New advances in lingual brackets positioning. Case report

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Abstract
Through an orthodontic re-treatment case report, this article explains the procedure of brackets positioning with the CLASS System, using the Set-Up Model Maker (SUM), and Occlusal Plane Reference (OPR). The self-ligating brackets and Smart Cap transfer tray system were used. The treatment was carried out with CLO Technique (Custom-made Lingual Orthodontics).
Keywords: Lingual Orthodontics. Set-Up Model Maker. Occlusal Plane Reference. CLASS System.

Introduction
Female adult patient previously treated with labial orthodontics, not satisfied with the result, underwent the treatment in which the crowns were positioned in upper central incisors, and veneers in the rest of upper teeth. As she wasn’t happy with the obtained esthetic result, she required another treatment with lingual orthodontics. The patient presents a molar Class I malocclusion with crowding in both arches, contraction of upper arch, posterior cross bite, and anterior deep bite (figs. 1-8).
Fig. 3
Initial intraoral left view.

Fig. 4
Initial occlusal upper view.

Fig. 5
Initial occlusal lower view.

Fig. 6
Initial panoramic X-ray tracing.

Fig. 7
Initial profile X-ray tracing.

Fig. 8
Initial cephalometric tracing.
The CLASS System\textsuperscript{1,2,3} mounting was carried out using the laboratory system adenta Lab Tec, designed by Dr. Pablo Echarri and eng. Claus Schendell\textsuperscript{4,5}. The mounting of the models was carried out in the SAM3 articulator, and set-up models were carried out with the Set-Up Model Maker (SUM) (fig. 9). The Occlusal Plane Reference was used for set-up models correction and brackets positioning. Evolution SLT (adenta GmbH) self-ligating brackets were used and the transfer trays were carried out with Smart Cap System.

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{Fig9.png}
\caption{The Set-Up Model Maker (SUM).}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{Fig10.png}
\caption{Model positioned in the SUM.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{Fig11.png}
\caption{The impression of the model is taken with the SUM.}
\end{figure}

**Treatment**

First, the models were mounted in the SAM3 articulator, and then the upper model was transferred to the Set-Up Model Maker (SUM), and it was fixed together with its articulator plate to the Model Holder of the SUM (fig. 10). An impression of dento-alveolar zone was then taken in silicone using the upper part of the SUM, and the same position obtained by articulator mounting was maintained (fig. 11). Then, a horizontal cut was made in the base of the model (fig. 12) and all the teeth were separated, one by one (fig. 13). After trimming, the teeth were
put back in the impression (fig. 14) and they were fixed to the base with the wax (figs. 15-16). In this way, the set-up model is carried out quickly and with accuracy, so it can be put back to the articulator maintaining all its relations that has been programmed previously.

The Occlusal Plane Reference (OPR) was used to correct the set-up model according to the treatment plan. The OPR uses the same base as SUM, but the upper part of the SUM is replaced by Multidirectional Adaptation Appliance (MAA), which allows the adaptation of the transparent Occlusal Plane Plate to the model. It also allows the movements in all planes (fig. 17). The Occlusal Visual Treatment Objective (OcVTO) is fixed to transparent Occlusal Plane Plate, and it was superimposed upon the teeth (fig. 18). In this way, the set-up model correction can be carried out, having all the parameters under control:

Fig.12
A horizontal cut is carried out in the model to separate the dento-alveolar zone from the model base.

Fig.13
Separated teeth.

Fig.14
Separated teeth, inserted back in the silicon impression.

Fig.15
The SUM with its upper part with the teeth. The same relationship with the base of the model is maintained.
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Fig. 16
Set-up model is finished and the upper SUM part is removed.

Fig. 17
The Occlusal Plane Reference (OPR) with the set-up model, adjusting the Occlusal Plane Plate to the model teeth.

Fig. 18
The Occlusal VTO is positioned on the OPR, and superimposed on the model.

Fig. 19
When the set-up model is corrected, the teeth of the model must match with the Occlusal VTO.

Fig. 20
Corrected set-up model.

Fig. 21
When both set-up models are corrected, they are put back in the articulator to check functional occlusion.
All dental movements match completely with the treatment plan.
Vertical dimension is maintained.
Sagittal rotation of occlusal plane is maintained.
Transverse rotation of occlusal plane is maintained.
Curve of Spee can be leveled.
Curve of Wilson can be leveled.

When the position of all set-up model teeth matched with the OcVTO (fig. 19), the correction was finished (fig. 20). The same procedure is used for antagonist set-up model. As all the relationships obtained in the articulator were maintained, the models were put back in the articulator to check the functional occlusion: anterior guide, canine guides, and mandibular movements (fig. 21).

