

JCO-Online Copyright 2012**Lingual Orthodontics: A Status Report, Part 5: Lingual Mechanotherapy****VOLUME 17 : NUMBER 02 : PAGES (99-115) 1983****C. MOODY ALEXANDER, DDS****R.G. ALEXANDER, DDS,****MS JOHN C. GORMAN, DMD****JAMES J. HILGERS, DDS, MS****CRAVEN KURZ, DDS****ROBERT P. SCHOLZ , DDS****JOHN R. SMITH, DDS****MICHAEL L. SWARTZ, DDS, Editor**

In the preceding articles, we have presented the development history, rationale, bonding procedures, and some general guidelines on patient selection for lingual orthodontics. These were offered as building blocks, providing the basis for this report and the case presentations to follow.

While we all know a "cookbook" approach cannot routinely be applied to a biological situation, we have found it necessary at this early stage of lingual development to attempt to categorize our diverse mechanotherapy approaches into a set of guidelines that the lingual practitioner must modify to meet the specific requirements of the case at hand.

These treatment guidelines are the result of two or more years of lingual experience compiled from seven practitioners of varying backgrounds and philosophies of treatment. Differences of opinion are presented along with concurrences. We present a few of the many avenues in lingual mechanotherapy that can lead to a unifying goal of excellence. Certainly, as we all continue to learn, these approaches will be modified and some discarded, for it would be presumptuous to imply that in our limited exposure to lingual mechanics there is no further improvement required.

Treatment Sequence-- General

For convenience of discussion, we have defined four primary phases of edgewise lingual mechanics:

1. Leveling, aligning, rotational control, and bite opening
2. Torque control
3. Consolidation and retraction
4. Detailing and finishing

These phases are generally characterized by a progressive increase in wire stiffness. A wire selection guide ([Fig. 1](#)), utilizing the work by Burstone¹ in quantifying wire stiffness, may provide some general guidelines in the archwire progressions by phase of treatment and degree of malocclusion.

The decisions on which teeth to bond or band and on the use of lingual and buccal brackets are dictated by:

1. The patient's smile and esthetic concerns
2. The lingual clinical crown length
3. Anchorage and arch form considerations

Whenever possible, the patient should be encouraged to accept conventional labial appliance treatment on the lower arch. In a great many cases, this will satisfy the patient's needs and simplify the treatment. The bonding or banding of maxillary bicuspids is also an esthetic decision. Placement of buccal and lingual brackets on maxillary second bicuspids can be tolerated by many lingual patients and can add considerably to the stability of the buccal segments, particularly on extraction cases.

Short lingual crowns on mandibular bicuspids frequently preclude the bonding of lingual brackets. These teeth may be bypassed on the lingual arch in favor of buccal segments, or banded with buccal and lingual attachments. The latter would certainly be preferred in cases requiring the additional stability and control of arch form afforded by combined buccal/lingual mechanics.

Lingual archwire form and the necessary first and second order bends require some discussion. Compensating bends should be made in the very first wire placed. First order bends between cuspids and bicuspids should be made at right angles, with a generous step to allow for the differences in labiolingual thickness between cuspids and premolars. First order bends contacting the mesiolingual of bicuspids or first molars can also act as archwire stops. These can provide an advancing or expansive force to the arch ([Fig. 2A](#)). While this can be used to advantage when advancement is indicated, one must be cautious to allow room

between wire bends and lingual brackets and teeth for retraction or consolidation mechanics, and to avoid undesirable anterior expansion ([Fig. 2B](#)).

The lingual appliance can be expansive in nature. Much of the expansion force can be attributed to insufficient constriction of archwire form in the anterior segments. As rotations are corrected and the anteriors align, archwire length is gained. If the anterior arch form is just slightly oversize, the gain in archwire can produce an advancing force. Contouring a small-diameter, dead-soft brass wire into the bracket slots cuspid to cuspid and measuring the resulting archwire length may be helpful in determining arch form and necessary wire length.

A tendency to induce an anterior maxillary open bite should also be recognized. While all the cause-and-effect relations are not fully understood at present, this tendency seems to occur more often in nonextraction cases and in moderate-to-high mandibular plane angle cases. Advancement of maxillary anteriors on resilient round wires, coupled with posterior extrusion, may permit the tongue to open the anterior bite further. This tendency is difficult to control, but its prevention is of paramount importance.

Prevention includes:

1. Early control of posterior extrusion with high-pull headgear and the early establishment of buccal segment control
2. Minimizing anterior advancement until the rectangular archwire stage (i.e., .016" x .022" D-Rect or greater)
3. Patient education on tongue positioning
4. Prevention of vertical archwire bowing by avoiding intra- and intermaxillary elastics until stiffer rectangular archwires are used
5. Coordination of arches to maintain the relation of maxillary incisor bracket bite plane to mandibular incisor
6. Early use of vertical lingual elastics on suspect cases
7. Delaying the treatment of maxillary second molars until finishing arches

Leveling, Aligning, Rotational Control, and Bite Opening

The objectives of this initial phase of therapy are to:

1. initiate tooth movement with light forces,
2. provide for a period of patient adaptation,
3. eliminate rotations,
4. level and align individual arches to permit wire progression,
5. obtain initial torque control when required,
6. establish posterior anchorage units with buccal segments,
7. initiate posterior segment control with extraoral traction and transpalatal arch when required,
8. reduce any excessive overbite, and
9. gain space for rotations and additional bracket bonding.

Typically, these objectives have been met using lingual archwires having a wire stiffness of less than 200, combined with complete seating of the archwire within the bracket slot and a degree of patience in permitting these resilient wires to express their control.

A common problem in lingual therapy, infrequently encountered with labial brackets, is the inability to place a lingual bracket or to achieve wire engagement with moderate-to-severe crowding. A common problem with lingual edgewise brackets that have a horizontal slot is the additional difficulty in obtaining complete archwire engagement and the tendency for the archwire to be pulled out of the bracket slot. Neither of these concerns occurs with labial mechanics, and both are a function of the high bracket-slot torque angles and lingual directional forces ([Fig. 3](#)).

A ligation method termed the double-over tie has been effective with both metal and elastic ligatures in directing the ligating force more directly along the bracket-slot angle ([Fig. 4](#)). This ligating technique has greatly improved the ability to eliminate rotations and maintain archwire engagement throughout treatment. Several auxiliary devices have been tried for rotational control. Thus far, round elastomeric tubing with .009" ligature wire passing through the tubing and ligated in place has been most effective in correcting rotations ([Fig. 5](#)).

Lingual archwires that have proven effective for initial leveling and alignment have been the multistrand spiral wires-- .0155" and .0175" [Respond](#), .014" [Nitinol](#), .016" [TMA](#), and where early torque control is required, .016" X .022" [D-Rect](#).

While the immediate bite opening can present some additional difficulties, e.g., vertical and A-P changes, it is certainly beneficial in deep bite correction and can be used to advantage in other instances. The immediate posterior disclusion provides an excellent opportunity for molar uprighting, any mesial posterior movement desired, and crossbite corrections; and, if distal movement via headgear is expected, it will be facilitated by the absence of interference of the posterior occlusion. If preparation for any of these corrections is required prior to opening the bite, bonding of the maxillary lingual brackets can be delayed.

These cases are best treated by initiating alignment with as many teeth as possible, while obtaining space for further alignment. On severely crowded extraction cases, initial cuspid retraction should not be attempted until the case is into a lingual arch having

a wire stiffness factor of 200 or more, e.g., .016" round stainless steel. Once space is gained, any remaining rotations are bonded and continued alignment is achieved with lighter wires, i.e., Respond, Nitinol, TMA, or D-Rect ([Fig. 6](#)). Initial cupid retraction for high or blocked-out cuspids can be achieved with light buccal elastics placed to a distogingly, labially bonded plastic button or [Elastilug](#) ([Fig. 7](#)). Where maxillary crowding involves the centrals or laterals, high-pull headgear with J-hooks to the lingual of the cuspids has been utilized effectively for gaining space by cupid retraction ([Fig. 8](#)). Open coil springs and initial cupid retraction with elastic chain have worked well in preparation for further alignment ([Fig. 9](#)).

Retraction/Consolidation Mechanics

Lingual mechanotherapy techniques for retraction and consolidation have followed conventional appliance procedures, using either sliding mechanics, closing loop arches, or combinations.

Proper anchorage preparation should receive additional attention, with the initial loss of posterior occlusion resulting from the bite plane opening. It has become standard practice to place a transpalatal arch and/or headgear on all extraction cases. As described in Part 4 (JCO, January 1983), this has eliminated earlier problems of transverse arch bowing and excessive mesiobuccal molar rotation due to retraction forces ([Fig. 10](#)).

Buccal segments should be leveled and aligned prior to initiating retractions. Buccal segment archwire stiffness should routinely be greater than lingual archwire stiffness by at least 400 stiffness numbers, e.g., .016" round stainless steel (Ws 256) or .0175" X .0175" TMA (Ws 292) lingual retraction arch, with buccal segments of .017" X .025" TMA (Ws 740/342) or .016" X .022" stainless steel (Ws 1130/598). On brachyfacial cases with more critical anchorage, consideration might be given to establishing a firm posterior occlusion prior to retraction mechanics.

Retraction of the maxillary anterior segment as a unit has become more frequent, as the cosmetically conscious lingual patient may object to the spacing with cupid retraction. This, of course, gives additional import to anchorage units and torque control during retraction.

Retraction mechanics should not be initiated until wires of sufficient stiffness (Ws greater than

250-300) can be utilized. Typically, the lingual archwires used for retraction have been .016" round stainless steel (Ws 256), .0175" X .0175" TMA (Ws 292), and .016" X .016" stainless steel (Ws 434). As mentioned previously, alignment of the anterior segment, prior to retraction, may require initial unraveling on heavier wires (e.g., .016" stainless steel), returning to the more resilient Respond, TMA, or D-Rect for complete engagement and alignment, followed again by the lingual retraction archwires. Retraction technique option considerations are: (1) anchorage needs, (2) patient desires and cooperation, and (3) the operator's preference, based on prior experience and expertise.

Where anchorage is of concern or maxillary anterior intrusion is desired, high-pull anterior headgear may be considered. This extraoral traction method has been successful with J-hooks to the lingual of the cuspids and the anteriors ligated together. A lingual closing archwire can be used in conjunction with the extraoral retraction ([Fig. 11](#)). Another effective method that may offer additional torque control is the use of high-pull headgear to an acrylic plate ([Fig. 12](#)).

Cupid retraction, when indicated and permitted by the patient, has most often been accomplished on .016" stainless steel or .016" X .022" stainless steel. Posterior segments should be ligated as a unit and the cuspids firmly ligated with double-over steel ligatures. The maxillary anteriors may be ligated lateral to lateral with either steel ligature or elastic chain. A three-unit elastic chain is then placed from the ball hook on the cuspids to the most mesial tooth in the posterior unit. Once cupid retraction is complete, the cuspids are ligated as part of the posterior unit and anterior retraction is initiated on rectangular wire (e.g., .017" X .025" TMA) with closing loops ([Fig. 13](#)). The anteriors must be firmly ligated with a double-over tie at this time. One method used to insure complete seating of the retraction archwire and to unify the anterior segment is to place both metal and elastic ligatures. Steel ligature wire (.009") is first figure-eight tied to the segment. The archwire is then placed and secured with double-over tie elastic ligatures ([Fig. 14](#)).

Retraction of the entire anterior segment, following any initial cupid retraction and anterior alignment, should be performed on a rectangular wire with a relatively high stiffness factor, e.g., .016" X .022" stainless steel (Ws 1130/598) or .017" X .025" stainless steel (Ws 1761/815). Anodic reduction of the posterior wire will facilitate sliding mechanics while maintaining anterior torque control. Class I retraction force with closing loops ([Fig. 15](#)), sliding mechanics and elastics ([Fig. 16](#)), or J-hook headgear ([Fig. 11](#)) have all been effective options. Following retraction, any additional arch consolidation, torque control, and arch leveling can be accomplished with .016" X .022" stainless steel or .017" X .025" TMA and elastic chain or closing loops.

Midline corrections are difficult to make after arch consolidation, and every effort should be made to correct midline discrepancies by intra-arch shifting, i.e., unilateral retraction or coil springs.

Torque Control

Fortunately, with the rectangular wire selections available ([Fig. 1](#)) and following Burstone's principles of variable modulus orthodontics,¹ we can now initiate torque control early in treatment using .016" X .022" D-Rect (Ws 68/36) or .017" X .025" D-Rect (Ws 106/49) and maintain it in all

phases of treatment when torque control is required.

The amount of desired torque is obtained by varying the size of the square or rectangular archwires used. More torque has been built into the lingual brackets than is normally required to compensate for the many variables such as variable tooth morphology, bracket height vs. torque change, mode of treatment, and wire selection. It is, therefore, left to the practitioner to select the amount of torque and degree of control via his wire selection. Typically, lingual archwires used in finishing and torque control have been .016" X .022" stainless steel for moderate torque and .017" X .025" TMA for full torque.

Class II Correction and Detailing/Finishing

Whenever possible, utilization of intermaxillary elastics should be reserved for finishing arches with sufficient wire stiffness (greater than 700) to resist any arch deformation. Lingually placed Class II elastics, from the lower first molars to the maxillary cuspids, have not proven to be very effective. This is perhaps due to the more vertical vector component of the shorter span. Debnam cleats or Elastilugs bonded labially on maxillary cuspids are relatively esthetic, and elastics from the lower second molars to these cleats are functional and easier for the patient to apply and remove ([Fig. 17](#)). Additional Class II correction can also be accomplished with a gnathological positioner. Finishing archwires have been .016" X .022" stainless steel, .017" X .025" TMA, or .016" and .018" TMA when additional detailing of the occlusion is required.

Summary

As a number of our initial lingual cases reach completion and the earlier problems of accurate bracket placement are resolved, it becomes more and more apparent that lingual mechanotherapy should follow well-established conventional therapy principles. Additional archwire changes are often required, but with time and further refinements in appliance design, the system will be improved and simplified.

The cautious optimism of two years ago has been reinforced as our cases progress. Numerous mistakes have been made, but the trials and tribulations have resulted in positive developments. Continued research, perseverance, and patience will undoubtedly make this mode of treatment a viable alternative.

The suggested guidelines, with modification for the individual biological situation and with proper case selection, can yield treatment results with the same excellence that we strive to attain in all modes of orthodontic care.

(Examples of typical lingual mechanotherapy sequences are following)

Clinician: Dr. John Smith Case Type: Class I Crowding, Four Bicuspid Extraction

1. ? Indirect bond lingual brackets to upper and lower incisors, cuspids, and upper second bicuspids
.0175" Respond archwires

Separators for first molar bands

Extract four first bicuspids

2. ? Band upper and lower molars, buccal and lingual tubes

Transpalatal sheaths and transpalatal arch on upper first molars

Bond buccal attachments to upper and lower second molars and lower second bicuspids

.016" X .022" D-Rect (.018" slot) buccal segments

.016" TMA upper and lower lingual archwires; engage as many teeth as possible

3. Initial cuspid retraction

.0175" x .0175" or .017" x .025" buccal segments

Ligate bicuspids and molars together

? Upper and lower .016" SS or .016" x .016" SS lingual archwires; engage as many teeth as possible

Initiate cuspid retraction with elastic thread or chain from cuspids to second bicuspids

4. Anterior alignment

Discontinue cuspid retraction when sufficient space is obtained

Bond remaining anteriors and place .0175" Respond archwire to align

Wire progression: .0175" Respond, .016" TMA, .0175" x .0175" TMA, .016" x .022" SS

Double-over elastic ties

5. Anterior retraction

Figure-8 tie upper cuspids with .009" ligature

.016" X .022" SS upper archwire with compensating lingual arch bow

Double-over tie upper laterals

Steel ligature tie upper cuspids

Retract anterior segment with elastic chain or thread from anterior segment to second bicuspids

? Consolidate mandibular arch with .016" X .022" SS archwire with closing loops and/or elastic chain

Support anchorage with cervical, high-pull, or combination headgear, depending on MPA

6. Finishing arches

Continue with .016" x .022" SS; transition to .017" x .025" TMA if additional torque is required

Option-- .016" TMA for occlusal detailing

7. Extraction variations: upper first and lower second bicuspid or lower molar extraction cases

Proceed as outlined; place buccal and lingual closing loops

Gable bends in extraction sites

Clinician: Dr. John Smith Case Type: Nonextraction Class I or II

1. ? Indirect bond lingual brackets to upper and lower incisors and cuspids and upper first and second bicuspids

Bond buccal brackets to upper and lower second molars and lower first and second bicuspids

Band upper and lower first molars, buccal and lingual attachments

2. Level and align

? Lingual archwire progression: .0175" Respond, .016" TMA, .0175" X .0175" TMA, .016" X .016" or .016" X .022" SS

Gain space with interproximal reduction or with coil springs

.016" X .022" D-Rect or .017" X .025" D-Rect buccal segments

Transition to .017" X .025" TMA

3. Torque control

.016" X .022" SS, or .017" X .025" TMA if needed

Class II correction with .016" X .022" SS or wire of greater stiffness

Lingual Class II elastics

4. Finishing arches

.016" X .022" SS or .017" X .025" TMA

Option-- .016" TMA for occlusal detailing

Clinician: Dr. R.G. Alexander Case Type: Extraction

1. ? Indirect bond lingual brackets to upper incisors, cuspids, and second bicuspids

Separators for first molar bands

Extract four first bicuspids or upper first and lower second bicuspids

Direct bond buccal tubes to upper second molars if required

2. ? Band upper first molars, with buccal and lingual tubes and transpalatal sheaths

Initiate headgear and/or transpalatal arch per anchorage and MPA requirements

.017" X .025" D-Rect buccal segments

3. Level and align maxillary arch

Archwire progression: .0155" or .0175" Respond, .016" TMA, .016" SS

Eliminate rotations

Double-over elastic ties

4. Cuspid retraction

.017" X .025" SS buccal segments; ligate as a unit

.016" SS upper lingual arch

Elastic chain upper lateral to upper lateral

Retract cuspids with elastic chain from cuspids to second bicuspids

Complete rotation correction

5. Maxillary arch consolidation

Initiate mandibular arch Tx

Bond and band upper and lower arches with labial appliance whenever possible; or indirect

bond lower incisors and cuspids with lingual brackets, band lower second bicuspids and first molars with buccal and lingual brackets, and bond lower second molars with buccal tubes

.0155" or .0175" Respond lower archwire to level and correct rotations

Ligate upper cuspids, second bicuspids, and first and second molars as units

? Retract upper anterior unit on .017" X .025" TMA archwire with closing loops, maintaining headgear wear, or retract upper anterior unit on .016" X .022" SS with sliding mechanics and elastic chain

6. Upper and lower arch coordination

Continue upper anterior retraction

Lower archwire progression: .016" TMA, or .016" X .022" D-Rect if torque control is required

Lower .016" X .022" SS with arch-closing loops and/or elastic chain

Add molar to molar labial elastics when required for final space closure or minor rotations

7. Finishing arches

.017" X .025" TMA upper archwire

.016" X .022" or .017" X .025" TMA lower archwire

Detailing

Clinician: Dr. R.G. Alexander Case Type: Nonextraction

1. ? Indirect bond lingual brackets to upper incisors, cuspids, and first and second bicuspids

.0155" or .0175" Respond

Separators for upper first molar bands

Direct bond upper second molar buccal tubes if required

2. ? Band upper first molars, buccal and lingual tubes

Initiate headgear per anchorage and MPA requirements

.017" X .025" D-Rect on upper first and second molar buccal segments

3. Level and align upper arch

Archwire progression: .0155" or .0175" Respond, .016" TMA, .017" X .025" TMA

Gain space with interproximal reduction or consolidation of space with elastic chain

.017" X .025" SS buccal segments

4. Initiate lower arch treatment

.017" X .025" TMA finishing arch

? Treat lower arch with labial appliance; or indirect bond lingual brackets to lower incisors and cuspids, direct bond buccal brackets to lower first and second bicuspids and second molars, and band lower first molars, with buccal and lingual tubes

? Lower arch progression to level and align: .0175" Respond, .016" TMA or .016" X .022" D-Rect, .017" X .025" TMA

.017" X .025" D-Rect buccal segments

Transition to .017" X .025" SS

5. Finishing arches

.017" X .025" TMA upper and lower lingual archwires

.017" X .025" SS buccal segments

Initiate Class II, vertical, or midline elastics

Final positioning and detailing

Clinician: Dr. John C. Gorman Case Type: Class II Division 1, Upper First Bicuspid Extraction

1. ? Indirect bond lingual brackets to upper and lower incisors, cuspids, and second bicuspids, and lower first bicuspids

.0155" Respond on upper cuspid to cuspid and lower second bicuspid to second bicuspid

Separators for upper molar bands

Extract upper first bicuspids

2. ? Band upper and lower first and second molars, with buccal tubes, and lingual tubes and transpalatal arch sheaths on upper first molars

Transpalatal arch

.016" X .022" TMA buccal segments

3. Initial cuspid retraction

.016" TMA upper archwire

.0175" Respond lower archwire

High-pull headgear with J-hooks to upper cuspids

.017" X .025" TMA buccal segments

4. Cuspid retraction Level and align

.016" SS upper archwire

.016" TMA lower archwire

? Continue high-pull headgear with J-hooks to upper cuspids and supplement with elastic chain from cuspids to posterior segments

Discontinue cuspid retraction when sufficient space is gained to correct anterior crowding

.0175" Respond upper archwire, with double-over ties to correct rotations

Progress to .017" X .025" upper arch and .016" to .018" SS lower arch

5. Anterior retraction

.018" X .025" SS buccal segments

.017" X .025" SS archwire with closing loops, reduced in posterior segments to .016" X .022"

Figure-8 tie upper cusps

High-pull headgear with J-hooks to upper cusps

6. Finishing arches

.017" X .025" TMA upper archwire with omega loop stops, tied back

.018" SS lower archwire

Detailing

Clinician: Dr. John C. Gorman Case Type: Class II Division 1, Four Bicuspid Extraction

1. ? Indirect bond lingual brackets to upper and lower incisors and cusps, and upper second bicuspids

.0155" Respond upper and lower cuspid to cuspid

Separators for upper and lower molar bands, lower second bicuspid bands

Extract four first bicuspids

2. ? Band upper and lower second molars with buccal attachments, upper and lower first molars and lower second bicuspids with buccal and lingual attachments; transpalatal sheaths on upper first molars

Transpalatal arch

.016" X .022" TMA or .017" X .025" D-Rect buccal segments

3. Level and align

.016" TMA upper archwire

.0175" Respond lower archwire

Open coil spring where necessary to gain space in anterior segments

4. Initial cuspid retraction

.017" X .025" TMA buccal segments

.016" SS upper and lower arches with open coil springs

Initiate cuspid retraction with elastic chain

5. Anterior alignment

Discontinue cuspid retraction when enough space is gained to align upper anteriors

.0175" Respond upper arch, double-over ties

.0175" X .0175" TMA lower arch for torque control

Continue cuspid retraction to align and level lower arch

6. Maxillary anterior retraction

Class II correction

.018" X .025" SS buccal segments

.017" X .025" SS upper lingual archwire with closing loops

High-pull headgear with J-hooks to upper incisors and cusps ligated as a unit

.017" X .025" SS lower lingual archwire with closing loops

Initiate Class II elastics after arches are consolidated and level

7. Finishing arches

.017" X .025" TMA archwires, tied back

Detailing

Clinician: Dr. John C. Gorman Case Type: Class I Bimaxillary Protrusion With Severe Crowding (cusps blocked out), Four Bicuspid Extraction

1. ? Indirect bond lingual brackets to upper and lower incisors and second bicuspids

.0155" Respond archwires

Separators for molar bands

Extract four first bicuspids

2. ? Band upper and lower first and second molars, with buccal tubes

Lingual tubes on upper and lower first molars

Transpalatal sheaths on upper first molars

Transpalatal arch

.017" X .025" D-Rect buccal segments

Bond labial plastic retraction buttons on cusps as required

3. ? Initiate cuspid retraction on .0175" Respond archwire with Class I light elastics on buccal from second molars to cusps

4. Anterior alignment

Bond lingual brackets to upper and lower cusps when they are retracted sufficiently

.0155" or .0175" Respond, cinched back, to align

5. Arch leveling

? Upper and lower archwire progression: .016" TMA, .016" SS with lingual vertical elastics as required to close anterior bite
.018" X .025" SS buccal segments

6. Space closure, arch consolidation

.017" X .017" TMA upper archwire with elastic chain for continuous arch-sliding mechanics

.018" SS lower archwire with retraction loop

Class I elastics from loops to lower first molars

Double-over ties

7. Finishing arches

.0175" X .025" TMA upper and lower archwires

Detailing

Clinician: Dr. James J. Hilgers Case Type: Class I Bimaxillary Protrusion, Extraction

1. ? Indirect bond lingual brackets to upper and lower incisors and canines, and upper second bicuspids

.0155" or .0175" Respond

Separators for molar bands

Extract four first bicuspids

2. ? Band upper and lower first molars and lower second bicuspids, with buccal and lingual attachments

Band or bond buccal tubes to upper and lower second molars

.018" X .018" Nitinol buccal segments

3. Establish buccal segment posterior anchorage units

Initiate headgear wear if necessary

Buccal segment archwire progression: .018" X .018" Nitinol, .0175" X .025" TMA, .016" X .022" SS

Figure-8 ligate buccal segments (5-6-7)

? Lingual archwire progression: .0155" or .0175" Respond, .016" TMA, .016" Australian wire, .018" Australian wire; double-over elastic ties

4. Cuspid retraction

.018" Australian lingual archwires

.016" X .022" SS buccal segments, 5-6-7 ligated together

Metal ligature ties on upper and lower canines

Double-over elastic ties on upper and lower incisors

Retract canines with elastic chain from canines to second bicuspids

First and second order bends in lingual archwires mesial to second bicuspids and first molars

5. Anterior retraction

.017" X .017" TMA archwires with closing loops

Figure-8 ligate 3-5-6-7

Double-over metal ligature ties on upper and lower incisors

Coordinate upper and lower anterior retraction to maintain bite plane occlusion

6. ? .016" X .022" or .017" X .025" D-Rect or Force 9 to level

7. Torque control and finishing arches

.016" X .016" SS to .016" X .022" SS archwires

Seat occlusion and detail

8. ? Gnathological positioner and/or retention appliance

Clinician: Dr. James J. Hilgers Case Type: Class II Division 2 Nonextraction, TMJ Tx

1. ? Expand and advance upper arch with Crozat appliance

2. ? Temporary stabilization of upper arch with vacuum-formed plastic splint during fabrication of lingual indirect setup

3. ? Indirect bond lingual brackets to upper and lower canines, canines, and first bicuspids, and upper second bicuspids

.0155" or .0175" Respond

Separators for molar and lower second bicuspid bands

4. ? Band upper and lower first molars and lower second bicuspids with buccal and lingual attachments

Band lower second molars, with buccal tubes

Banding of upper second molars can be delayed until Class II elastics are initiated

5. Level, align, and consolidate arches

.0155" or .0175" Respond archwires, upper and lower first molar to first molar

.018" X .018" Nitinol buccal segments

.016" TMA, upper and lower first molar to first molar

.017" X .025" TMA buccal segments

.016" X .022" TMA or .018" X .018" Nitinol, upper and lower first molar to first molar, double-over ties

.016" X .022" SS buccal segments

6. Class II correction

Arches leveled and aligned

.016" X .022" TMA upper and lower lingual archwires, or wire of greater stiffness

Band or bond upper second molars

.016" X .022" SS buccal segments

Bond distogingival elastic hooks (Elastilug or Debnam cleat) to upper cuspsids

Labial elastics from upper cuspsids to lower second molars

Double-over metal ligatures on upper and lower incisors and cuspsids

7. Finishing arches

.016" X .022" SS, with metal ligature ties

Continue Class II elastics and/or vertical elastics to seat occlusion

8. ? Gnathological positioner and/or retention appliance

Clinician: Dr. James J. Hilgers Case Type: Class I Crowded, Nonextraction

1. ? Indirect bond upper and lower incisors, cuspsids, and first bicuspids, and upper second bicuspids

.0155" or .0175" Respond

Separators for upper and lower first molar and lower second bicuspid bands

2. ? Band upper and lower first molars and lower second bicuspids, with buccal and lingual attachments

Band or bond lower second molars, with buccal tubes

.016" Nitinol or TMA lower archwire

.018" X .018" Nitinol buccal segments

3. Level and align arches

Gain space with interproximal reduction and/or expansion

Progress to .016" TMA upper and lower lingual arches

Open coil spring as required

Double-over elastic ligature ties

4. Torque control and leveling

.018" X .018" Nitinol lingual arches

.0175" X .025" TMA or .016" X .022" SS buccal segments

5. Finishing arches

.016" X .016" SS or .016" X .022" SS, with buccal vertical elastics

Detailing

6. ? Gnathological positioner and/or retention appliance

Clinician: Dr. Craven Kurz Case Type: Class I Deep Bite, Consolidation

1. ? Indirect bond lingual brackets to upper and lower incisors, cuspsids, and first and second bicuspids

.Q155" or .0175" Respond

Separators for molar bands

2. ? Band upper and lower first and second molars, with buccal and lingual tubes on first molars

.0175" Respond, or .016" TMA if possible

Initiate headgear therapy

Buccal molar segment progression: .016" SS, .018" SS, .018" X .025" SS

3. Level and align

Lingual arch progression: .016" TMA, .016" X .022" or .017" X .025" D-Rect, .016" X .022" SS

Elastic thread or chain to close spaces

4. Torque control

.016" X .022" SS lingual arches

.018" X .025" SS buccal molar segments

Initiate high-pull anterior headgear if required for upper anterior intrusion

5. Finishing

.017" X .025" TMA lingual arches

Intramaxillary elastics

Clinician: Dr. Craven Kurz Case Type: Class I or II, Extraction

1. ? Indirect bond upper and lower incisors, cuspsids, and second bicuspids

.0155" Respond

Separators for molar bands

2. ? Band upper and lower first and second molars, with buccal and lingual tubes on upper first molars, and transpalatal sheaths and buccal tubes on upper second molars

Transpalatal arch

Initiate headgear as required

.0175" Respond lingual archwires

.016" SS molar buccal segments

3. Level and align

.018" SS molar buccal segments

Lingual arch progression: .0175" Respond, .0175" X .0175" TMA

Double-over metal ligatures

4. Retraction/consolidation

.018" X .025" SS molar buccal segments

.016" X .022" SS lingual arches

Class I elastics from cuspids to first molars until anteriors are aligned

Figure-8 upper and lower cupid to cupid and retract anterior segments with sliding mechanics

5. Torque control

.016" X .022" SS lingual arches

Elastic chain as required

6. Finishing

.017" X .025" TMA lingual arches

Intermaxillary elastics

Figures

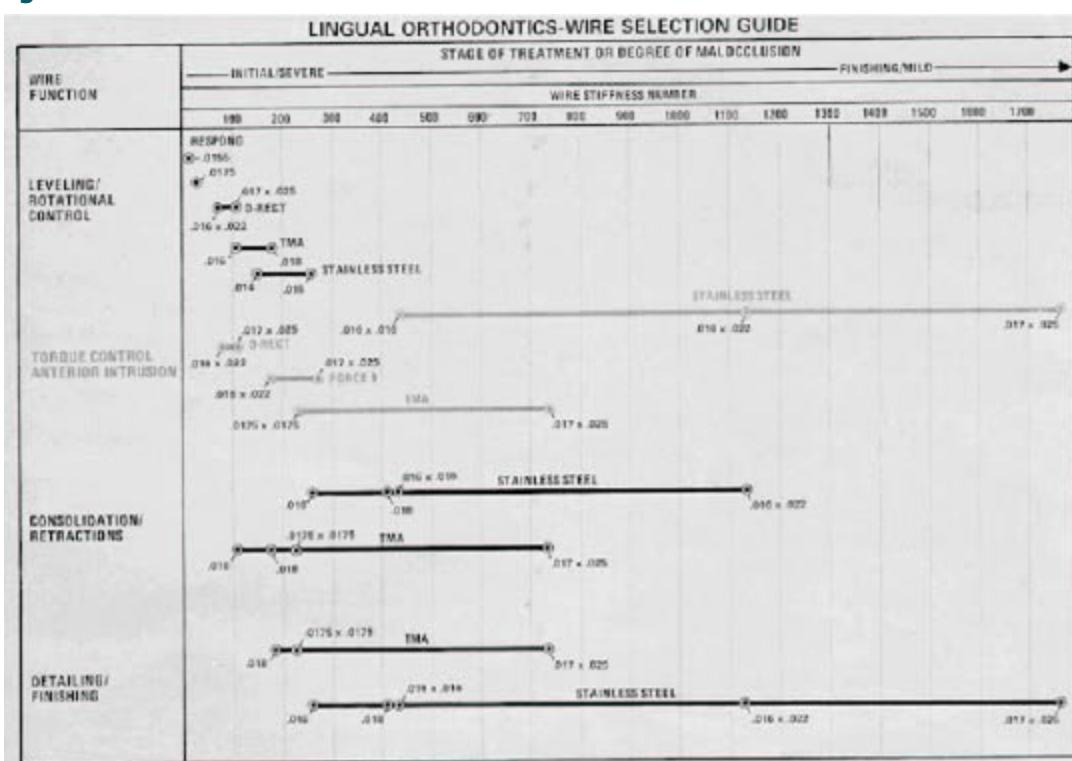


Fig. 1 Lingual Archwire Selection Chart

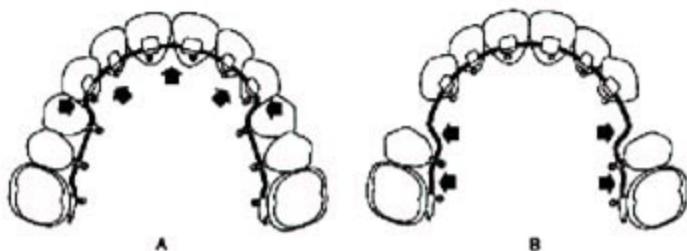


Fig. 2 A. First and second order bends contacting the teeth or brackets can act as stops and result in an expansion force as arch wire length is gained through alignment. B. First and second order bends should be made with sufficient spacing to prevent anterior advancement or to provide for retraction mechanics.



Fig. 3 Elastic ligature and archwire force vectors, labial versus lingual. Conventional ligation of lingual brackets does not exert a force along the high torque angled bracket slot

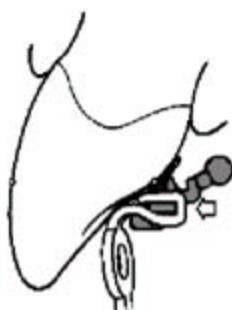


Fig. 4 Double Over Tie. The double over ligation method applies the ligating force along the bracket slot to seat the archwire. Double over elastic ties also exert twice the force of a conventional ligation.



Fig. 5 Rotation Auxiliary. Elastomeric tubing and steel ligature wire have been effective in reducing rotations.

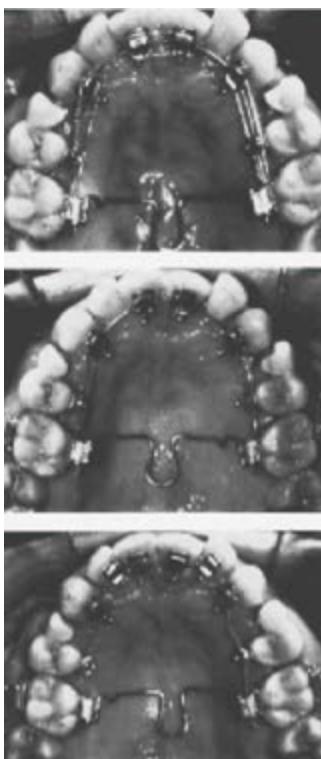


Fig. 6 Anterior Leveling and Alignment. A. Initial cupid re traction is conducted on .016" round stainless steel with Class I elastic thread. Note the transpalatal arch and bonded pontics. B. Once sufficient space is obtained to correct the crowded condition, further retraction is postponed. C. Any blocked-out teeth are bonded and alignment is continued with .0175" Respond.



Fig. 7 Class I elastics to labially bonded plastid buttons can be used for initial cupid re traction. After minimal re traction to permit bonding of the cupids, continued anterior alignment is performed, using .0155" Respond. Note the off center positioning of the central brackets necessitated by the rotations. These brackets can be repositioned following additional alignment.



Fig. 8 Cupid retraction with high pull headgear, using lingually placed J- hooks. Lingual archwire, .016" TMA.



