

# Complete Clinical Orthodontics: treatment mechanics: part 3

Dr. Antonino Secchi summarizes the specific strategies within the CCO System to manage space closure in different anchorage situations

## Introduction

Anchorage management, specifically in extraction cases, is an important concept in clinical orthodontics. Therefore, the main objective of this article is to summarize the specific strategies within the Complete Clinical Orthodontic (CCO) System<sup>1</sup> to manage space closure in different anchorage situations.

Although the type of anchorage required and used should be determined before treatment starts, the actual space closure mechanics in extraction cases is handled at the working stage, and after the following objectives have been previously and properly achieved:

- Complete leveling and alignment
- All rotations corrected
- Maxillary and mandibular arches coordinated
- Maxillary and mandibular occlusal planes flat
- Proper maxillary and mandibular incisors inclination achieved

Once CCO's Stage 1 (Leveling and Aligning) is completed the residual extraction spaces are often smaller than at the

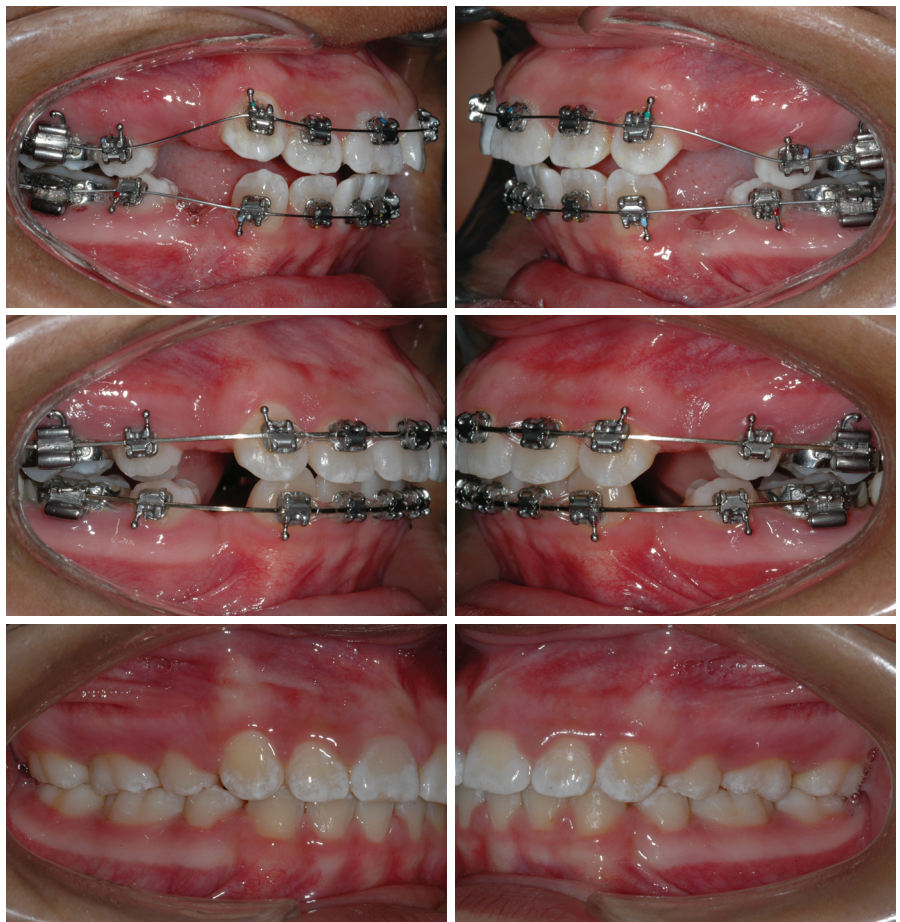
## Educational aims and objectives

This article aims to continue to the discussion of the CCO System and to explore strategies within the system to manage space closure in different anchorage situations.

## Expected outcomes

Correctly answering the questions on page xx, worth 2 hours of CE, will demonstrate the reader can:

- Identify accurate ways to determine the anchorage requirement by using a visual treatment objective (VTO).
- Discuss three types of anchorage requirements: minimum, medium, or maximum.