Then the brackets were positioned to the model using the OPR, too. The transparent Occlusal Plane Plate in MAA was replaced by short transparent arch wire positioning plate (fig. 22). The full size .018” x .025” SS ideal lingual arch wire was adapted. This arch wire can be positioned again any time during the treatment, and this is why it is stored together with the records of the height and rotation used for its positioning, so if necessary, a bracket can be re-positioned again.

The next step is the positioning of the brackets to the arch wire. In this case, the ligatures were not necessary, because self-ligating brackets were used (Evolution SLT Bracket) (figs. 23-24).
The model was painted with plaster separator and the brackets were bonded to the model with Light Bond. All the brackets then were opened to facilitate the removal of the arch wire (fig. 25). As it has been already mentioned, the short transparent arch wire positioning plate was stored until the end of the treatment (fig. 26). To finish the process, transfer trays were carried out (figs. 27-28).

Smart Cap transfer tray System was used, which consists of the following ready-made elements: Smart Tube (fig. 29a&b), which fits perfectly to the Evolution SLT brackets, Smart Connector (fig. 30), and Smart Cap (fig. 31). When the bracket was bonded to the model tooth (fig. 32), Smart Connector was inserted into the Smart Tube (fig. 33), which is positioned on the bracket on the model (fig. 34). The height was marked (fig. 35), and then the Smart Connector was bent to labial (figs. 36-37). Then, another mark was made on the Smart Connector at the level of the labial cusp of the tooth (fig. 39). A base was formed with Triad or similar resin over the labial cusp of the tooth. Then, Smart Connector was bent to occlusal (fig. 40), and the Smart Cap was positioned (Fig. 41).
Smart Cap was fixed with resin to the base we had carried out over the labial cusp (fig. 42), and the transfer tray was finished. Smart Jig (figs. 43-44) can also be used for easier manipulation of the tray. The figure 45 shows finished transfer tray.

Fig. 29
a&b – Smart Tube.

Fig. 30
Smart Connector.

Fig. 31
Smart Cap.

Fig. 32
Bracket bonded to the model.

Fig. 33
The Smart Connector is inserted into the Smart Tube.

Fig. 34
The Smart Tube is positioned on the bracket.
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**Fig. 35**
The occlusal height is marked on the Smart Connector.

**Fig. 36**
The Smart Connector is bent to labial.

**Fig. 37**
Smart Tube in its position.

**Fig. 38**
The labial tooth cusp position is marked on the Smart Connector.

**Fig. 39**
The resin or composite base is carried out over the tooth cusp.

**Fig. 40**
The Smart Connector is cut and bent to occlusal.
Fig. 41
The Smart Cap is positioned in the Smart Connector.

Fig. 42
The Smart Cap and the resin base in labial cusp are joined with the resin.

Fig. 43
The Smart Jig can be used for easy manipulation of the tray.

Fig. 44
The tray is finished and held by the Smart Jig.

Fig. 45
Finished tray.
In bonding stage, all the teeth were etched with the orthophosphoric acid, except upper central incisors, in which hydrofluoric acid was used, because of the porcelain crowns (fig. 46). The bonding can be carried out tooth-by-tooth, or the transfer trays can be positioned to the initial model and one-piece silicon tray can be carried out over them to facilitate the simultaneous bonding of all the teeth at once. The figures 47 and 48 show the process of bonding using the light-curing Transbond. With these trays, light-bonding adhesives can be used, flash paste excess can be removed, and also, they can be re-used in re-bonding during the whole treatment, if necessary.

In the maxilla, the sequence of the following arches was used: thermally formed .012” NiTi, .016” NiTi, thermally formed .016” x .022” NiTi, and .016” x .025” SS (figs. 54-59). Intermaxillary elastics were indicated for occlusion adjustment. The total treatment time was 16 months.

The final result can be seen in the figures 60-64. Also, after the treatment, the replacement of prosthesis and veneers was carried out to optimize the esthetics.

A complete protocol has been presented, which simplifies and standardizes the indirect bonding technique by CLASS System using the new laboratory system.
Fig. 49
Treatment progress in maxilla.

Fig. 50
Treatment progress in maxilla.

Fig. 51
Treatment progress in maxilla.

Fig. 52
Treatment progress in maxilla.

Fig. 53
Treatment progress in maxilla.

Fig. 54
Treatment progress in mandible.
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Fig. 55
Treatment progress in mandible.

Fig. 56
Treatment progress in mandible.

Fig. 57
Treatment progress in mandible.

Fig. 58
Treatment progress in mandible.

Fig. 59
Treatment progress in mandible.

Fig. 60
Final intraoral right view.
Fig. 61
Final intraoral central view.

Fig. 62
Final intraoral left view.

Fig. 63
Final occlusal upper view.

Fig. 64
Final occlusal lower view.

Bibliography: