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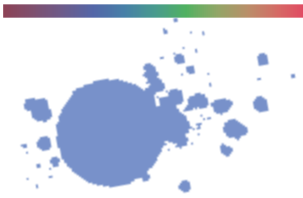
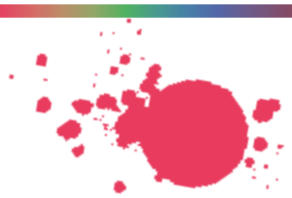
Lingual & Esthetic Orthodontics

QUINTESSENCE PUBLISHING

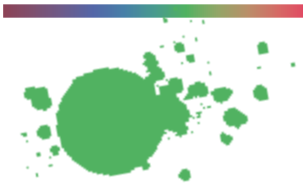
London, Berlin, Chicago, Tokyo, Barcelona, Beijing, Istanbul, Milan,
Moscow, New Delhi, Paris, Prague, São Paulo, Seoul and Warsaw

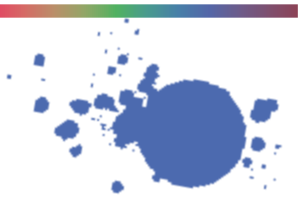
Contents





Section III: Mechanics: from Alignment to Finishing 307





Introduction and Acknowledgments

Although only just over a decade has passed since our first lingual book (*Lingual Orthodontics*, B.C. Decker, 1998), myriad changes have occurred in lingual orthodontic techniques: numerous new brackets have been presented by various companies, including individualized computerized techniques; laboratory techniques have been upgraded and protocols are more detailed and simple; and biomechanics have been thoroughly investigated. As a result, lingual orthodontics has gained popularity and become part of the daily routine in many clinics.

At the same time, a different esthetic option has emerged: clear aligners (Invisalign and the like). This has challenged practitioners to ascertain the true advantages of the lingual technique over other esthetic alternatives. The demand for esthetic treatment is constantly growing – a trend that will doubtless continue. Yet, the lingual technique still constitutes only a niche and lingual practitioners are still an exclusive group, meeting each other at the few meetings held worldwide.

Although research and information on the lingual technique is still deficient, this book presents probably the most up-to-date information available to the clinician. It covers not just a specific bracket or a specific technique, but the entire scope of options and information available.

Thirty-four of the best clinicians from around the world, who practice lingual orthodontics on a daily basis, have contributed their experiential knowledge in the most objective, noncommercial manner. The book does not aim to direct the orthodontist toward a specific treatment modality, but rather to review innovations in the technique and to serve as a reference source, which to date has unfortunately been lacking for the lingual clinician.

The book has been written and edited in a very short period of time, to render it as up-to-date as possible. Being free of commercial

constraints, I believe the book presents orthodontists with the broadest perspective and range of updates on the lingual technique.

On a personal note, my lingual practice began soon after I completed my postgraduate programme. I was advised by a good friend in France to adopt this unique esthetic technique, and with his help I met Dr Didier Fillion, who then was already one of the gurus of the technique. Dr Fillion's enthusiasm and exclusive dedication to lingual treatment inspired me and was one of the major reasons for editing my first textbook.

Over the years, I have gained numerous personal friends within this field of orthodontics, many of whom gladly accepted my invitation to contribute to this textbook. I thank them most sincerely and profoundly for their commitment and motivation. Special thanks go to my associate editors, Dr Silvia Geron and Dr Pablo Echarri.

I am deeply grateful to Quintessence Publishing, especially to the publisher Dr H. W. Haase and his son, Mr C. W. Haase, for their continued support. This is my third book to be published by Quintessence, and I have also been appointed Editor-in-Chief of *ORTHODONTICS: The Art and Practice of Dentofacial Enhancement* (formerly *WJO*) by Quintessence Publishing.

I thank my personal assistant, Evelyn Rosenberg, and last but not least my beloved family: my father, Dr Albert Romano, also a dentist, who inspired me and followed my developing career; my wife, Michal; and our four children, Emily, Lee-Ann, Illy, and Adam.

Rafi Romano, DMD, MSC

I

The Lingual Appliance: Brackets, Wires and Accessories

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Christophe Gualano
Laurent Sempe
Ari Sciacca
Geoffrey Hall
Hatto Loidl
Manabu Nakagawa
Victoria Burdess

Fig 6-4 (a to c) Case 1: Extraoral initial photographs.