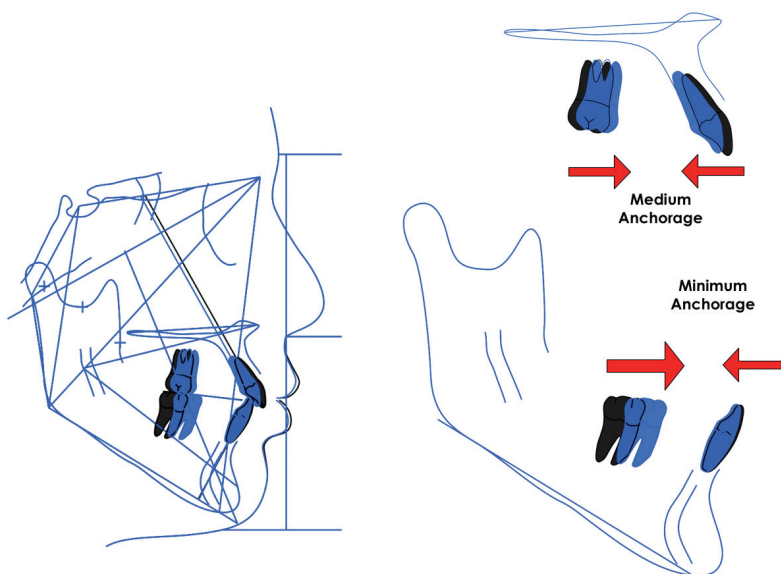
Figures 1A-1F show an upper and lower first premolar extraction case at the beginning of treatment with the initial 0.014-inch Sentalloy wire. 1C-1D show the same case at the end of Stage 1 and beginning of Stage 2 where all the objectives before starting space closure mechanics have been achieved. Upper and lower teeth are aligned and leveled, all rotations are corrected, upper and lower incisors are uprighted, the overjet and overbite improved, the extraction spaces have decreased, and the maxillary and mandibular occlusal planes are flat. Now, the case is ready for space closure. 1E-1F show the case finished



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beginning of treatment. This phenomenon is seen since a portion of the extraction space has been used to unravel the initial crowding and to upright the maxillary

and mandibular incisors, as described in "Complete Clinical Orthodontics: Treatment Mechanics, Part 1"<sup>2</sup>. Also, the maxillary and mandibular occlusal planes should be



Figures 2A-2G: 2A-2B show the initial photos of a case treated with extractions. The anchorage was determined based on the VTO. Figure 2C shows the initial cephalometric (black) superimposed with the VTO (blue). Two years of growth were factored in. Torque of the upper and lower incisors was maintained. The anchorage for the maxilla was determined as medium (at least on the right side most of the space would be taken by the ectopically positioned canine). For the mandible the anchorage was determined as minimum since the molars would be moved forward to a Class I relationship. 2D-E show the case at the beginning of treatment with an 0.014-inch Sentalloy wire. Upper first premolars and lower second premolars were extracted. 2F-2G show the case at the end of treatment

flat or almost flat, the upper and the lower arches should be coordinated,<sup>3</sup> and the six anterior teeth should be consolidated into one unit (Figures 1A-1D). At this point,

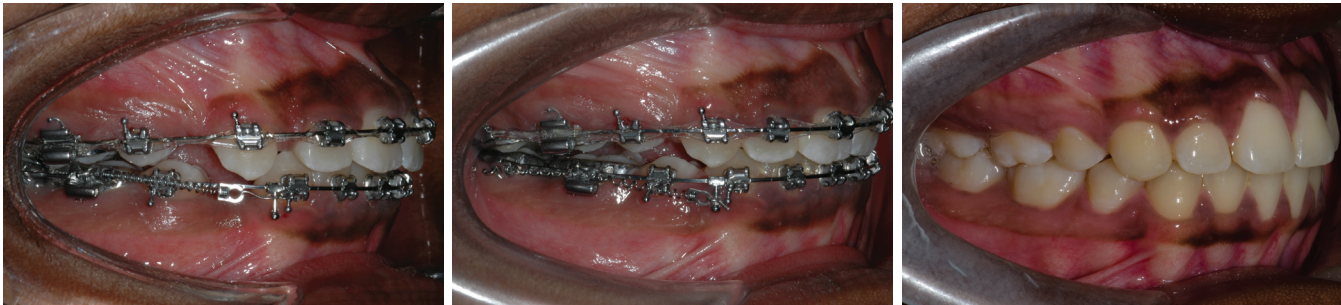
we should be working with a rectangular stainless steel (SS) archwires, either a 0.019×0.025-inch or 0.021×0.025-inch, depending upon the anchorage situation.