Fig. 9 Open coil spring and Class I elastomer used to gain space for initial leveling and alignment. Lingual archwire, .016" TMA.

Wire sequence: .0155" Respond, .016" TMA, .0175" Respond, .016" SS.



Fig. 10 Utilization of transpalatal arch on extraction cases to control molar rotation, transverse dimension, and anchorage. Lingual archwire, .016" TMA, with double-over ligation.

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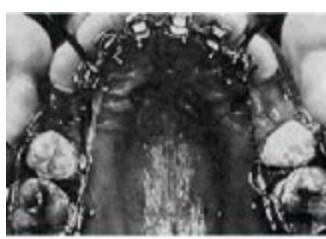


Fig. 11 Anterior segment retraction with high-pull head gear, J-hooks, and .017" x .025" TMA lingual arch with closing loops. The anterior segment is figure eight ligated.

Fig. 11 Anterior segment retraction with high-pull head gear, J-hooks, and .017" x .025" TMA lingual arch with closing loops. The anterior segment is figure eight ligated.



Fig. 12 Following initial leveling and alignment, anterior high pull headgear to an acrylic plate can be used for anterior retraction and intrusion.



Fig. 13 Anterior retraction with .017" x .025" TMA archwire with closing loops, following cuspid retraction.

Fig. 13 Anterior retraction with .017" x .025" TMA archwire with closing loops, following cuspid retraction.

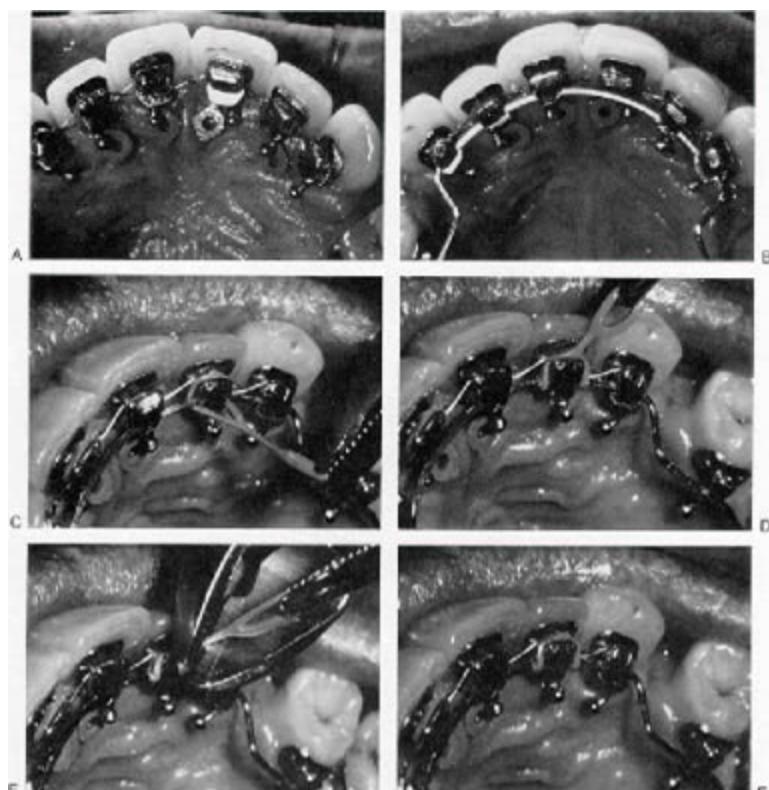


Fig. 14 Double-Over Ligature Tie. A. Teeth may first be ligated together with .009" steel ligature wire. Two or more segments of elastic chain are used on each tooth, with one segment placed over the bracket before the archwire is placed. The other segment of the chain will serve as a handle. B. The archwire is then inserted over the previously placed elastic chain modules. C. The elastic chain module is then stretched out of the gingival bracket tie wings and over the archwire. D. The elastic chain module is then inserted into the incisal tie wing. E. The excess chain is cut. F. The remaining elastic ligature originates and ends at the incisal tie wing and exerts a force directly along the archwire slot.



Fig. 15 Maxillary and Mandibular Retraction Series. **A.** Leveling and alignment, .016" TMA with high-pull posterior headgear. **B.** Closing loop mechanics, .017" x .025" TMA. Note: First and second order bends are incorporated in with the closing loops. **C.** Maxillary arch: .017" x .025" TMA with steel ligature and elastic chain for consolidation. Mandibular arch: .016" TMA lingual finishing arch.

Fig. 15 Maxillary and Mandibular Retraction Series. A. Leveling and alignment, .016" TMA with high-pull posterior headgear. B. Closing loop mechanics, .017" x .025" TMA. Note: First and second order bends are incorporated in with the closing loops. C. Maxillary arch: .017" x .025" TMA with steel ligature and elastic chain for consolidation. Mandibular arch: .016" TMA lingual finishing arch.



Fig. 16 Sliding mechanics: .016" TMA with Class I elastic thread.

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Fig. 17 Class II elastics to a bonded Debnam cleat.

Fig. 17 Class II elastics to a bonded Debnam cleat.

References

1.

Footnotes

- 1.** Ormco/Division of Sybron Corporation
- 2.** Unitek Corporation
- 3.** Ormco/Division of Sybron Corporation
- 4.** Ormco/Division of Sybron Corporation
- 5.** Ormco/Division of Sybron Corporation