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Dear Readers,

Sometimes as orthodontists we tend to simplify what our specialty is about. Behind the simplicity—straightening teeth—there is a wide spectrum of facial, functional and physiological effects that we will generate, all of them intimately interconnected. The patient’s soft tissue is not self-supported, so an adequate volumetric amount of hard tissue underneath sculpts the facial harmony. Orthodontics affects important dental, skeletal, functional, postural, physiological, articular, facial and psychological areas for the patient. It is a powerful specialty in which the teeth are only a part.

As orthodontists, we are responsible for accomplishing a balanced mid- and lower third of the face by managing a correct functional and anatomical relation between the maxillae and mandible, harmonising the position of the teeth into an aesthetic interrelation, achieving a functional occlusion. Ultimately, we sculpt the patient’s soft tissue, providing facial proportion and a harmonic smile design.

In addition to aesthetics, correct functional occlusion and tooth alignment will promote a healthy condition of the maxillae and mandible, gingivae and teeth, preventing many potential systemic diseases related to periodontal or dental sickness.

This rare ability of our specialty to change the extrinsic traits, the facial features, and maintain simultaneously the facial icon, while enhancing the patient’s positive facial features, can also achieve the opposite effect by promoting the patient’s negative facial features, maybe obstructing the patient’s airway or ending up with incorrect functionality of the stomatognathic system.

Today, a new treatment modality has arisen in orthodontics, commonly known as “do it yourself”. This development signals that it is time to start teaching society about the real power of orthodontics.

Dr Luis Carrière
Specialist in orthodontics and dentofacial orthopaedics
editorial

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Dr Luis Carrière

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BT2 treats severe, skeletal deep overbite malocclusion. Bonded palatally on the upper central incisors, it is the key for Rapid Deep bite Correction (RDC). Its patented curvature designed by Dr. J. Voudouris, reduces muscle hyperactivity, parafunction and permits anterior guidance of the lower incisors that lift the bite preventing anterior interferences during forward grinding.

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3. Six Undercuts
   for crossbite elastics in lateral open bite treatment that commonly require maxillary expansion.
In-office welding by Nd:YAG laser
Prof. Carlo Fornaini & Prof. Caroline Bertrand, France

Introduction

Just after the introduction of the first laser by Maiman in 1960,1 there was a very fast evolution of this new technology, characterised by constant progression in techniques and applications, increasing the possibility to have smaller and cheaper devices and introducing ever-new wavelengths. Laser welding was first introduced in the jewellery industry during the 1970s and soon after successfully used by dental technicians as well.2 The first lasers used were the carbon dioxide and Nd:YAG lasers, but the market was rapidly conquered by the second, owing to the results that could be obtained with it.3, 4 Laser welding offers a great number of advantages compared with traditional welding. Firstly, the laser device saves time in the commercial laboratory because all welding is done directly on the master cast. Inaccuracies in assembly caused by transfers from the master cast along with investment are reduced.5 The heat source is a concentrated light beam of high power, which can minimise distortion problems in metals.6 By using laser technology, it is possible to weld very close to acrylic resin or ceramic parts with no physical (cracking) or colour damage.7 This means it is possible to save time and money during the restoration of broken prostheses or orthodontic appliances, because it is not necessary to remake the non-metallic parts. This welding technique may be used on every kind of metal, but its property of being very active on titanium makes it particularly advisable for prostheses supported by endosseous implants.8

Many laboratory tests have demonstrated that laser-welded joints have a high reproducible strength for all metals, consistent with that of the substrate alloy.9 All these advantages led to this method being extensively used in dental technicians’ laboratories and stimulated companies to put on the market increasingly upgraded appliances. Some aspects, such as large dimensions, high costs and delivery systems, today still characterise those machines that use fixed lenses, strictly limiting their use to dental technicians’ laboratories.

The aim of this study is to show, through the description of a series of clinical cases, the utilisation of a laser device normally used for surgery in the dental office to weld orthodontic appliances and to demonstrate the advantages of this technique. The appliance used, the Fidelis Plus III (Fotona), is a combination of two different laser wavelengths, the Er:YAG ($\lambda = 2,940$ nm) and Nd:YAG ($\lambda = 1,064$ nm). The first allows the dentist to treat hard tissue (enamel, dentine and bone) with a mechanism that, utilising the affinity of this laser for water and hydroxyapatite, induces the explosion of intracellular water molecules and so causes the ablation of the tissue.10 Its utilisation may be extended also to dermatology, where it can be employed in the treatment of keloid scars and wrinkles with resurfacing, in addition to the elimination, by vapourisation, of lesions such as condyloma, naeves, warts and mollusca contagiosa.11 The Nd:YAG laser allows the dentist to perform surgery with complete haemostasis, utilising the affinity of this wavelength for haemoglobin and thus avoiding the use of sutures.12 The delivery system for this laser is provided by optic fibres of different sizes, chosen according to the kind of application needed, ranging from 200 μm (endodontics) to 900 μm (whitening).

In addition to a pulse duration of microseconds, which is necessary during dental interventions, the peculiarity of the Fidelis Plus III appliance is the possibility of pulse durations of milliseconds (15 or 25), which can be utilised in phlebology, in the treatment of lesions of vascular origin, owing to the affinity of this wavelength for haemoglobin.13

In our previous work,14 we demonstrated, by in vitro tests on different metal samples, the good quality and high resistance of a joint welded by this device, while in this paper we demonstrate the clinical application of this technique.

Material and methods

The laser device used was, as already stated, the Fidelis Plus III, with a 900 μm fibre and a 2 mm spot handpiece (R32, Fotona), normally utilised in dermatology, or in some cases a prototype provided by Fotona itself. The parameters that we normally use for welding are:

- Wavelength: 1,064 nm
- Energy: 9.9 J
- Frequency: 1 Hz
- Spot diameter: 1 mm
- Pulse duration: 15 m/s
- Fluence: 1,260 J/cm²
- Working distance: 8 mm
A 9-year-old female patient in orthodontic treatment in our office came in urgently owing to damage to the rapid palatal expander applied to her maxillary molars. The clinical examination revealed that the brace had been damaged close to the connection with the arm (Fig. 1). The patient had just finished one stage of the expansion, and since it was very risky to leave her without an appliance, we decided to weld it directly in the office with the Fidelis laser.

The expander was prepared with the conventional procedure required before laser welding (sandblasted with alumina powders of 50 μm in diameter using the Mini-blower, Deldent; cleaned with acetone and both parts dried). The appliance was directly welded in the office using CoCr-Schweißdraht welding wire (DENTAURUM). After a few minutes only, the appliance was ready to be recemented into the patient’s mouth (Fig. 2).

Clinical cases

Case 1

Fig. 1: The damaged appliance removed from the mouth. Fig. 2: The repaired appliance.

Fig. 3: The Schwartz appliance with a broken Adam’s hook. Fig. 4: Laser welding process without filler metal. Fig. 5: The hook repaired without damaging the nearby acrylic part. Fig. 6: The appliance replaced into the mouth.
Case 2

An 8-year-old male patient in treatment in our office with a Schwartz removable orthodontic appliance came to us for periodic checking of the appliance, and we saw that one of the Adam’s hooks had broken (Fig. 3). We welded it without filler metal (Fig. 4), and the plastic shield, although very close to the welding zone, was not damaged or modified (Fig. 5). We were able to reseat the repaired appliance in the patient’s mouth after only some minutes (Fig. 6).

Case 3

An 8-year-old male patient in treatment in our office with a Frankel removable orthodontic appliance came to us for periodic checking of the appliance, and we saw that one of the wires had broken (Fig. 7). We welded it without filler metal (Fig. 8), and the plastic shield, although very close to the welding zone, was not damaged or modified (Fig. 5). We were able to reseat the repaired appliance in the patient’s mouth after only some minutes.

Case 4

A 14-year-old male patient came to our office with the lingual wire of his appliance broken. The appliance was an orthodontic appliance called Delaire consisting of two wires, one vestibular and one lingual, connected to two braces on first maxillary molars (Fig. 9). Owing to the presence of a sizable restoration on the first maxillary right molar, we decided not to remove the appliance and to perform an intra-oral laser welding. A previously made screen in silicone was used to protect the soft tissue, and the appliance was welded without filler metal; the entire operation lasted 4 minutes; the welding was done in 75 s (Fig. 10). After a few minutes, without having to send it to the dental laboratory and with no discomfort to the patient, the appliance could be repaired (Fig. 11). The follow-up was done monthly for six months and showed that the appliance was active and strength-proof.

Case 5

A 14-year-old female patient, in orthodontic treatment with a Veltri fixed appliance to open the space in the upper arch in order to insert the second premolar, came to us for a normal check of the appliance, and it was observed that an arm had broken near the brace of the first premolar (Fig. 12). The removal of the appliance in order to send it to the laboratory was deemed as having too many risks, since the treatment was still in the activation phase. Therefore, it was decided to perform an intra-oral laser welding. In order to protect the soft tissue, a silicone film...
about

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was employed (Fig. 13). The procedure was performed without filler metal and took 2 minutes, and the irradiation time was 20 s (Fig. 14). After the reparation, the therapy was continued, turning the screw until the required space was achieved (Fig. 15).

Conclusion

The ability to weld broken orthodontic appliances directly in the office represents for the dentist a new prospect, allowing the restoration of appliances extremely quickly without additional costs (the welding appliance is the same used for dental therapies). Being able to maintain the integrity of plastic, acrylic and ceramic parts close to the welding zone and the ability to make the reparation while the patient is sitting in the chair and in one visit only are, in our opinion, the great advantages in terms of costs, marketing, patient satisfaction and efficiency of the office. Moreover, as shown in the clinical cases presented, the welding process may also be performed intra-orally without risks and discomfort to the patient. The period of learning for dentists is very short, owing to the simple and fast procedure, because the parameters are standard and it is not necessary to change or adapt them to different clinical situations. We think that this technique represents a valid aid in our daily practice and, simultaneously, opens a new chapter in laser dentistry, bringing new possibilities we intend to analyse and test in further research.
Surgical crown lengthening and botulinum toxin in the management of the orthodontic patient with gummy smile

Dr Irineu Gregnanin Pedron, Brazil

Introduction

The demand for cosmetic procedures has grown exponentially. Dental procedures, as well as medical ones, besides working to obtain the principle of health promotion, seek to achieve smile aesthetics, as the smile is a form of communication and social expression of many feelings.1–5

Facial aesthetic harmony correlates directly with the smile and this, in turn, is formed by the union of three components: teeth, gingivae and lips.1–4 The smile becomes aesthetically pleasing when these elements are disposed in suitable proportion and exposure of the gingival tissue is limited to 3 mm. When the gingival exposure is greater than 3 mm, it characterises the unaesthetic condition called gummy smile, which affects some patients psychologically.1, 3, 5–8

Several therapeutic modalities have been proposed for the correction of gummy smile, among them gingivectomy or gingivoplasty,1–3, 5, 6, 8 myectomy6, 8 and orthognathic surgery.6, 8, 9 The last two procedures are more invasive and associated with high morbidity.7 In contrast, the use of botulinum toxin can be considered a therapeutic alternative to surgery, because it is a more conservative method, more effective, faster and safer than surgical procedures.5, 10

Botulinum toxin is synthesised by the Gram-positive anaerobic bacterium Clostridium botulinum and inhibits the release of acetylcholine at the neuromuscular junction, preventing muscle contraction.1, 6, 8, 9 There are seven distinct serotypes of toxins, A, B, C1, D, E, F and G. However, the subtype A is the most frequently used clinically and the most powerful.2, 6

Botulinum toxin has been shown to be effective in the treatment of gummy smile in patients with hyperfunction of the muscles involved in smiling, as well as in patients with other disorders, such as temporomandibular disorders (hypertrophy of the masseter muscle, bruxism, clenching) and myofascial pain.3, 6, 9 The purpose of this article is to report on a case of a patient who presented with gummy smile and was treated with a combination of surgical crown lengthening (gingivoplasty) and application of botulinum toxin.

Case report

A 27-year-old African-descendant female patient attended the clinic with the complaint of gummy smile (Fig. 1). Clinically, the patient had an anatomical discrepancy between the length of the anterior teeth and evident gingival exposure greater than 3 mm, characterising gummy smile (Fig. 2a). Chu’s Proportion Gauge (Hu-Friedy, Chicago, US) was used to measure the length of the teeth (Fig. 2b).

Surgical crown lengthening (gingivoplasty) was proposed and later, after the presentation of the results, the application of botulinum toxin for the correction of gummy smile. However, the patient was informed about the recurrence of gingival smile six months after application, because of its temporary result. Under local infiltrative anaesthesia, bleeding points were determined with the aid of a millimetred probe and the union of these points was performed with electrocautery.2 The length of the teeth increased, characterising the dental zenith. Subsequently, the scraping was performed, resembling the technique of external bevel gingivectomy, in order to enhance tissue healing. There was no need for the use of surgical cement, given that wound healing would occur by secondary intention. The patient reported no complaints or complications after surgery.

At the subsequent consultation 30 days later, the orthodontic appliance was removed and satisfactory tissue repair was observed (Fig. 3), and no changes or complaints were reported by the patient. However,
the persistence of the complaint of gummy smile was reported by the patient (Fig. 4). At the same consultation, botulinum toxin was applied. Prior to application of the botulinum toxin, the surface of the skin was disinfected with 70% ethyl alcohol and the oils from the area were removed, in order to avoid local infection. The points of application were marked beside each nostril. Then, local anaesthetic (EMLA, AstraZeneca) was applied with the aim of promoting comfort during the procedure. Botulinum toxin A (BOTOX 200, Allergan) was diluted in 2 ml of saline, according to the manufacturer’s instructions, and two units injected into the predetermined sites, lateral to each nostril. After application, the patient was advised not to bend her head forwards for the first 4 hours and not to engage in physical activity for the first 24 hours after the procedure.

After ten days, the patient was examined. She presented with a uniform dehiscence of the upper lip (Fig. 5). No side-effects or complaints were reported.

Discussion

Gummy smile is characterised by the exposure of more than 3 mm of gingival tissue during smiling,1, 3, 5, 7 and it is often seen in women.10 The predominance among women can be explained by the fact that men present with a lower smile line.4, 5 Several aetiologies for gummy smile have been suggested, including vertical maxillary excess,6–8, 9 delayed passive eruption,4, 6, 7, 9 hyperfunction of the muscles involved in smiling4, 6, 7, 9 and reduced length of the clinical crown of the teeth1, 2, 7. These can occur separately or together, and determine the type of treatment to be used.

In gummy smile caused by overactive muscles, botulinum toxin is indicated. It is the treatment of choice for ease and safety of application, and its rapid effect, besides being a more conservative approach when compared with surgical procedures (myectomy or Le Fort I osteotomy).3–11 The clinical effects appear within two to ten days after the injection, and the most visible effect occurs 14 days after the injection.3–5 This effect lasts about three to six months.3, 5, 6, 9

The action of smiling is determined by several facial muscles, such as the elevator of the upper lip, the elevator of the upper lip and wing of the nose, the zygomaticus major and minor muscles, the muscle of the angle of the mouth, and the orbicularis oris and risorius muscles.3–6, 8–10 Among them, the first three have a greater influence and determine the amount of lip elevation and, therefore, should be the muscles targeted by the injection of botulinum toxin. The fibres of these muscles converge at the same area, forming a triangle, and it is here that the three muscles can be targeted with a single injection. The injected toxin can spread over an area of 10–30 mm and this is its effective extent.3–5

Fig. 1: The patient presented with gummy smile. Figs. 2a & b: Anatomical discrepancy between the length of the anterior teeth (A). Length of teeth measured by Chu’s Proportion Gauge (B). Figs. 3a & b: Thirty days post-op: Satisfactory tissue repair (A); increased length of teeth measured by Chu’s Proportion Gauge (B). Fig. 4: Persistence of complaint of gummy smile. Fig. 5: The patient presented with a uniform dehiscence of the upper lip ten days after the application of botulinum toxin.
is lateral to the wing of the nose. After being injected into the predetermined locations, the toxin decreases the contraction of the muscles responsible for the elevation of the upper lip, and this reduces gingival exposure.

Each muscle involved in the elevation of the upper lip has a function during the action of smiling. The points of the injections are determined by the contraction of specific muscle groups that results in different areas of gingival display. Several classifications have been proposed for gummy smile: anterior, posterior, mixed and asymmetric, depending on the muscle groups involved.

The anterior gummy smile should be treated with the conventional technique, with the applications lateral to the wing of the nose. In patients with posterior gummy smile, the application of the toxin must involve the zygomaticus major and minor muscles, with the injection of the toxin at two different points: the point of greatest contraction of nasolabial folds during the action of smiling and the second point 2 cm lateral to the first, at the level of the ala-tragal line. In the case of patients who have mixed gummy smile, the application of the toxin should be performed at all the points mentioned above. However, the dose should be reduced to 50% at the point lateral to the wing of the nose. In cases of labial asymmetry, which occurs owing to differences in muscle activity, patients receive injections of different doses on either side of the face.

Botulinum toxin A is a hydrophilic powder, stored under vacuum, that is sterile and stable. The reconstitution occurs with the smooth injection of the diluent (0.9% sodium chloride) into the bottle. The solution should be stored at 2–8 °C and used within 4–8 hours in order to ensure its effectiveness.

At the beginning of the treatment, extra-oral photographs, including a close-up of the smile, were taken. Several authors note the importance of recording the smile before and after the application of the toxin.

It has been suggested that the photographing of the smile should be performed with the muscles individually stimulated with electrical current in order to ensure that the muscle contraction is controlled, precise and repeatable, as a spontaneous smile is extremely difficult to replicate. Patients know that the treatment is carried out to produce a different smile, so from this perspective, unconsciously, there is a tendency to smile differently in photographs after the treatment.

The injection of botulinum toxin, despite being a simple and safe procedure, may be associated with some adverse events, such as pain at the injection site, bruising, infection, oedema, dysphonia, dysphagia, ptosis or lengthening of the upper lip and asymmetry of the smile.

The dentist should be attentive to dosage, precision of technique and location of the injection sites. In this case, no complaints or changes arising from the application were reported. Contra-indications to the use of botulinum toxin are pregnancy, lactation, hypersensitivity (allergy) to botulinum toxin, lactose and albumin, muscle and neurodegenerative diseases (myasthenia gravis and Charcot-Marie-Tooth disease), and concurrent use of aminoglycoside antibiotic, which enhances the action of the toxin.

In this case, the result was satisfactory regarding the harmony of the smile of the patient by the combination of treatments, resective gingival surgery and application of botulinum toxin A. The use of isolated treatments would not have achieved the excellence of the results obtained. Initially, the creation of the new dental zenith during the course of resective gingival surgery promoted the new dental architecture, favouring gingival-dental-facial harmony for the patient. Subsequently, the application of botulinum toxin A softened the gummy smile, by the uniform dehiscence of the upper lip, promoting smoothness of the facial lines of the smile, as can be seen in the nasolabial folds adjacent to the nostrils by comparing Figures 1 and 5.

Conclusion

In summary, the application of botulinum toxin is an alternative treatment that is less invasive, faster, safer and more effective, and it produces harmonious and pleasing results when applied to target muscles, respecting the appropriate dose and type of smile. Therefore, it is a useful adjunct in the aesthetic improvement of the smile and provides better results when combined with resective gingival surgery.

Editorial note: A list of references is available from the publisher.
ALMOST INVISIBLE

INVISIBLE: www.lingualsystems.com
Non-surgical treatment of a Class III malocclusion with missing lateral incisors

Dr Ana Maria Cantor, Spain

Class III malocclusions are classified into four types of skeletal and dental relationships with either (1) mandibular protrusion, (2) maxillary retrusion, (3) a combination of the two or (4) a normal relationship of the jaws.\textsuperscript{1,2,3} The prevalence of Class III malocclusions is estimated to be 1 to 10%, depending on ethnicity, sex and age. The aetiology may be skeletal or dentoalveolar.\textsuperscript{4} The incidence of lateral incisor agenesis in the permanent dentition is estimated to be between 1.6 and 9.6%,\textsuperscript{5,6} and there is a correlation between the size of the maxilla and agenesis of maxillary teeth.\textsuperscript{6}

The two possible therapeutic options for adult patients with Class III malocclusions are orthognathic surgery or camouflage orthodontics.\textsuperscript{7} Regardless of the option chosen, it is important to take into consideration increasing the angle of convexity (ANB) to improve the profile of the face with a greater increase in the length of the upper lip.\textsuperscript{8} It is, however, often difficult to predict the result that can be offset by labial inclination of the maxillary incisors and the subsequent negative effect on the patient’s smile,\textsuperscript{9} as well as retro-inclination of the mandibular incisors, with deleterious effects on the periodontium.

The combination of Class III malocclusion with missing maxillary lateral incisors can be challenging to resolve satisfactorily while enhancing the facial profile of the patient given the constriction of the maxilla. In patients with these characteristics, a combination of orthognathic surgery and orthodontics with a bridge or implants is often recommended.\textsuperscript{10} Given that the patient in the following case report would not consider orthognathic surgery or opening space orthodontically for the placement of implants, the alternative recommended was camouflage orthodontic treatment. The case report is intended to illustrate treatment of a Class III malocclusion exhibiting maxillary lateral incisor agenesis with the use a simple Class III functional appliance for anterior-posterior correction, followed by fixed self-ligating appliance therapy.

Diagnosis and treatment plan

A 30-year-old female patient presented with a concave profile and maxillary hypoplasia with a short upper lip and lower retracted labial protrusion, an obtuse nasolabial angle, and skeletal Class III maxillary retrusion and mandibular protrusion. Dentally, the patient exhibited a Class III malocclusion with marked crowding, an anterior crossbite, a 1 mm midline deviation, a moderate curve of Spee and agenesis of the maxillary lateral incisors that the panoramic radiograph confirmed (Figs. 1a–j; Tab. 1).

The treatment goals were to improve the patient’s facial aesthetics, correct the Class III malocclusion exclusively with orthodontics, reduce the concavity of her profile and create greater fullness of the upper lip, correct the anterior crossbite, distalise the mandibular posterior segment, protract the maxilla and close the spaces from the congenitally missing lateral incisors, reconstructing the canines as lateral incisors and the first premolars as canines. Since the patient rejected the more invasive options recommended and opted for camouflage orthodontics, she was cautioned that a satisfactory result depended on her strict compliance with the treatment protocols, specifically the use of elastics.

Wire sequence

Treatment followed the Carriere System (Henry Schein Orthodontics) archwire sequence, except in this case the first wire was a 0.016 in. dimension wire rather than a 0.014 in. wire. The archwires were all thermally activated wires, with lower transformation temperatures chosen as archwire sizes increased to limit force on the periodontium:
- 0.016 in. Cu NiTi (27 °C)
- 0.014 × 0.025 in. Cu NiTi (27 °C)
- 0.017 × 0.025 in. Cu NiTi (35 °C)
- 0.019 × 0.025 in. Cu NiTi (35 °C).

Treatment progress

Treatment commenced with the simultaneous use of a Carriere Motion 3D Class III Appliance (Henry Schein Orthodontics) for sagittal correction and Carriere SLX (Henry Schein Orthodontics) 0.022 in. MBT prescription pre-adjusted, passive self-ligating brackets bonded with 0.016 in. Cu NiTi archwires engaged in the upper arch for anchorage. The Motion 3D Class III appliance
was bonded directly to the mandibular canines and first molars with 6 oz, 0.25 in. intra-oral elastics engaged for Class III traction to maxillary second molar tubes. Upper arch levelling and alignment was performed with 0.016 in. Cu Nitanium archwire, and bilateral stops placed mesially to the bonded first molar buccal tubes to assist with protraction of the upper arch. Proper patient compliance achieved correct intercuspation in four months; the negative overjet had corrected to an end-on position in five months (Figs. 2a–c). At that point, the Motion appliance was debonded and Carriere SLX 0.022 in. MBT prescription pre-adjusted, passive self-ligating brackets were bonded in the lower arch (Figs. 3a–c).
Treatment results

After 16 months, treatment concluded with the patient showing a significant profile improvement, a correction of the maxillary hypoplasia, anterior crossbite and Class III malocclusion with greater upper lip fullness, a balanced smile line, adequate gingival margins, levelling, and suitable overjet and overbite. By replacing the congenitally missing lateral incisors with reconstructed canines and positioning reconstructed first premolars as canines, good occlusion was achieved (Figs. 4a–c).

For the re-anatomisation of the canines and first premolars, we performed a laser diode gingivoplasty, then shaved the cusp tips of the canines and sculptured their distal and mesial borders with composite resin. Finally, we shaved and recontoured the palatal cusps of the first premolars to avoid premature contact at functional occlusion (Figs. 5a–j; Tab. 2).

Discussion

Many Class III patients elect not to undergo invasive treatment that involves surgery, extractions and/or implants, especially if treatment affects maxillary anterior teeth considered critical to overall smile aesthetics. When such aesthetic problems are presented, it is important that orthodontists have adequate training in and experience and awareness of facial aesthetics to be able to offer more conservative solutions because such issues, if unresolved satisfactorily, can detrimentally affect the patients’ emotional state and self-esteem.

The position of the maxillary and mandibular incisors determines facial harmony and a pleasing smile. Maxillary lateral incisor agenesis makes obtaining good treatment results a challenge, especially with reduced maxillary arch length, owing to the lack of these important teeth.
Treatment plans for cases of maxillary hypoplasia with agenesis of the lateral incisors often call for opening space for implants. The greatest problem with such plans is that it is impossible to predict when, to what degree, or in which patients unattractive soft- and/or hard-tissue changes around implant-supported porcelain crowns, especially noticeable in the maxillary anterior teeth, will occur. Biological and technical complications are frequent and can appear even after only a few years.\(^1\) Space closure with protraction of the maxilla and later re-anatomisation of the canines to replace the congenitally missing lateral incisors can be a good alternative. Handled carefully, this option avoids gingival retraction that can accompany implant placement or metal show-through on crowns, bridges and implants that can occur in some restorations after a period. Clinicians treating Class III patients with maxillary hypoplasia have traditionally avoided space closure because of the potentially adverse effects on the profile. The combined use of the Motion 3D Class III Appliance and SLX Brackets for applicable cases biomechanically eliminates these side-effects by optimising the relationship between the maxilla and the mandible, both occlusally and aesthetically,\(^1\) for better results than simply neutralising the potentially adverse effects of opening space for implants.

Camouflage orthodontic treatment can result in protrusion\(^8\) of the maxillary incisors (giving an appearance of a short upper lip), as well as retro-inclination of the mandibular incisors, with deleterious effects on the periodontium. The actions of the Carriere Motion 3D Class III Appliance is distalisation of the mandibular segments from molar to canine as a unit, with intrusion of the mandibular molars, extrusion of the mandibular canines and retraction of the mandibular incisors, the result of which is an anticlockwise rotation of the posterior occlusal plane, producing a significant improvement in the prognathic profile.\(^1\) In Class III cases, choosing brackets rather than an aligner for anchorage and bonding them simultaneously with the functional appliance produces distalisation of the mandibular posterior segment while achieving torque control of the maxillary incisors\(^1\) and space closure, yet with a protractor effect on the maxilla that develops upper lip fullness.
Conclusion

Treatment with the Carriere Motion 3D Class III Appliance is efficient for the correction of adult Class III malocclusions, producing satisfactory results both aesthetically and functionally. The Carriere Motion 3D Class III Appliance used in combination with Carriere SLX Self-ligating Brackets is a biomechanically efficient means of addressing cases with maxillary hypoplasia. Compared with alternatives, such as a combination of surgery and conventional orthodontics for opening space for implants or bridges, these appliances can significantly reduce treatment time for treatment of Class III patients. In cases of agenesis of the maxillary lateral incisors, the approach represented by this case is an efficient alternative for closing spaces while balancing the patient's profile and correcting the Class III malocclusion.

Editorial note: A list of references is available from the publisher.
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Six keys to effectively using alveolar corticotomy: A different perspective on surgically assisted tooth movement

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Introduction

Alveolar decortication (corticotomy) has long been used with orthodontic treatment in order to accelerate orthodontic tooth movement (OTM) while reducing the undesired effects of root resorption, loss of vitality, periodontal problems and relapse of the corrections. The acceleration of tooth movement should shorten the therapy. However, the scientific and clinical assumptions of the early days were totally different from the more recent ones: we moved from a pure mechanical approach to a biological and physiological one.

In 1983, Suya1 proposed a great improvement of the surgical approach described in 1959 by Kole2 modifying the horizontal osteotomy in a corticotomy, avoiding the alveolar crest in the vertical cuts and eliminating the luxation of the blocks. He proposed this “corticotomy-facilitated orthodontics” to treat adult patients, ankylosed teeth and crowded malocclusions to avoid premolar extractions. Like Kole, Suya believed he was creating bony blocks and suggested accomplishing most of the movements in the first three to four months of treatment before the fusion of the blocks (healing of the bone).

The concept of corticotomy-assisted OTM drastically changed in 2001 after the publication of Wilcko et al.3 In this key case report, two adult patients received a selective corticotomy, along with alloplastic resorbable grafts, to increase the bone level and avoid the risk of recessions. An accurate evaluation with CT scans before and after treatment, and histological sections in one case, allowed the authors to formulate a new hypothesis about what really happens at the bone level after corticotomy. No movement of tooth–bone blocks, but a transient reduction of mineralisation of the alveolar bone and modifications similar to those described by Frost4–7 during the healing of fractured bones and named “regional acceleratory phenomenon” (RAP) most likely occur. The surgery-orthodontic protocol proposed by Wilcko et al.3 has been subsequently patented as Periodontally Accelerated Osteogenic Orthodontics (PAOO). The claims of PAOO are (a) accelerated tooth movement with reduction of the total treatment time; (b) osteogenic modifications with transportation of the bony matrix, and final improvement of hard- and soft-tissue support of the teeth treated orthodontically; (c) increase of the short- and long-term stability of the orthodontic treatment. So far, scientific evidence has been given only on the acceleration of tooth movement that is transient, and lasts as long as there is a RAP modification in the alveolar bone surrounding the teeth.

After more than one and a half decades of clinical experience with alveolar corticotomy, in light of the current literature published on this topic, six rules have been established that should be taken into account when considering using alveolar corticotomy in a complex orthodontic case. These keys are the best way to ensure effectiveness and reduce the risk of producing no positive effect or, worse, causing damage. The six keys are as follows:

1. Alveolar corticotomy is to facilitate OTM.
2. Alveolar corticotomy has limited effect in time.
3. Alveolar corticotomy has limited effect in space.
4. A proper surgical procedure must be followed.
5. Proper orthodontic management after corticotomy must be performed.
6. Proper patient selection for corticotomy is essential.

A detailed description of each rule follows.

1. Alveolar corticotomy is to facilitate orthodontic tooth movement (Periodontally Facilitated Orthodontics)

Speed is a fascinating issue in life. We like to go fast in cars, motorbikes, boats, airplanes and so forth. Speed in orthodontics is a different matter. It is one of the main objectives of modern orthodontics to reduce treatment time, but we must recognise that a great number of variables may affect it.8–11

The initial difficulty of the malocclusion and tooth malposition, the age of the patient, the variability of the individual response to the treatment, the quality of the end
result, and the patient’s compliance are just a few of the variables that should be considered. Numerous case reports have been published showing how treatment time can be reduced when patients are treated with corticotomy. Case reports, however, have limited scientific validity.

The predictability and quantification of treatment time reduction are still not scientifically possible. The additional expenses and morbidity associated with the use of alveolar corticotomy should always be carefully evaluated to determine whether they are worth the saving of few months. A shorter orthodontic treatment is desirable, but certainly not at the expense of a high-quality end result.

Regarding OTM, numerous studies have shown that its speed is influenced by bone turnover and the individual response to mechanical forces and it is not related to the level of the forces. Clinical experience confirms this: there are slow movers and fast movers, but we are still far from recognising them. In addition to this variability, there is the temporary effect of alveolar corticotomy, which we will discuss under the third key. A faster treatment may be a secondary advantage and may be obtained in a substantial way only in those “simple” orthodontic cases that require a naturally short treatment.

In conclusion, alveolar decortication should not be combined with orthodontic treatment with the only objective of accelerating OTM and reducing treatment time: the risk of not obtaining either as desired may be high.

Despite this scientific evidence against its major claims, alveolar corticotomy has its place in orthodontic therapy. Let us consider the surgical insult and the associated RAP reaction produced at a biomechanical level: the increased metabolism, the transient reduced regional density (osteopenia) created by the increased osteoclastic activity, the reduced undermining resorption and hyla- linisation (we still do not know exactly what happens in humans) facilitate OTM. The decorticated tooth is less resistant to orthodontic forces and will be easier to move and will require less anchorage.

Spena et al. in two studies conducted on a total of 12 adult patients with Class II malocclusions treated with distalisation of the maxillary molars showed how maxillary molars could be bodily distalised with simple buccal mechanics and no anterior anchorage. Corticotomy was performed only on the teeth to be moved, thus reducing the anchorage needs and their resistance to distal forces.

The term “Periodontally Facilitated Orthodontics”, instead of “Periodontally Accelerated Osteogenic Orthodontics”, is used to describe a procedure that has the primary goal of simplifying, enhancing and improving OTMs that are difficult or risky, from a biomechanical and biological point of view. The surgical procedure and the associated orthodontic treatment and biomechanics depend on the initial problems and the goals of every single specific treatment. This is in agreement with Oliveira et al.: corticotomies should be used to “…facilitate the implementation of mechanically challenging orthodontic movements and enhance the correction of moderate to severe skeletal malocclusions”.

2. Alveolar corticotomy has limited effect in time

Since the early studies of Frost on the biology of fracture healing, it is known that the altered metabolism of bone after a traumatic (or surgical) event has limited duration: it is the natural search for equilibrium or homeostasis.

The burst of hard- and soft-tissue remodelling starts a few days after the insult, peaks at the first or second month, and returns to a normal pace after a maximum of four to six months. This RAP reaction, when applied to the alveolar bone, causes an accelerated/facilitated movement of the teeth subjected to applied orthodontic forces. The effect lasts for as long as there is this reaction, so for a limited part of an orthodontic therapy. This has been confirmed by experimental studies on animals and by clinical studies on patients. Clinically, this temporary phenomenon leads to the need to perform the alveolar corticotomy when the RAP is necessary. Timing is fundamental.

Alveolar corticotomy may be repeated during the treatment with the objective of prolonging the effect. The effective benefit, cost and risks must be taken into account. Sanjideh et al. in a split-mouth study on fox-hounds found that a second corticotomy performed after 28 days in the mandible produced a higher rate of tooth movement and a greater total tooth movement. However, they concluded that proper timing for a second corticotomy needed to be better determined.

Dibart and Murphy claimed that continuously activated orthodontic forces applied after decortication may maintain a constant mechanical stimulation, and allow a prolonged osteopenic state during which teeth can be moved rapidly.

In order to achieve this effect, they recommended seeing patients frequently (every two weeks) and continuing the activation of the applied orthodontic forces. If not, remineralisation would complete the healing process and bring the bone metabolism to a normal level. It must be said that these claims have never been demonstrated either clinically or histologically.
3. Alveolar corticotomy has limited effect in space

The effects of alveolar corticotomy are localised to the area immediately adjacent to the site of injury. This finding is of utmost importance. Different surgeries may affect differently the resulting OTM. Glenn et al. and Tuncay and Killiany, in two experimental studies on animals published before the new trend on corticotomy, found that fiberotomy (a corticotomy limited to the crestal side of the alveolar bone) affected the rate of OTM and shifted the centre of rotation toward the apex of the roots, thus modifying the biomechanical behaviour of the teeth under the orthodontic forces. If the surgical insult is applied to a limited area of the alveolar bone (i.e. middle third and only buccal surface; Fig. 1), the RAP reaction will not be extended to the entire root area. The modifications at the bone level will be limited at the area of the decortication, and control of the apical and lingual sides will not be influenced as desired.

As a general rule, if a mesiodistal bodily movement or better control of the apical area are the biomechanical needs of the OTM to be achieved and enhanced (i.e. intrusion/extrusion), the decortication needs to be extended to the entire alveolar bone surrounding the roots of the teeth, buccally and lingually (Fig. 2); if the movement is less complex or anatomical limitations of the surgical site impede an extended decortication, the cuts may be limited in the direction of the OTM. These biomechanical needs determine the type of procedure in both the open-flap and the flapless surgeries.

4. A proper surgical procedure must be followed

Several surgical protocols for performing alveolar corticotomy have been proposed. Most of them have been tried in the last 15 years on several patients. These surgeries may be divided into two groups: the open-flap and the flapless corticotomies (Tab. 1).

The original corticotomies were performed after raising a flap. This type of surgery is still preferred when an extended or critical area of decortication has to be managed and when an extended grafting is planned.

The flap can be designed according to the periodontal characteristics of the site and has to be full thickness in the area of decortication and split thickness below this area to ensure a good blood supply. Interproximal and subapical cuts of 1–2 mm in the cortical bone (Figs. 3 & 4) are performed together with a light scraping of the external cortex in between the cuts. This extended surgical insult will produce a wide RAP reaction and prepare a bleeding bed for any grafting material eventually placed.
in association with the decortication. Piezo-surgical calibrated micro-saws are preferred to rotating surgical burs because of their selective, safer, micrometric and more precise cuts; better irrigation/cooling effect from cavitation; better comfort for the surgeon; and better healing for the patient. The open-flap corticotomy procedure is routinely used during orthognathic surgery, when exposing impacted teeth, to treat transverse maxillary deficiencies and periodontally involved cases.

Flapless surgery has been proposed as an alternative way of performing a corticotomy. Corticision and Piezocision have been an attempt to reduce the invasiveness of the decortication and the possible periodontal damage and postoperative discomfort with raising a flap. Even if attractive, they seem to have surgical and biomechanical limitations.

The surgical limitations include risks when performed in crowded arches, limited visibility when producing the cuts, limitation of the cuts to the interproximal areas and to the middle third of the roots, difficult control of the grafting in the apico-coronal direction and need for optimal extension of the attached gingiva in the area of decortication. The biomechanical limitations are strictly related to the fact that corticotomy is performed only on the buccal side and middle third of the roots.

They are definitely not minimally invasive surgeries as claimed and are quite expensive for the patient, since only a well-trained periodontist/oral surgeon can perform them and they often require complex planning with digitally designed 3-D surgical guides.

The Micro-Osteo-Perforations (MOPs) described by Alikhani et al. and Teixeira et al. are an effective and minimally invasive way of producing insult to the cortical alveolar bone. These MOPs may be created with manual instruments (Excellerator, Propel Orthodontics) or with dedicated burs on a reduced-speed electric handpiece (Fig. 5).

MOPs are produced with a penetration in the cortex of a maximum of 1–2 mm. Instead of conventional local anaesthesia, a strong anaesthetic gel placed on the mucosa for three minutes is sufficient to control the patient’s pain and discomfort. It is advisable to produce two to three MOPs in each interproximal area of the teeth and both buccally and lingually (Fig. 6), to ensure that the metabolic changes are extended around the entire radicular alveolar bone. Manual MOP is usually created in the frontal areas, whereas drilled MOP is usually performed in the posterior and lingual areas (Figs. 7–9).
procedure and the precautions are similar to the insertion of mini-screws. Orthodontists can easily create MOPs at the chairside, and the cost is a great deal more affordable for the patient. Finally, they can easily be repeated during treatment if additional bone stimulation is needed. No packing and no sutures are necessary after MOP. The limit is that no grafting can accompany MOP.

Whenever possible and desirable, grafting may accompany alveolar corticotomy. The grafting is usually planned before surgery, based upon initial clinical and radiographic evaluation, the desired OTM, and the short- and long-term periodontal considerations. In situations of thin bone and a thin gingival biotype, with risky movements like expansion, labial proclination or antero-posterior movements in reduced bone volumes, grafting may be indicated to reduce/eliminate fenestrations and dehiscences, produce additional support for the roots, and improve final aesthetics and stability.

Grafting may include hard-tissue, soft-tissue and autologous growth factors. Quality and quantity may be modulated at the surgery depending on the clinical conditions of the surgical site. As a general rule, composite bone grafts where allogeneic bone (bone from human cadavers that is freeze-dried to reduce antigenicity and demineralised to expose the underlying collagen and its growth factors, like bone morphogenetic protein) with osteoinductive properties, is mixed with xenogenic bone (bone usually from bovine animals that provides a physical matrix or scaffold suitable for deposition of new bone and that prevents its rapid resorption) with osteoconductive properties are preferred (Fig. 10).

Soft-tissue grafts are added to bone graft when a thin biotype or gingival recession is present. If the area to be regenerated is small, an autologous connective tissue graft is the gold standard procedure. Large areas may be managed with allogenic human acellular dermal matrices, that are available in different sizes and thicknesses (Fig. 11).

Soft-tissue grafts are sutured with resorbable sutures. Both bone and soft-tissue grafts are coupled with autologous growth factors. With ageing, the number of stem cells rapidly decreases. These cells are important in case of injury and healing processes. Studies have shown that growth factors from platelet-concentrated plasma (platelet-derived growth factor, vascular endothelial growth factor, transforming growth factor beta 1 and 2) may rapidly increase the number of the available stem cells, stimulate their activity, as well as reduce inflammation and pain during the healing process. Platelet-rich fibrin (PRF) and the platelet rich in growth factors (PRGF) are prepared via two different protocols in which blood centrifugations allow separation of the plasma platelets from the white and red cells. PRF contains leucocytes and the process for its preparation produces membranes with a light compression of the centrifuged fraction.

The process for preparing PRGF allows the separation of three fractions with different concentrations of platelets. They may be mixed with bone grafts (increasing the graft’s viscosity and adherence to the surgical site, thus facilitating its application) and soft-tissue grafts. Activating and heating the PRGF fraction produces clots/membranes of fibrin that are placed on the bone grafts, stabilising their position (Fig. 12).

When using grafts along with alveolar corticotomy, a tension-free flap closure must be achieved at the end of the surgery, to provide optimal coverage of the decorticated area and the grafted material, and to enhance final soft-tissue healing. Non-resorbable sutures are left for at least 14–21 days.

5. Proper orthodontic management after corticotomy must be performed

Orthodontic treatment associated with periodontally facilitated orthodontics may be carried out with any fixed or removable appliances. It is the clinician’s choice to combine periodontally facilitated orthodontic procedures with fixed, active self-ligating appliances (In-Ovation) with the new prescription of the CCO System (GAC-Dentsply Sirona; Fig. 13). The management and wire changes are similar to those of any orthodontic case. No initial heavy force is necessary. There is no rule regarding timing of the bond-
ing: in some cases, appliances are placed a week after the surgery, while in others (for example, when distalising maxillary molars or repositioning impacted teeth) several months before corticotomy.

The enhanced tooth movement deriving from the RAP reaction is obtained when needed. The major difference is that, after the periodontal surgery and until tooth movement is clearly enhanced, the visits for wire activations or wire changes are every two weeks instead of the usual six to eight weeks.

When corticotomy is performed along with aligner treatment, the frequency of appliance changes is every three to four days.

Alveolar corticotomy may easily be associated with skeletal anchorage devices. Temporary anchorage devices are used to increase anchorage, while corticotomies are used to reduce anchorage.