The archwire selection will be further described in detail later in this article. To efficiently close the remaining spaces, we then need to implement the selected and necessary anchorage modality, which will allow us to move teeth either more mesially or distally to achieve the desired functional and esthetic goals.

We believe that one of the easiest and more accurate ways to determine the anchorage requirement is to perform a visual treatment objective (VTO). The VTO is a cephalometric exercise popularized by Ricketts<sup>4</sup> where we modify the patient's cephalometric tracing to achieve the desired "end of treatment" result. When both tracings are superimposed, we can visualize and quantify the movements that need to occur to obtain that result. The VTO is not a formula or equation that will determine or impose a specific type of treatment, but it is an exercise where we can take into account our clinical experience from other similar cases, provide an estimation of the growth the patient will have during treatment, assess the patient's biotype and soft tissue characteristic, etc. This tool and guide allows the clinician to more accurately treatment plan cases and have a visual representation of the journey and end result. Once the VTO is completed, the anchorage requirements can be defined and be divided into one of three types: minimum, medium, or maximum. It is important to notice that the anchorage requirement is arch specific and therefore, there are clinical situations where the anchorage will differ from one arch to the other (Figures 2A-2G).

Before describing each one of these anchorage situations, it is important to indicate the wires and auxiliaries used at this stage as well as the goals to be achieved (Table 1). In the CCO system, straight archwires with hooks and Sentalloy<sup>®</sup> coils (GAC International) are used. The wire is stainless steel and can be either 0.019×0.025-inch or 0.021×0.025-inch, depending upon the anchorage situation. The hooks are crimpable hooks that are usually crimped into the archwire distal of the canine. The Sentalloy coils can be light (100 gr), medium (150 gr), or heavy (200 gr). The most common coils used are medium (150 gr) and heavy (200 gr). They work very well in all kind of anchorage situations. When the anchorage situation calls for it, additional auxiliaries may be utilized to enhance the posterior anchorage. For example, the clinician may





Figures 3A-3C: 3A shows an extraction case at the beginning of the space closure. Notice the crimpable hook distal of lower canine and the Sentalloy coil attached from first molar to the surgical hook. 3B shows the same case after the space has been closed. During space closure the Sentalloy coils were moved from the first molar to the second molar to adjust the anchorage as required by the case. Figure 3C shows the case finished



Figure 4A-4C: 4A shows a case with a missing lower first molar. The treatment plan was to move the second and third molars forward to close the space. The Sentalloy coil was attached from the second molar to the hook of the first premolar. Notice that all anterior teeth are tied with an elastomeric chain, so they can act as one unit in this minimum anchorage case. 4B shows the space already closed with the molars in Class I. Now the coil is extended to the third molar to move it forward. 4C shows the case with all the spaces closed and the case ready to be finished

Extractions			
.022 Slot	.018 Slot	Anchorage	Goals
.019 x .025 ss with hooks Sentalloy coils 150 gr	.018 x .022 ss with hooks Sentalloy coils 150 gr	Medium	Close spaces by moving anterior teeth backward approximately the same amount as moving the posterior teeth forward.
.019 x .025 ss with hooks Sentalloy coils 150-200 gr	.018 x .022 ss with hooks Sentalloy coils 150-200 gr	Maximum	Close spaces by moving anterior teeth backward minimizing the movement of posterior teeth forward.
.021 x .025 ss with hooks Sentalloy coils 150-200 gr	.018 x .025 ss with hooks Sentalloy coils 150-200 gr	Minimum	Close spaces by moving posterior teeth forward minimizing the movement of anterior teeth backward.

choose to use auxiliaries like transpalatal bars (TPB), temporary anchorage devices (TAD), or extraoral anchorage such as headgear (HG).

Sentalloy Coil Activation

As pointed out before, Sentalloy coils come in different strength, 100 gr (blue dot), 150 gr (yellow dot), and 200 gr (red dot). These coils deliver the same force independent of the amount of activation or length the coil is stretched. In the CCO mechanics, a surgical hook is crimped distal of the canine where the Sentalloy coil is engaged. The other end of the coil is connected to the elastic hook of either the first or second molar (Figures 3A-3B); the molar choice depends upon the anchorage required. If a surgical hook is not available, the Sentalloy

coil can be engaged to the hook of the canine or premolar’s bracket. This situation requires the six or eight front teeth to be tied together with either an elastomeric chain or a stainless steel ligature so they act as a unit (Figures 4A-4B).

Medium Anchorage

This is the most common anchorage situation encountered. Medium anchorage means that the remaining spaces are closed reciprocally. For this situation, we use a 0.019×0.025-inch SS wire. The activation of the Sentalloy coils for this anchorage requirement is often to the elastic hook of the first molar (Figures 5A-5B). However, it can also be done from the second molars depending on how the case is progressing. The bone and attachment apparatus is not

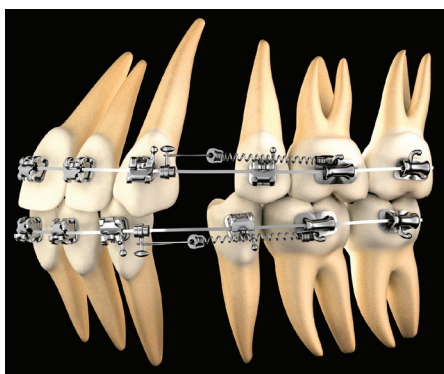
the same for every patient, and therefore, the response to the closing mechanic could differ between cases. A clinical examination of the overbite/overjet, canine and molar relationship, and facial esthetics should be done at each visit to evaluate any changes in activation that may be required. This should take minimal additional chairtime, since the management of the Sentalloy coil is in itself an easy procedure. At this point, we ask the patient to wear short, 3/16” 4 oz Class II elastics at nighttime.

Maximum Anchorage

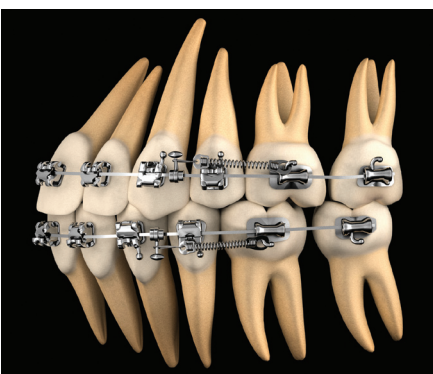
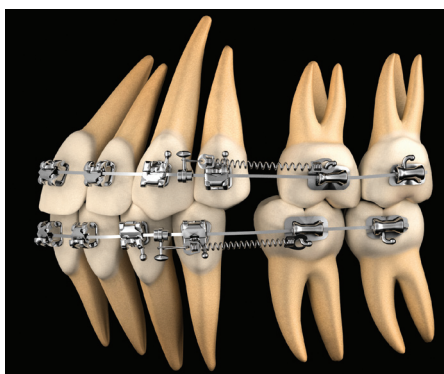
In a maximum anchorage situation, most of the remaining space left after leveling and aligning is closed due to distal movement of the anterior teeth. We use a 0.019×0.025-inch SS wire. The Sentalloy coil is activated from the second molars (Fig. 6a-b). Also, at this point, we ask the patient to wear short, 3/16” 4 oz or 6 oz Class II elastics at nighttime as well as during daytime if needed. Although not frequently required, auxiliaries to enhance posterior anchorage such as TPB, TADs, or HG can be used.