Social Six Treatment

The so-called Social Six treatment is a clinical procedure proposed by Scuzzo and Takemoto for the correction of all malocclusions with slight to moderate crowding or diastemata limited to the anterior portion of the maxillary and mandibular dentition. This is an invisible treatment, which necessitates no patient collaboration and limited chair-side time; patient comfort is favored due to the use of small brackets (STbs) attached only to incisors and canines and, in a small number of cases, the first premolars.

Social Six generally involves the use of round, very light wires; it cannot be used in cases requiring torque control of one or more dental elements. Thus, the bracket positioning in this technique does not require complex laboratory procedures, and can therefore be performed by the orthodontist directly on the malocclusion model of the patient (simplified indirect bonding). Bracket transfer is then carried out by means of transfer masks; Scuzzo and Takemoto suggest that this is performed using thermoplastic glue to optimize precision.

The first archwire to be positioned must be very resilient (0.012 or 0.013-inch Ni-Ti or copper-nickel-titanium (Cu-Ni-Ti)) to ensure light forces and rapid dental movements, and will remain in place for a period of 5–16 weeks. If necessary, posttreatment finishing can be carried out using a more rigid wire (0.016-inch Ni-Ti or TMA (beta-titanium)).

Figures 6-4 to 6-11 illustrate a case of Class I dental malocclusion with maxillary and mandibular diastemata treated via Social Six with STb brackets. Figures 6-4 to 6-6 show the pretreatment situation.

After an initial phase of tooth alignment using a 0.012-inch Ni-Ti archwire (Fig 6-7), spaces were closed using elastic chains on a more rigid 0.016-inch TMA archwire (Fig 6-8). Figures 6-9 to 6-11 show intraoral and extraoral images after treatment.

Fig 6-5 (a to e) Case 1: Intraoral initial photos.

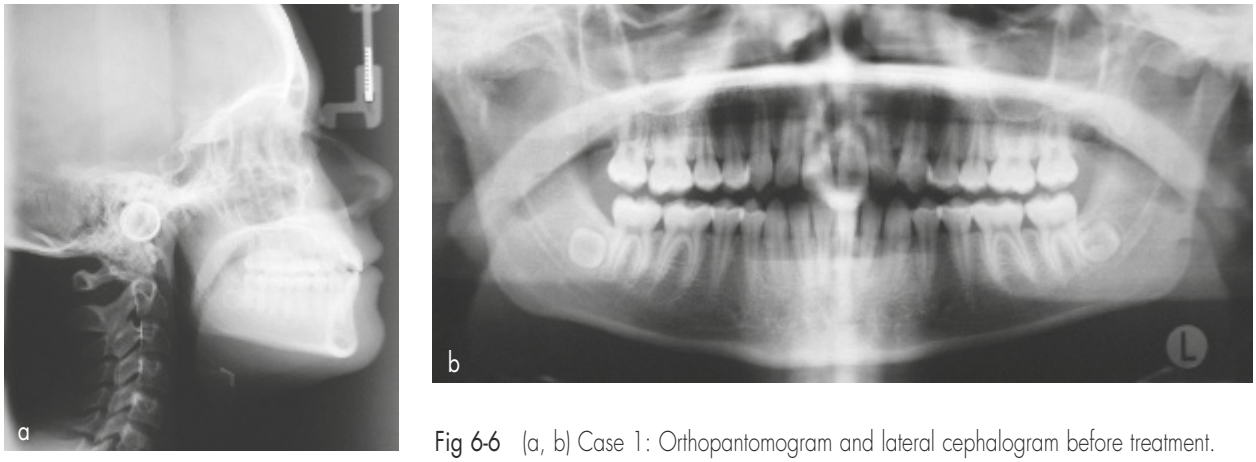

Fig 6-6 (a, b) Case 1: Orthopantomogram and lateral cephalogram before treatment.

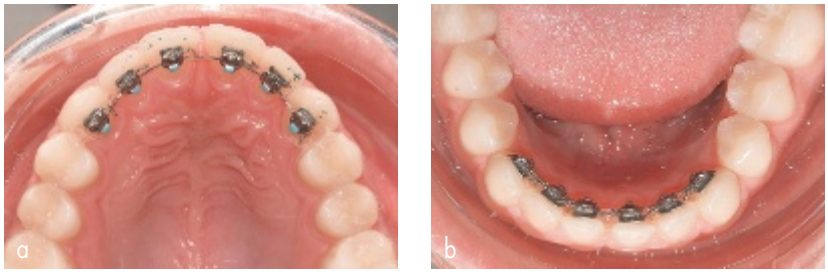

Fig 6-7 (a, b) Case 1: Tooth alignment using a 0.012-inch Ni-Ti archwire.

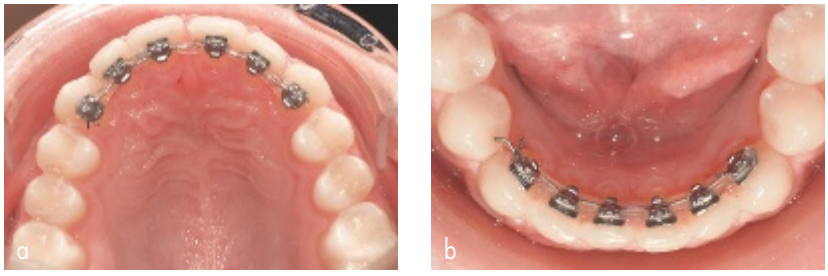

Fig 6-8 (a, b) Case 1: Space closure.

Fig 17-13 (left) Anterior view of the dental arches in occlusion and the contact points – collision test.

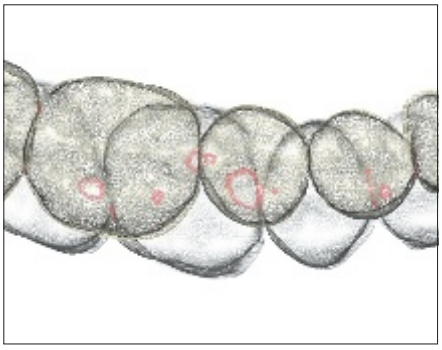

Fig 17-14 (right) Posterior view of the dental arches in occlusion and the contact points – collision test.

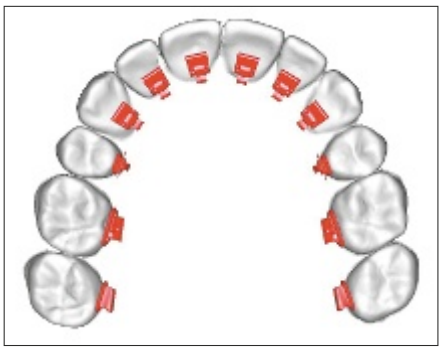

Fig 17-15 (left) Bracket positioning on the virtual setup.

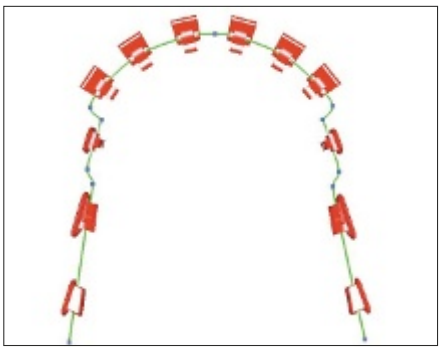

Fig 17-16 (right) Bracket positioning for a mushroom archwire.

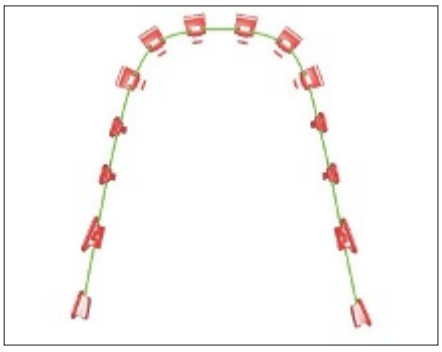

Fig 17-17 (left) Bracket positioning for a straight archwire.

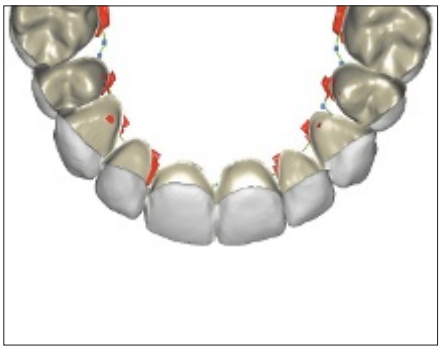

Fig 17-18 (right) Adjustment for bracket positioning in a 3D view.

4. Virtual bracket positioning

Once the virtual setup is completed in the software library, the selection of virtual lingual brackets is processed. All brackets will initially appear in the same virtual plane, parallel to the occlusal plane (Fig 17-15), and will be moved as a group to arrange the composition according to conventional bracket placement (mushroom archwire) (Fig 17-16) or lingual straight archwire (without in-out bend) (Fig 17-17). It is then possible to move each bracket individually to refine bracket positioning (Figs 17-18 and 17-19).

The brackets can be moved vertically to find the ideal height, with lateral movements providing the ideal inclination, and in the sagittal plane to achieve the shortest distance between the bracket base and the enamel surface to obtain the smallest resin pads possible (Fig 17-20). The program

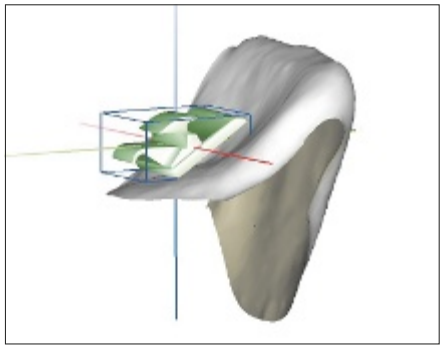

Fig 17-19 (left) 3D bracket individualization.

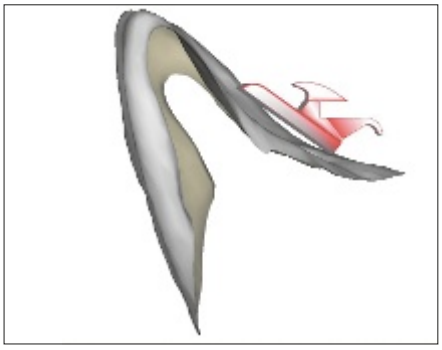

Fig 17-20 (right) The resin pad can be minimized by adjusting the bracket positioning.

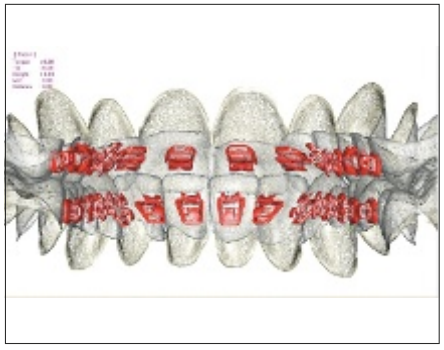

Fig 17-21 (left) Checking bracket positioning with the arches in occlusion.

Fig 17-22 (right) Clinical view showing resin pad sizes for incisor brackets with a mushroom archwire.

Fig 17-23 (left) Clinical view showing resin pad sizes for incisor brackets with a straight archwire.

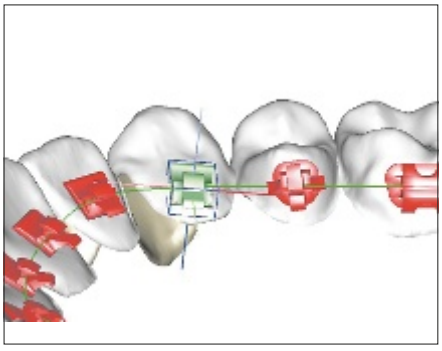

Fig 17-24 (right) Canine bracket in slight rotation for straight-wire technique.

makes it possible to check whether the lingual brackets respect the teeth limits and whether there are any interferences when the maxillary and mandibular arches are in occlusion (Fig 17-21) and adjustments can be made.

When mushroom archwires are used, the incisor brackets are relatively far from the lingual surfaces because their positions depend on the thickness of the canines (Fig 17-22). In the lingual straight-wire technique, the position of the incisor brackets no longer depends on canine thickness. The incisor brackets are placed with the maximum possible contact with the lingual surfaces (Fig 17-23). To eliminate the bends between canine and premolar, the canine brackets must be placed in rotation (Fig 17-24) (distal offset); likewise, to eliminate the bends between premolar and molar, the second premolar brackets must sometimes be slightly in rotation (according to the thickness of the first molars).

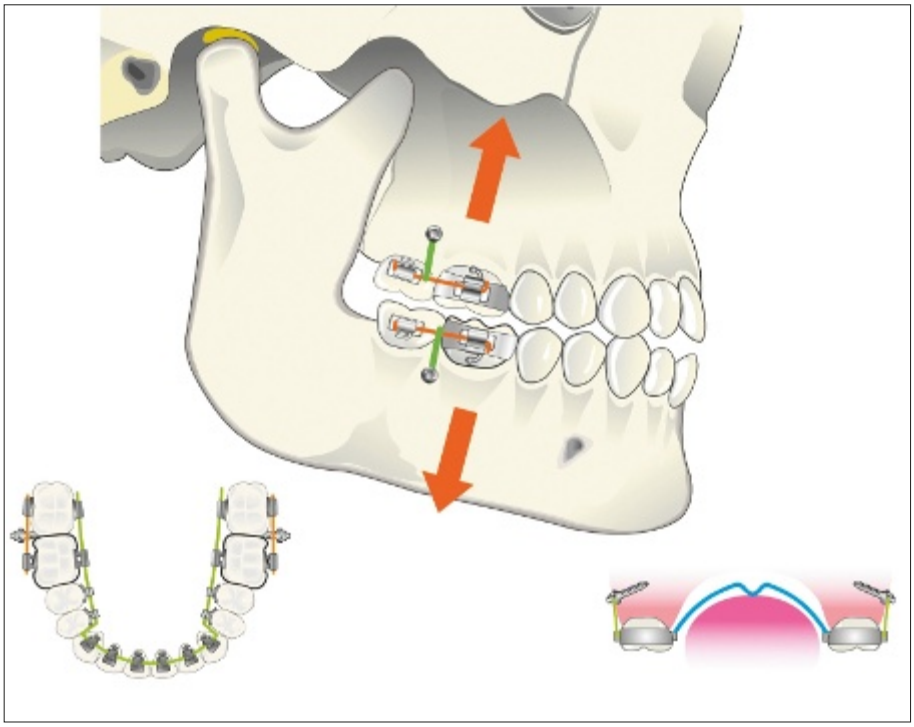

Fig 29-84 Molar intrusion.

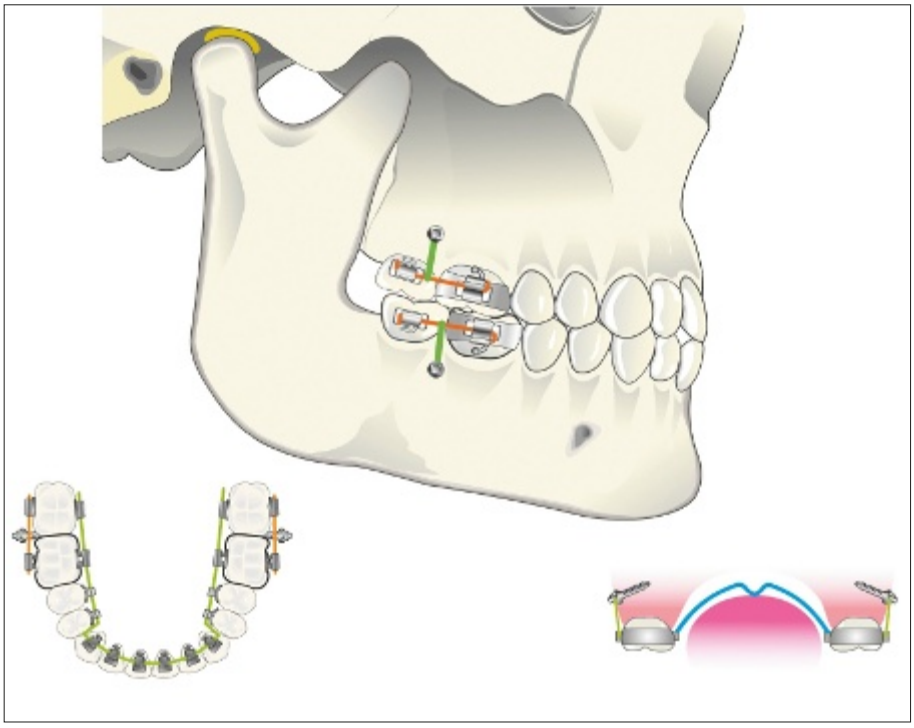

Fig 29-85 Detailing and finishing.

