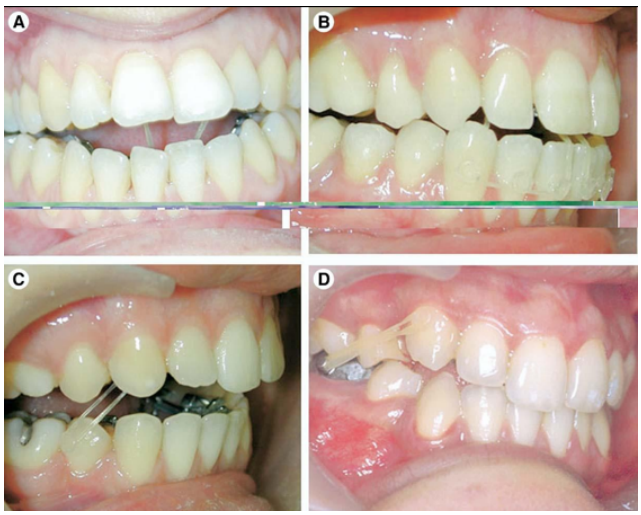

Fig. 3: Vertical elastics used in lingual orthodontics. (A) Anterior vertical elastics from lingual to lingual brackets for open bite cases. (B) Elastic tied from upper lingual brackets to lower labial clear buttons for Class III cases. (C) Elastic tied from upper lingual brackets to lower labial clear button as short Class II elastics. (D) Elastic tied from the labial clear button on the canine to a labial cleat on the lower molar, for extrusion and distal movement of the canine.

7. Step III of Finishing Protocol

The third step in the finishing procedure is final detailing and finishing bends. At this stage finishing bends are preferred over bracket repositioning since accurate repositioning for a minor correction is difficult to achieve. As this is the final archwire, it should not be necessary to reproduce these corrective bends in subsequent arches. When all desired changes have been noted, the orthodontist must decide whether to bend the detailing wire at the chairside or whether to do so during nonpatient time.

8. Different Bends Used for Detailing

8.1. Inset bends

Inset bends should be wide and as far from the mesial and distal borders of the bracket as the interbracket distance permits. This is to allow full engagement of the protruded bracket and to ensure that the ligature for this bracket will not slide outside the inset (Fig 4A). The inset bend may cause elongation of the crown, and therefore it should be bent combined with a step-up.

8.2. Offset bends

Offset bends should be narrow to allow full engagement of the brackets adjacent**.**

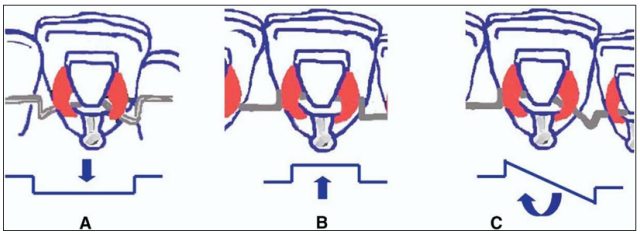

Fig. 4: (A) Inset bend should be wide and far from the bracket as much as the interbracket span permits; (B) offset bend should be narrow; (C) the aspect of the rotation bend directed lingually must be as far as possible from the bracket being rotated.

8.3. Inset bend

Inset bends should be wide and as far from the mesial and distal borders of the bracket as the interbracket distance permits. This is to allow full engagement of the protruded bracket and to ensure that the ligature for this bracket will not slide outside the inset (Figure 4A). The inset bend may cause elongation of the crown, and therefore it should be bent combined with a step-up.

8.4. Offset bends

Offset bends should be narrow to allow full engagement of the brackets adjacent should be combined with archwire expansion to avoid constriction of the dental arch.

8.5. V Bend

An anterior V bend may be used between the upper incisors to correct the root angulation of four incisors if the roots are too divergent and to improve a flat smile line. This bend should be combined with expansion of the archwire. This bend may help to reduce the prominence of "black triangles." Moving the roots together will move the proximal contact gingivally, creating a more normal gingival embrasure. This bend also helps to parallel the roots of teeth adjacent to extraction sites.

8.6. Rotation bend

Managing rotations has previously been described; any remaining rotations can be corrected during finishing by small rotation bends in the wire. The wire must be tied with a steel ligature and the lingual component of the bend must be kept far from the bracket being rotated. This is to ensure that the ligature for this bracket will not slide outside the rotation bend (Figure 4C).

The use of tooth positioners has been suggested for final finishing; however, with adult patients, diligent use of a tooth positioner may be questionable, risking the possible reopening of extraction spaces and further loss of final detailing. There should be a gradual progression towards finishing rather than an abrupt stage of tedious wire bending. Therefore, the fewer the errors made as treatment progresses, the less work required during finishing.[6]

9. Post finishing Finalizing Procedures

When the appliances are removed the occlusal contacts should be checked with articulating paper and equilibrated for removal of any balancing and functional interferences. Finally, esthetic recontouring of incisal edges should be performed to improve both esthetics and function. Bleaching for color enhancement is also considered as part of the finishing procedure and should be done before finally selecting the method of retention.[7]

A case finishing checklist had been developed to ensure quality standards, that should begin to fill out three to six months before debonding each patient. Marking in red the areas that need to be addressed helps the clinician design a sound plan for finishing treatment. This might also be of benefit to those who are preparing ABO cases, as a detailed checklist for study club evaluations, or simply to monitor patients' progress throughout treatment.[8]

10. Conclusion

The final stage of fixed appliance orthodontic treatment,is the final detailing which is to idealize individual tooth postion.[9] The orthodontists must plan from the beginning of treatment to minimize errors in the different variables so that minimum amount of work is required during the actual phase of finishing and debracketing which provides an efficient results.

11. Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

12. Source of Funding

None.

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