Minimum Anchorage

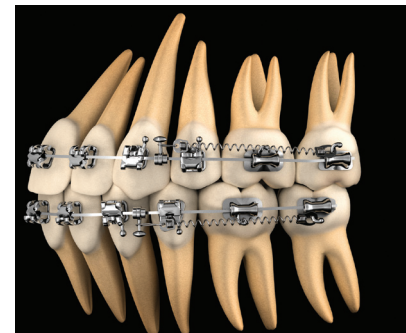
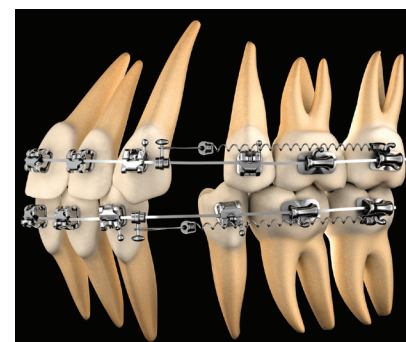
In a minimum anchorage situation, molars are moved mesially to close the



Figures 5A-5B show the diagram of a medium anchorage situation. Crimpable, surgical hooks placed distal of the canines and Sentalloy coils attached from the surgical hook to the elastic hook of the first molars. It is important to remember that the Sentalloy coils should not be extended more than five times their passive length. Therefore, depending on how long is the distance from the hook to the molars, the coils can be extended using stainless steel ligatures.



Figures 7A-7B show the diagram of a minimum anchorage situation. Usually second premolars are extracted, the wires increased in stiffness to an 0.021x0.025-inch SS, and the coils are activated from the first molars



Figures 6A-6B shows the diagram of a maximum anchorage situation. Usually first premolars are extracted, the wires are 0.019x0.025-inch SS, and the coils are attached from the second molars to the surgical hook

remaining extraction spaces. The use of a 0.021x0.025-inch SS wire facilitates this type of movement more efficiently. This wire will not only help to maintain the buccal crown torque of the maxillary incisors and the mesial tip of the maxillary and mandibular canines, but even more important, this wire will prevent the collapse of the occlusal plane because of its stiffness. This is typically seen in the lower arch; when the the molars are moved mesially/forward, the Curve of Spee becomes deep, the incisors tip back, the molars tip mesially, and a lateral open bite develops. Round wires of any kind and/or any flexible wire are not stiff enough to overcome the collapse of the occlusal plane when protracting molars. The activation of the Sentalloy coils must be done from the elastic hook of the first molars in minimum anchorage situations (Figures 7A-7B). As a reminder, molar tubes are essentially passive attachments with a very low resistance to sliding (even lower than most passive brackets<sup>5</sup>) and therefore sliding and control of molars are

both possible when using such large SS wire as the 0.021x0.025-inch SS wire.

After the first molar is moved mesially/forward to its desired location, the second molar can subsequently be activated and moved mesially/forward. Most often, this is not required since the second molars will travel mesially/forward with the first molars. The residual space remaining between the first and second molars is very small and can be easily closed with an elastomeric chain. At this point, we ask the patient to wear short, 3/16" 4 oz Class II elastics at nighttime.

In summary, understanding anchorage requirements and management is of paramount importance, especially in extraction cases. Completing a VTO helps to determine the specific anchorage requirements for a particular case. Anchorage requirements can be divided in minimum, medium (the most common), and maximum. Each one of these three types of anchorage requires the use of specific archwires and auxiliaries such Sentalloy coils and crimpable hooks. It is

very important to remember that before closing extraction spaces, all the objectives of Stage 1 are accomplished. The CCO System has a simple but accurate and predictable protocol to manage the anchorage requirements as well as space closure in extraction cases. **OP**

#### REFERENCES

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5. Garcia-Baeza J. *Resistance to Sliding of Different Molar Bracket Tubes/Archwire Couples at Different Angulations* [master's thesis]. Philadelphia, PA: University of Pennsylvania, Department of Orthodontics; 2011.