6. Proper patient selection for corticotomy is essential

Alveolar corticotomy is not for every patient, and it is not feasible to use it on a routine basis in clinical practice. The main indication is in clinical cases with complex OTMs. Open-flap surgery is indicated in impacted teeth, surgery-first procedures with extractions, orthognathic surgery with major postoperative OTMs, complex space closures with reduced supporting tissue, and maxillary expansion in periodontally compromised cases. MOP is indicated in treatments with aligners, complex OTMs without periodontal problems and patients with financial limitations.
One case treated with open-flap corticotomy and two cases treated with MOP will be shown to elucidate the concepts described in this article.

Case 1
A 19-year-old male patient with a Class III dental malocclusion with anterior midline discrepancy wanted to be treated only with aligners (Figs. 14a & b). Treatment was carried out with 71 aligners and two MOPs performed at the second month and at the fifth month of treatment, only on the premolar and molar maxillary dentition (Fig. 15). Class III elastics were prescribed throughout the therapy. Treatment was completed in seven months with acceptable intercuspation in the buccal segments and correction of the midlines (Figs. 16a & b) and with good anchorage control in the lower arch (Fig. 17).

Case 2
A 22-year-old female patient with a Class II, Division 1 dental malocclusion with a missing mandibular right first molar and mandibular anterior midline deviated toward the right presented for treatment (Figs. 18a–c). The treatment plan was to extract the maxillary first premolars and close the mandibular right molar space with minimum anchorage. MOPs were performed after insertion of the mandibular working wire (0.019 × 0.025 in., stainless steel; Figs. 19a–d). Nickel-titanium closed coil springs were applied right after the decortication (Fig. 20). Treatment was completed with good intercuspation, coincident midlines and all spaces well closed (Figs. 21a–c). Figures 22a to d show the dental panoramic tomograms and lateral cephalometric radiographs before and after treatment.
Case 3
A 30-year-old male patient, after two unsuccessful previous orthodontic treatments, with a Class II malocclusion with an anterior open bite, a unilateral cross bite and generalised recession on the buccal aspects of maxillary teeth presented for treatment (Figs. 23a & b). The ideal treatment would have included surgically assisted maxillary expansion, followed by combined orthodontic-orthognathic surgery. The patient refused this treatment, but accepted an alternative treatment with open-flap corticotomy extended from molar to molar and generous hard- and soft-tissue grafting (Figs. 24a & b). Treatment started a week after the surgery and continued with visits every two to three weeks. Once arch coordination had been slowly achieved with 0.019 × 0.025 in. stainless-steel archwires (Figs. 25a & b), followed by 0.021 × 0.025 in. stainless-steel archwires (Figs. 26a & b and 27a & b), the anterior open bite spontaneously closed (Figs. 28a & b). The CBCT images before and after treatment reveal the increased volume of the maxillary alveolar bone that allowed the successful expansion of the upper arch, despite the age of the patient and the initial periodontal problems (Figs. 29a & b).

Conclusion
Alveolar corticotomy (or periodontally facilitated orthodontics as we prefer) is an effective procedure in which alveolar decortication is associated with orthodontic treatment with the primary goal of enhancing OTM and reducing anchorage needs. By accelerating the rate of OTM and reducing the complexity of a clinical case, bone
Decortication may reduce treatment time. However, this effect is considered a side-effect and not the primary reason for using this periodontal surgery. According to the patient’s needs, it may be performed with an open-flap or a flapless procedure and may be associated with hard- and soft-tissue grafting. Further studies are still needed to evaluate indications, contra-indications and risks. The procedures described here will certainly evolve and improve with the improvement of the materials, devices and appliances utilised.

Editorial note: A list of references is available from the publisher.
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Accelerated treatment modalities in clear aligner treatment

Dr Gary Brigham, US

Adopting new technologies is critical to any orthodontic practice that aspires to expand and innovate in the twenty-first century. Responding to patients’ evolving needs is vital to establishing patient satisfaction with treatment and subsequent practice success. Accordingly, the capacity to offer patients unique treatment benefits that specifically address their principal concerns, is perhaps one of the most important driving forces to incorporating acceleration technologies and adjunctive treatment modalities into practice. Significantly, when these technologies are used in combination with other innovative treatments, such as clear aligner therapy, the resultant synergy can potentially result in markedly improved and timely treatment outcomes. Such is the case, I believe, with micro-osteoperforation (MOP) for acceleration of orthodontic treatment, and high-frequency vibration (HFV) for enhanced clear aligner seating and pain/discomfort reduction.

I have found MOP to be clinically effective in acceleration of treatment and in enhancement of clinical results for a broad range of malocclusions, including crowding, space closure, molar uprighting, rotations, intrusions and extrusions.\(^1\)–\(^3\) A research survey of adult patients has indicated that a majority were interested in any procedures that could effectively reduce their treatment time.\(^4\)

My decision to implement MOP in my own treatment procedures arose from increasing requests from my patients to reach their orthodontic aesthetic and functional goals, within a time frame that aligned with their expectations as well as their own estimated capacity for compliance with treatment. Even with Invisalign’s current seven-day aligner exchange protocol, patients have expressed interest in further truncating their treatment time, without increasing the discomfort sometimes associated with tooth movement. MOP has proven to be instrumental in addressing these patient concerns in my practice. It can be performed chairside within several minutes using the Excellerator PT power driver with the disposable surgical grade Excellerator PT power tips. I find predictability and confidence in knowing this device is specifically designed and indicated for performing multiple micro-osteoperforations in a single treatment. The procedure can be applied in both fixed and removable orthodontic appliance therapy, but is especially dramatic in its capacity to impact clear aligner treatment.

The science underlying MOP is based in orthopaedics dating back over 100 years. In 1989, Harold Frost coined the term “Regional Acceleratory Phenomenon” (RAP) to describe this predictable remodelling response of bone to iatrogenic stimuli. Its premise suggests that disruption of the cell membranes of osteocytes, the most ubiquitous cell in bone, stimulates their secretion of a cascade of cytokines and chemokines that accelerate the physiological rate of bone remodelling.\(^5\)–\(^7\) As research has demonstrated that the rate of tooth movement is dependent upon the rate of the physiologic process of bone remodelling, it is reasonable to surmise that an increase in the rate of bone remodelling should correlate with an increase in the rate at which clear aligners can be exchanged.\(^3\), \(^5\)–\(^6\) Use of the Excellerator PT device to create micro-osteoperforations of the cortical plates of interseptal bone activates a chemically-based natural immune response, that accelerates bone turnover and subsequent tooth movement when orthodontic forces are simultaneously applied.\(^5\), \(^6\)

The procedure conducted under topical, or local anaesthetic imparts minimal discomfort to the patient. To further mitigate any potential discomfort, the patient is instructed to take 1,000 mg of Tylenol one hour prior to the appointment. In preparation for conducting the MOP, a topical anaesthetic gel (12.5% lidocaine, 12.5% tetra-caine, 3.0% prilocaine and 3.0% phenylephrine) is sparingly applied and is supplemented with local infiltration anaesthesia using Septocaine (4.0% articaine HCL and epinephrine 1:100,000) in buccal and labial vestibule if needed. Following MOP, the patient is further directed to take 500 mg of Tylenol (acetaminophen) every six hours for the next 24 hours to alleviate any residual discomfort associated with the procedure. Significantly, a majority of patients have reported that they did not require the use of any post procedure analgesics.

Case 1: MOP can especially be used effectively in conjunction with clear aligner therapy. For example, in Figures 1a and b, a 19-year-old female patient presented with a vertical Class II skeletal malocclusion four years post fixed appliance treatment. She demonstrated clinically a retrognathic chin point, an anterior open bite with inadequate incisal guidance, and dark buccal corridors. A treatment plan including adjunctive MOP therapy in conjunction with Invisalign Teen treatment was accepted by the patient, with the patient caveat that no elastics...
would be used and that the treatment would be completed in 12 months. The treatment plan included creating graduated Curves of Spee in both arches by means of maxillary molar and second bicuspid intrusion and mandibular first molar and second bicuspid intrusion, following one of Dayan’s posterior tooth intrusion protocols for anterior open bites. The intrusion mechanics were anticipated to generate a mandibular hinge axis of closure that would create a forward projection of the chin point to improve the patient’s profile and establish incisal guidance while respecting the patient’s maxillary incisal display without the use of elastics. The anticipated forward projection of the mandible offered the secondary benefit of applying interproximal reduction to the proclined mandibular incisors to create space to upright these teeth to an improved position, and to increase the overjet through incisor retraction to accommodate the forward projection of the mandible. In addition, a broadened arch form was expected to be created to address the dark buccal corridors without concern for opening the patient’s vertical further, by virtue of the occlusal coverage afforded by the aligners as well as the adjunctive treatment. The maxillary incisors were extruded less than 1 mm to establish an aesthetic smile arc.