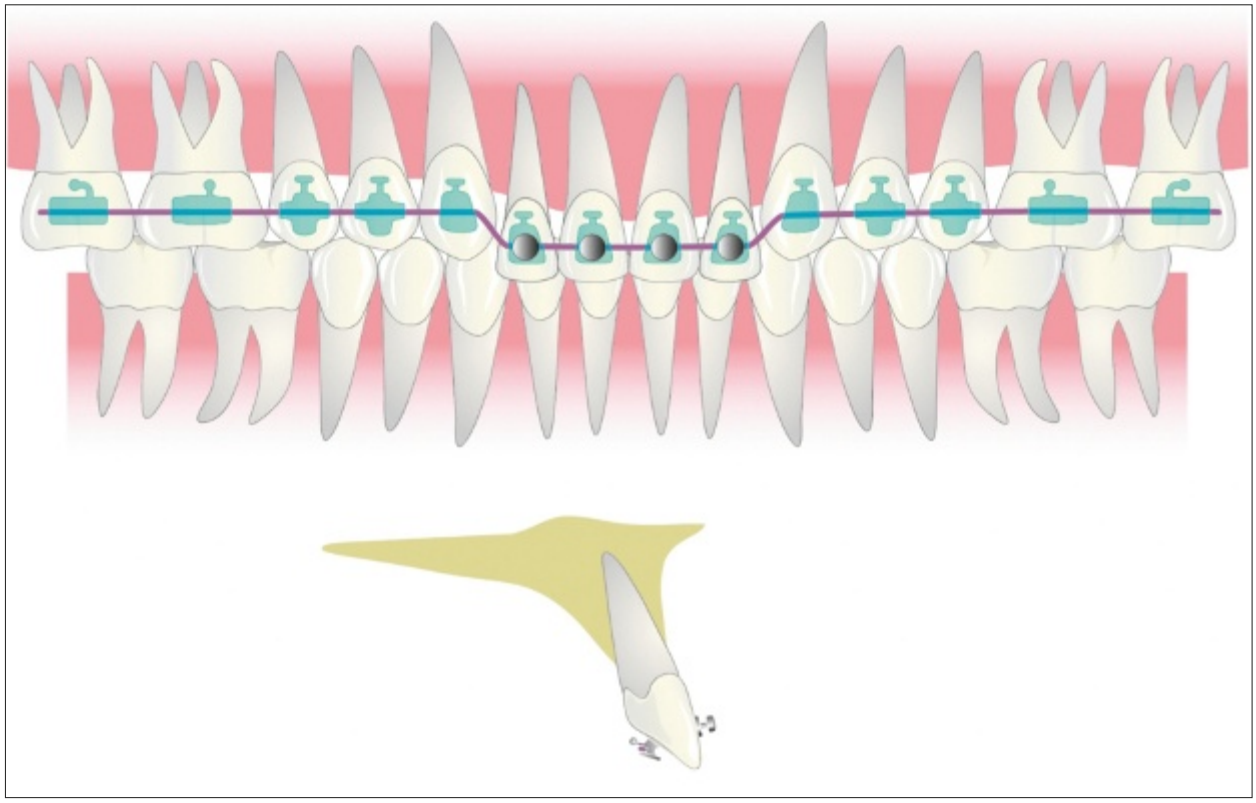

Fig 29-86 Lingual brackets and labial buttons.

Deep-bite cases

For the treatment of deep-bite cases with the intrusion of the incisors, the following is the protocol[23]:

1. Indirect bonding of the lingual brackets and tubes to all maxillary and mandibular teeth.
2. A 0.016-inch Ni-Ti archwire for alignment and leveling and a 0.0175 × 0.0175-inch TMA archwire for torque control (Fig 29-86).
3. Insert a microimplant between the roots of the central and lateral incisors in the labial side and bond labial ceramic or plastic buttons onto the labial surface of the upper incisors (Figs 29-87 and 29-88).
4. Intrusion of the upper incisors, using elastic chain or light elastics (3.5 oz and 1/8 inch) from the microimplants to the labial buttons (Fig 29-89)
5. Detailing and finishing with a 0.016-inch stainless steel or TMA archwire (Fig 29-90).

Conclusion

Microimplants enable more effective mechanics, which facilitates labial and lingual orthodontics and therefore reduces the treatment time.

