MAK Bends and MAK Stops: An Innovative Way to put Bends and Stops in NiTi Archwires

PG Makhija, Abhishek Gupta, Kamna Jain, Virag Bhatia, Madhur Navlani

ABSTRACT

Introduction: It is difficult to bend NiTi wire because of its shape memory properties. Although prefabricated NiTi archwires, such as the Connecticut Intrusion Arch or utility archwire are available, there is no simple, economic method available to incorporate first or second order bends in NiTi wires. Similarly there is no simple, economic and reliable method available to place stops in NiTi archwires. A simple creative method of using sterile disposable surgical needle segments as archwire stops (Makhija, Abhishek, Kamna or MAK stops) and archwire bends (MAK bends) is demonstrated. These may be adapted as custom stops and bends in NiTi archwires for fabricating intrusion, extrusion, expansion and distalization archwires.

Materials and methods: Fresh unused, sterile, disposable, 18 to 23 gauge surgical needles are segmented using a diamond cutting disk to use as crimpable stops (MAK stops), stops of varying length may also be bent with optical pliers to incorporate bends in NiTi wires (MAK bends).

Conclusion: MAK stops and MAK bends are simple, easy and an economical chairside method to incorporate a range of applications which, overcome some of issues with formability of NiTi wires.

Keywords: Molar stops, NiTi wires, Anchor bend.


INTRODUCTION

Nitinol wires have limited formability, which contraindicates their use for situations where bends with a small radius are required.

Nitinol wires are associated with advantages, such as fewer archwire changes, less chairside time, reduction in time required to accomplish rotations and leveling and less patient discomfort. However, several other properties of nitinol impose limitations on its use. The poor formability of these wires challenges the clinician to incorporate first-, second- and third-order bends. Nitinol fractures readily when bent over a sharp edge.

Several attempts were made to bend NiTi wires and simultaneously keep their superelastic properties. Miura et al proposed the direct electric resistance heat treatment method which was used to develop the first machine known as Archmate by Gac, but it was not popular.

Since hooks cannot be bent or attached to nitinol, crimpable hooks and stops have been recommended for use. Cinch-backs distal to molar buccal tubes can be obtained by placing crimpable archwire stops, preformed archwire stops, Gurin locks, crimpable hooks have been used for a variety of applications which include molar distalization. The Connecticut Intrusion Arch is a multifunctional wire that is preformed from nickel-titanium and provides the high performance and mechanical advantages of these alloys. Although incisor intrusion is its most common application, various other functions can easily be performed with only minor modifications like simultaneous Class II molar correction, incisor flaring, correction of minor open bite (incisor extrusion) and correction of anterior occlusal cant.

All of the aforementioned applications of preformed archwires and auxiliary attachment, such as stops and hooks reduce the adaptability of the wires as the clinician is limited by its proprietary shape. Moreover, the cost of the archwires and auxiliaries may be prohibitive in some circumstances.

MATERIALS AND METHODS

Makhija, Abhishek and Kamna or MAK stops are fabricated by cutting the prescribed dimension (Table 1) from sterile, disposable, hollow surgical needles (Fig. 1) for the specific dimension of flexible round or rectangular NiTi wire. MAK bends are modified MAK stops which incorporate bends in the NiTi wires for specific activities.
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**Methods**

A simple and easy technique to fabricate a MAK stop is described as follows:

1. A carborandum or diamond cutting disk (Fig. 2) is used to segment the prescribed gauge needle for the particular dimension of superelastic wire, as given in the table (Table 1). The usual length of a segment is 2 mm for stops and 4 mm for bends depending on the intended use. The lumen of the segment is cleaned by wiping it with alcohol followed by compressed air.

2. For MAK stops, needle segment is passed over the archwire end, placed in the designated position and crimped using Weingart pliers secure over NiTi.

3. To fabricate the MAK bends, the secured sleeve is bent with optical pliers to fabricate intrusion, extrusion, flaring, bite correction or distalization arches.

**Clinical Uses**

MAK stops and MAK bends can be a creative and cost-effective solution in many situations with NiTi wires. A number of applications include the following:

1. Midline stops to prevent slipping and walking or wandering of wire particularly in self-ligating systems (SLB; Fig. 3).
2. Toe-in bends mesial to molars (Fig. 4).
3. Molar stops (Fig. 5).
4. Stops to facilitate proclination of anterior teeth (Fig. 6).
5. Tight cinching at the back of wire (MAK stops crimped on distal ends).
6. Facilitation of single or double molar distalization (Figs 7A and 7B).
7. Placing anchor bends, toe in, toe out in flexible NiTi wires (Fig. 8).
8. Forming Connecticut intrusion and protraction archwire (Fig. 9).
9. Forming expansion or contraction archwires from NiTi wires.
10. Forming a utility archwire from flexible NiTi wires (Fig. 10).
11. Placing first- and second-order bends in flexible rectangular NiTi archwires (Fig. 11).
12. Space maintenance.
13. For space regaining when placed between adjacent teeth.

**Table 1: Suggested gauge of surgical needles**

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Dimensions of wire (superelastic NiTi)</th>
<th>Gauge of needle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.014” round</td>
<td>23</td>
</tr>
<tr>
<td>2.</td>
<td>0.016” round</td>
<td>22</td>
</tr>
<tr>
<td>3.</td>
<td>0.018” round</td>
<td>21</td>
</tr>
<tr>
<td>4.</td>
<td>0.016” × 0.022” rectangular</td>
<td>20</td>
</tr>
<tr>
<td>5.</td>
<td>0.019” × 0.025” rectangular</td>
<td>18</td>
</tr>
<tr>
<td>6.</td>
<td>0.021” × 0.025” rectangular</td>
<td>18</td>
</tr>
</tbody>
</table>

**Fig. 1:** Armamentarium used for fabrication of MAK stops, MAK bends

**Fig. 2:** Cutting the needle for MAK stops/bends

**Fig. 3:** Archwire stops in SLB archwires

**Fig. 4:** Toe-in mesial to molars with MAK bends
Fig. 5: Bilateral MAK stops for anterior expansion

Fig. 6: MAK stops to procline anterior teeth

Fig. 7A: MAK stops for molar distalization

Fig. 7B: MAK stops for double molar distalization

Fig. 8: Anchor bends in NiTi wire with the help of MAK bends

Fig. 9: MAK bends used for fabrication of intrusion arches

Fig. 10: MAK bends used for fabrication of utility arches

Fig. 11: MAK bends for first and second order bends in NiTi wire
CONCLUSION

A creative solution has been recommended to address poor formability issues with NiTi wires by fabricating a sleeve from a surgical needle (MAK stops) and then bending the sleeve itself to produce an accurate bend in a NiTi wire (MAK bend) to increase the functionality of NiTi wires.

REFERENCES