In order to support the intrusion mechanics, MOP was conducted in both arches and supported further by the patient’s use of rubber gum. Figures 1c–e illustrate the number and position of the perforations conducted. In addition, MOP was also conducted distal to the maxillary second molars to maximise molar intrusion. Treatment with 49 aligners was completed (Figs. 1f–h) in seven months and three weeks on a schedule of three- to five-day aligner exchanges, dependent upon the patient’s own determination of appropriate aligner tracking. Based upon experience with cases of a comparable nature where MOP was not used, use of MOP in this patient resulted in exceptional and uninterrupted aligner tracking, achievement of all treatment goals to the patient’s satisfaction, and a treatment time truncated by approximately five months.

Case 2: Occasionally, more complicated cases will require more than one MOP procedure. In my experience, the average MOP procedure will permit a three-
day aligner exchange from three to four months. Where cases are anticipated to extend beyond 50 aligners due to more challenging tooth movements, I then incorporate a second MOP procedure into the treatment plan. For example, in Figures 2a and b, a 28-year-old male patient presented for orthodontic consideration with a vertical Class III skeletal malocclusion characterised by bimaxillary arch constriction, an anterior/posterior crossbite from the left lateral incisor to the left second bicuspid, retroclined and extruded mandibular incisors, a mandibular shift to the patient’s left of 3.5 mm, a 1 mm overjet and a 10–15% overbite. A treatment plan including two adjunctive MOP procedures and Invisalign with 3/16 in., 6 oz Class III elastics was accepted by the patient. The treatment included broadening of the arch form, correction of the crossbite, intrusion of the mandibular incisors with the application of 15° lingual root torque, and intrusion of the posterior teeth to create a mandibular hinge axis of closure of the mandible, to achieve incisal guidance without altering the patient’s maxillary incisal display or extruding the mandibular incisors. In addition, an aesthetic smile arc was planned.

The first MOP procedure was conducted at aligner 1, and the patient exchanged aligners every three to seven days, dependent upon the patient’s own assessment of satisfactory aligner tracking throughout the initial set of 45 aligners. The second MOP procedure was conducted at aligner 1 of refinement (Fig. 2c), and the patient exchanged aligners at the same rate of exchange throughout the next 38 aligners. Following with a total of 83 aligners, the patient completed aligner treatment in 16 months.
Figs. 2a & b: Initial. Fig. 2c: Commencement of refinement prior to 2nd MOP procedure. Fig. 2d: Final.
(Figs. 2d–e), followed by an additional two months of elastic wear with four additional passive aligners (exchanged every two weeks), for a total of 18 months total treatment.

Although all patients are interested in reducing their treatment time, some are not amenable to MOP. For these patients, any adjunctive non-surgical device that has the potential to reduce treatment time by 25–30% has been demonstrated in surveys to be of interest. While the science supporting vibration as an adjunct for tooth movement is sparse, HFV technology appears to be a potentially viable alternative for these patients. Clinical experience has demonstrated HFV’s capacity to enhance aligner seating, which is particularly important with patients that fail to wear aligners the recommended 20–21 hours per day. The ability to progress treatment forward with less than fully compliant patients results in a reduction in midcourse corrections and refinements, and thus in effect secondarily reduces treatment time. Moreover, these devices have demonstrated the additional capacity to reduce the discomfort associated with tooth movement.

Case 3: The following example is illustrative. In Figures 3a and c, a 64-year-old female patient presented with a Class I malocclusion characterised by moderate incisor crowding, a 30% overbite and a 2 mm overjet. She initially agreed to MOP, but changed her mind at aligner delivery. In addition, she refused any attachments. However, she elected to use a VPro5, a high-frequency aligner seater device (Propel Orthodontics) for five minutes daily and to wear the aligners 21–22 hours per day. With a seven-day aligner exchange, her estimated treatment time was approximately eight months and two weeks. Treatment with 33 aligners was completed in five months and three weeks with a five-day aligner exchange, which is a decidedly 30% truncated treatment length when compared with the original anticipated treatment using a seven-day protocol. In addition, the patient indicated that the discomfort associated with new aligner exchange was immediately alleviated with the HFV seating device, and enabled her to progress with a truncated aligner exchange without discomfort. The patient was satisfied with her result and rejected any refinement.

Case 4: Over the past two years, I have used MOP in combination with the HFV aligner seating device. The following is an example of these cases. In Figures 4a and b, a 60-year-old female patient presented with a Class I malocclusion characterised by bimaxillary constriction manifested as severe maxillary and mandibular crowding, and a deep bite (80% overbite) with severely retroclined and super-erupted mandibular anterior, and a steep interincisal angle (158°) outside of the physiological range. The treatment plan included 3 mm intrusion of the mandibular incisors and 1 mm extrusion of the maxillary lateral incisors, to preserve the patient’s incisors display while creating an aesthetic smile arc. MOP was conducted from the distal aspects of the first premolar in both arches,
Fig. 3a: Initial. Figs. 3b & c: Final.
and supplemented with the use of the HFV device for five minutes per day. Prior to the procedure, the patient was instructed on recognising appropriate aligner tracking. As shown in Figures 4c and d, treatment with 79 aligners (43 initial, 22 first refinement, 14 second refinement) was completed in 13 months and three weeks (compared to the anticipated treatment time of 19.5 months without acceleration). The use of MOP in combination with the HFV device resulted in exceptional aligner tracking throughout treatment, patient comfort with the accelerated aligner exchange of every three to six days, and a treatment time truncated by almost six months.

Discussion and conclusion

In spite of a growing body of both laboratory studies and clinical reports investigating the effects of pulse vibration devices—both low- and high-frequency—
on the rate of tooth movement, the inconclusive and sometimes conflicting results, compounded by methodological heterogeneity, have made it difficult to critically assess the evidence. It is of critical importance to recognise this, in order to avoid misleading practitioners into promoting clinical outcomes to their patients that are specious. The paucity of high-quality randomised clinical trials is problematic. Moreover, this challenge is compounded by the trend of manufacturers directing patients to their orthodontic products rather than through orthodontic practitioners, as well as to selected clinicians that promote these products. An emergent scientific observation, for it to become an objective fact, whether or not it is accepted, requires more than a handful of selective scientific research. It requires a whole system of research all pointing in the same direction and towards the same consequences. In the absence of a body of science-based evidence, there, nevertheless, remains an increasing volume of clinical reports that illustrate the potential value of these accelerated modalities.

Precise aligner seating is not only integral to the clinician’s anticipated treatment schedule, but it also prevents teeth from moving in an undesired or unanticipated direction within the aligner, due to a less than adequate fit. Successful tracking is fundamental to accelerated aligner exchange. HFV pulse vibration devices such as the VPro5, have clinically demonstrated the capacity to enhance tracking and tooth movement; assuming appropriate diagnosis, treatment planning and Clincheck design.

An especially particular benefit of this HFV device is that patients only need to use it for five minutes per day, which is conducive to patient compliance. Moreover, it appears to be of benefit with tracking in patients that are less than compliant with the mandated 20 hours per day aligner wear protocol. A recent study demonstrated a significant 99.6% patient compliance rate with the five-minute HFV device. My own experience with a low-frequency vibration device wherein the manufacturer designated a mandatory 20 consecutive minutes of use, resulted in a compliance rate of only 10%, which led me to abandon its use.

During the first few hours or days of aligner exchange, some discomfort is expected. The HFV device has elicited a positive response from a majority of patients, with some patients claiming that its use immediately following aligner exchange, results in complete resolution of discomfort. Congruently, a recent study using the device in aligner therapy demonstrated a statistically significant immediate reduction in recorded pain scores, versus controls within five minutes of aligner exchange, as well as over a seven-day period following aligner exchange. Accordingly, it appears that many patients benefit from use of the device in discomfort modification.

Because the MOP procedure is entirely clinician-directed, it does not rely on patient compliance outside of the office to generate its effects. It therefore provides an opportunity to more readily appreciate its capacity to accelerate aligner treatment, and consequently remains the gold standard for acceleration in our practice. Moreover, based upon clinical experience, it appears that the combination of MOP and HFV devices provides a possible synergistic effect, where the capacity to exchange aligners every three days is extended over a greater period of time, as opposed to instances where MOP alone is used. The benefits of decreased treatment time with enhanced predictability and clinical outcomes are of importance to clinicians and patients alike. Within the past two years, we have experienced patients who have presented for treatment through patient referral, proactively requesting the MOP procedure as an adjunct to their aligner treatment. The use of these accelerated devices in clinical practice has the potential to augment the quality of care, patient acceptance of, and satisfaction with orthodontic treatment. Several years ago, these acceleration modalities had significantly influenced my practice. Now, they have defined it.

Acknowledgement

The Excellerator is the first and only device cleared by the US Food and Drug Administration (FDA) for micro-osteoperforation in orthodontic and dental operative procedures. Propel Orthodontics markets the VPro5, the first and only high-frequency vibration aligner seater. Propel Orthodontics provided financial support to the author.

Editorial note: A list of references is available from the publisher.