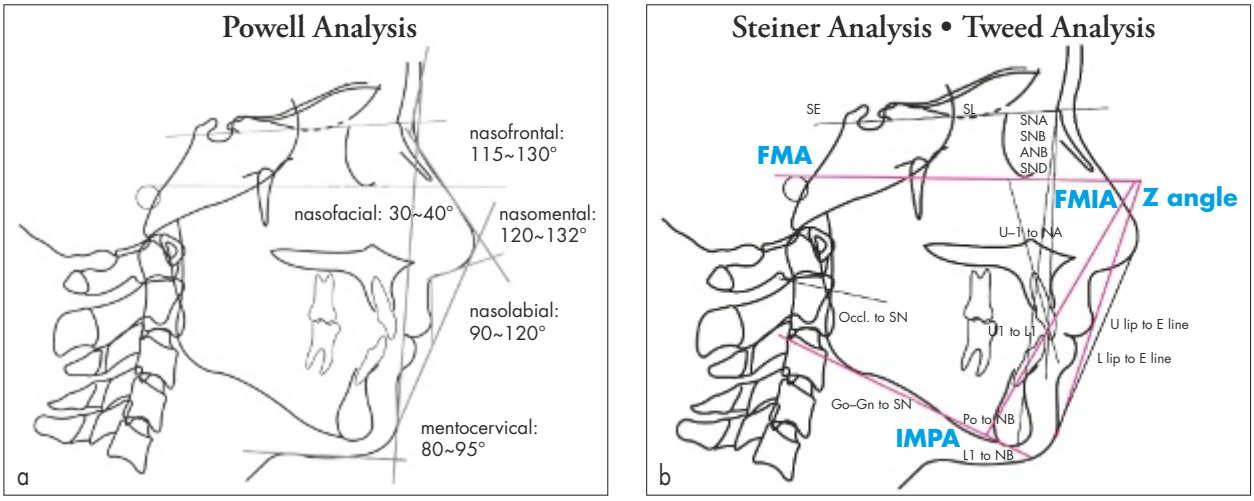

Fig 34-2 (a) Powell cephalometric analysis. (b) Steiner and Tweed cephalometric analysis.

4 measurements of the Tweed analysis and 4 measurements of the Powell analysis (Fig 34-2).

Results

Mean values of the pretreatment and posttreatment cephalometric measurements of the two groups were compared and tested for statistical significance (Table 34-1).

1. Many subjects in the straight group had maxillary protrusion with protrusive A point, while there was a greater proportion of the high-angle and Class II malocclusions with retrognathic mandibles in the convex group.
2. ANB angle was successfully reduced in the straight group, while ANB angle reduction was difficult in the convex group.
3. It was possible to retract point A, but very difficult to advance point B in both groups.
4. There were no significant changes in FMA or SN-M angle in either group, indicating that the mandibular plane angle was maintained without opening during lingual treatment.

Summary of the Study

Class II malocclusions can be categorized into two clinical types, according to the profile changes obtained with treatment:

- straight type with profile improvement: Class II malocclusion due to maxillary protrusion with protrusive A point

Table 34-1 Results. The official approval of mean value and significant difference

	Straight group			Convex group				
	Pre-Tx	Pre-Post significance	Post-Tx	Pre-Tx	Pre-Post significance	Post-Tx	Pre S-C significance	Post S-C significance
SNA	85.4	0.008**	84.6	82.3	0.006**	81.6	0.013*	0.017*
SNB	79.8	0.356	79.7	75.4	0.149	75.1	0.001**	0.001**
ANB	5.6	**0.001	4.9	7.0	0.084	6.5	0.071	0.033*
SND	76.5	0.245	76.6	71.5	0.200	71.3	0.001**	0.000**
U1 to NA (mm)	7.2	0.000**	3.7	8.0	0.000**	3.4	0.256	0.381
U1 to NA (degrees)	27.7	0.000**	15.6	30.8	0.000**	14.2	0.170	0.284
L1 to NB (mm)	9.6	0.000**	6.9	13.5	0.000**	9.2	0.001**	0.001**
L1 to NB (degrees)	31.7	0.009**	27.9	39.6	0.001**	29.0	0.008**	0.332
Po to NB	0.3	0.001**	1.3	−1.5	0.048*	−1.3	0.008**	0.001**
Po & L1 to NB	9.3	0.000**	5.6	15.0	0.000**	10.5	0.001**	0.000**
U1 to L1	115.0	0.000**	131.7	102.7	0.000**	130.4	0.014*	0.353
Occl to SN	17.0	0.021*	18.1	20.4	0.021*	22.5	0.064	0.027*
Go-Gn to SN	37.5	0.462	37.6	46.5	0.069	47.0	0.001**	0.000**
SL (mm)	46.3	0.152	46.3	36.7	0.062	35.9	0.006**	0.001**
SE (mm)	19.6	0.133	19.3	19.8	0.005**	19.4	0.448	0.499
U-lip to E-line	1.2	0.000**	−2.3	4.5	0.000**	1.5	0.000**	0.000**
L-lip to E-line	3.6	0.000**	−0.3	7.6	0.000**	3.7	0.001**	0.000**
FMA	32.3	0.457	32.3	39.3	0.102	39.8	0.002**	0.001**
FMIA	53.3	0.011*	57.4	42.8	0.001**	53.0	0.002**	0.039*
IMPA	94.4	0.013*	90.3	97.9	0.001**	87.1	0.166	0.153
Nasofrontal	137	0.293	136.3	135.2	0.158	133.6	0.176	0.112
Nasofacial	33.7	0.5	33.7	38.3	0.268	38.0	0.000**	0.001**
Nasomental	129.2	0.254	129.7	124.0	0.181	124.7	0.005**	0.007**
Mentocervical	95.5	0.043*	91.2	99.5	0.043*	95.9	0.178	0.143
Nasolabial	98.4	0.004**	107.2	106.2	0.003**	113.5	0.061	0.035*

Student t-test, * $P < 0.05$; **$P < 0.01$.

- convex type without profile improvement: Class II malocclusion due to a retrognathic mandible (particularly with a high-angle, dolichofacial pattern).

The following clinical criteria for achieving facial balance and harmony should be considered in planning lingual orthodontic treatment.

- Clinical criterion 1: A proper interincisal angle should be established by adequately uprighting madibular incisors, which necessitates the application of good lingual root torque to the maxillary incisors to prevent them from rabbiting.

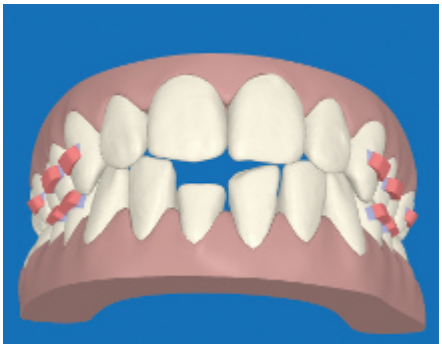

Fig 39-10 (left) ClinCheck with overcorrection of deep anterior overbite.

Fig 39-11 (right) Clinical result of ClinCheck overcorrection ordered in Fig 39-10.

images for a successful case of leveling of curve of Spee and deep bite with Invisalign, with no refinements or auxiliary treatment.

The ClinCheck treatment plan (Fig 39-10) to create this leveling and room for restorations (Fig 39-11) was specified with overcorrection, just as would be the case with an accentuated reverse-curve archwire.

The experienced Invisalign clinician learns to think of the white surfaces of the teeth (or edges of attachments) as the force application surfaces and not necessarily as teeth positions in some types of movements.

Treatment of Class II Malocclusion

Class II correction is a very common challenge faced by clinical orthodontists. Class II correction for the nongrowing or adult patient poses an even more complex set of clinical obstacles. Clinicians are encouraged to not alter their Class II treatment philosophy. Instead, clinicians should use Invisalign as a tool in their armamentarium. The treatment of Class II malocclusion in an adult is illustrated below. The author's philosophy is to approach the case with a technique to first correct the Class II molar relationship, and then later to correct the crowding and deep bite elements of the case. This has been the approach used for many cases. Clinicians may choose to distalize molars with other appliances, such as the Distal Jet™, Pendulum, T Rex™, Frog™, Celtin™, or Carriere™. All these appliances can be incorporated into Invisalign treatment. The clinician sets up the case using the appliance(s) of choice and then incorporates Invisalign to help obtain individual ideal treatment goals. The advantage of continuing to treat cases in the same way the clinician has in the past is that the only element that has changed is the Invisalign tool. This allows the clinician to compare the effectiveness of Invisalign with his or her previous experiences.

The case illustrated in Fig 39-12 is a typical Class II adult case that was corrected with Invisalign. Treatment began with a maxillary removable appliance (distalization screws) with adjunct anchorage provided by

Fig 39-12 (a, b) Before treatment of Class II, division 2, malocclusion.

Fig 39-13 (left) Maxillary removable appliance to distalize molars.

Fig 39-14 (right) Class II elastics to lower buttons with lower Essix retainer.

Fig 39-15 (a, b) Class II elastics to lower buttons during Invisalign.

Class II elastics (supported by a mandibular vacuum-formed retainer), as shown in Figs 39-13 and 39-14.

Once the maxillary molars were distalized, Invisalign could be used to sequentially distalize the premolars and then the anterior teeth, thus decreasing the overjet and correcting the dental Class II malocclusion. Note that with braces, patients use Class II elastics to avoid anchorage loss during this second phase of correction; this is also the case with Invisalign, where Class II elastics are used from the mesial aspect of the maxillary canines to bonded buttons on the mandibular second molars (Fig 39-15; however note that this figure shows a different case, to demonstrate the use of elastics with Invisalign).