## Acknowledgement

Dr Gary Brigham is a Top 1% Super Elite provider of Invisalign and has been an Elite provider since its inception. He has lectured across the US to doctors on all aspects of Invisalign treatment since 2004. In addition to his Doctor of Dental Surgery degree and Orthodontic Specialty Certification, Dr Brigham earned a Master of Science degree in Immunology at Case Western Reserve University in Cleveland, Ohio, in the US. For his research, he was presented with the Harry Sicher Research Award by the American Association of Orthodontists. A former Assistant Professor of Paediatric Medicine at the University of Illinois Medical Center in Chicago in the US, Dr Brigham currently serves as an adjunct professor and is the dedicated Invisalign and Propel instructor in the Graduate Orthodontics Program at A.T. Still University in Mesa, Arizona, in the US. In addition, he practises in Scottsdale and Cave Creek in Arizona, where he has treated 1,967 patients (including over 672 teens) with Invisalign.
Indirect bonding: Digital technique vs conventional method

Drs Arturo Fortini, Alvise Caburlotto, Elisabetta Carli, Giulia Fortini & Francesca Scilla Smith, Italy

One of the peculiar features of straight-wire techniques is the in-built tip, torque and in-out adjustments in the brackets, which reduces the need for making first-, second- and third-order bends on the arch. It follows that the precision in the positioning of the brackets is of fundamental importance for making the correct adjustments and for the consequent predictability of the result, thus making bonding one of the most important steps of the whole treatment.
With direct bonding, there is a high margin of error in bracket positioning, due both to the dental professional’s experience and to difficulty with visualisation. The positioning errors that can be made are on the horizontal, vertical and mesiodistal axes, and can create the need to reposition the brackets during orthodontic treatment, resulting in a waste of time. Over the years, indirect positioning techniques have been developed to make positioning more precise and to make the procedure as fast as possible. The aim of this study was to compare a new, digitally assisted method of indirect bonding (Transfer Bite Leone) with the conventional clear two-tray technique, using the split-mouth method to evaluate the amount of remaining composite around the base of the bracket in both procedures.

In order to avoid differences due to placement, we used the same dedicated programme for both methods. STL files, obtained from intra-oral arch scanning or stone model scanning, were loaded and processed with the Leone Maestro 3D Ortho Studio software (AGE Solutions). This digital tool permits the segmentation and width and height measurement of the teeth, and the subsequent determination of the long axis and the average height of the clinical crowns, in order to virtually arrange the brackets in the correct position. The den-
tist can later change the positioning height, the torque, the tip and the rotation to obtain an absolutely individualised and strategic positioning of the brackets for the case (Fig. 1).

Once the ideal position of the brackets had been obtained, we used the Maestro 3D software to obtain a file that allowed the 3-D printing of the model in which, in the left hemi-arch, the brackets were integrated to be able to use it to produce the conventional thermoformed clear trays that would contain the brackets to be placed in the mouth. In the right hemi-arch, using the software, we designed a Transfer Bite that permitted precise positioning of the brackets. The Transfer Bite is made of biocompatible material and is produced using a high-precision 3-D printer according to specific parameters.

Our split-mouth clinical investigation protocol was accepted by the American Association of Orthodontists committee for the table clinics that we presented at the 2017 annual congress in San Diego in the US (Fig. 2). This procedure clearly demonstrated the limitations of the conventional two-tray technique: inconsistent accuracy, an excess of composite around the base of the bracket that cannot be removed during the bonding step, and difficulty in removing the thermo-printed support (Figs. 3 & 4).

The Transfer Bite system with positioning devices was found to be better because it allows the clinician to have a complete view of the base of the brackets, optimising the removal of excess composite (Fig. 5). In addition, the Transfer Bite, compared with the thermoformed trays, has greater stability on the dental arches, with an even better precision result, and aids the dentist in repositioning the brackets in a detachment case. Our experience of using the Transfer Bite system on 12 patients allows us to confirm that this new indirect bonding method is simpler, easier and more accurate than the conventional method. Furthermore, it proved to be a less operator-dependent technique, allowing even less-experienced clinicians to achieve optimal results.

**Fig. 5:** Leone’s Transfer Bite system.

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Accelerated treatment modalities in clear aligner treatment

Indirect bonding: Digital technique vs conventional method

Hybrid Aligner Therapy

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Hybrid **Aligner Therapy**

Dr Wajeeh Khan, Germany

**Introduction**

The orthocaps Hybrid Aligner Therapy (HAT) is a treatment option that broadens the indications of aligner treatments. This technique makes aesthetic treatment possible for almost all malocclusions, without the need for complex labial or lingual systems. It also helps to reduce the number of treatment steps and treatment duration as a whole. Complicated tooth movements can therefore be carried out more effectively and quickly.

In 1950, Elsasser published an article on the use of the Kesling positioner: “H. D. Kesling developed the concept of an appliance capable of moving teeth without brackets, bands or wires... This was the beginning of a new treatment concept using tooth positioners.”

More and more patients today, want invisible orthodontic treatments instead of conventional fixed braces, yet still expect equivalent results. This increased demand for modern aligners or lingual appliances that we see today, was predicted by Kesling over 70 years ago and was also one of the motivations in developing his appliance.

**Limitations of lingual appliances**

The advent of modern lingual appliances, first introduced in 1967 by Kinja Fujita and developed further in the 1970s in the US, is the result of an ever-increasing demand for aesthetic alternatives in clinical orthodontics. The disadvantages of lingual appliances compared with conventional labial multi-band/multi-bracket appliances are high labour costs, reduced inter-bracket distance, difficult access during wire changes, speech problems, tongue irritation, complicated handling of the appliance and irregularities of lingual tooth surfaces.

**Limitations of aligner-based systems**

The main limitation of aligner-based systems, is the fact that they involve a removable appliance which cannot work unless worn by the patient as prescribed. A prerequisite therefore, is maximum patient cooperation. Another limitation is the difficulty of achieving targeted and constant orthodontic forces throughout the treatment. Attachments are therefore essential to transmit the right forces to correct malpositions.

Clinical studies to date, have mainly focused on one aligner system, which has dominated the market since 1999 namely, Invisalign. There are, however, no independent studies on the efficacy of other comparable aligner systems, such as orthocaps, ClearCorrect and eCligner. Differences in the treatment results between the systems mentioned should be expected, since there are differences in the respective concepts, workflows and materials used. Apart from that, the known general limitations of all removable thermoplastic appliances apply. A few studies that point to these limitations are discussed in this article.

Djeu et al. demonstrated that Invisalign did not perform as well as fixed appliances in a comparison group with malocclusions. The Invisalign group lost 13 objective grading system points compared with the fixed appliance group. The success rate with Invisalign was 27% lower than the success rate with fixed appliances. The aligner system was shown to have advantages in the closure of small gaps and anterior tooth rotations.

According to Phan and Ling, the Invisalign appliance can be used with limitations in patients with simple malocclusions. Furthermore, it was demonstrated that results are more difficult to achieve in comparison with fixed appliances. It was also mentioned that a combination of this aligner with fixed appliances could shorten treatment duration and improve results.

Kravitz et al. showed that the mean accuracy of tooth movements was 47.1% with Invisalign. The least accurate movement was extrusion of the maxillary central incisors (18.3%) and the mandibular central incisors (24.5%). Accuracy decreased significantly with rotations of more than 15°.

According to Simon et al., the mean success of tooth movement with Invisalign was 59%. The mean accuracy of incisor torque was 42%. Premolar de-rotation showed the lowest accuracy, of approximately 40%. Distalisation of the maxillary molars was achieved in 87% of cases. The extent of the planned movements and the staging had a significant influence on the treatment result.

In a review of 271 publications between April 2005 and December 2012, ten studies were selected for inclusion
in a systematic review. From these, it was concluded that Invisalign is suitable as an effective method for closure of minor gaps, lingual constriction and correction of anterior rotation. However, it found that this system did not appear to be able to correct antero-posterior discrepancies, occlusal contacts, extrusions and rotations of more than 15°.

Hybrid Aligner Therapy concept

Orthodontists have been combining multi-band appliances with aligners for quite some time, in order to compensate for certain limitations that are to be expected with aligner treatment alone. The new concept of HAT is based on the idea that part of the movements planned in aligner treatment, can be carried out with fixed partial appliances to achieve aesthetic, effective treatment. This method therefore allows for concomitant use of two conceptually and mechanically different appliances, through which an effective treatment can lead to better clinical results. The exact times, modalities and use of the common lingual fixed auxiliaries can be determined in the treatment plan. Aligners can only be used successfully for severe, protracted or complicated movements in combination with auxiliaries. A large part of the movement is achieved with the aligners, while auxiliaries are used as needed, primarily as support. Auxiliaries can be used during three different treatment phases.

1. Pre-aligner treatment auxiliaries

Certain distalisation, expansion and constriction appliances can be used as part of a comprehensive treatment plan before the initial use of aligners. Examples include such appliances as the Beneslider, Wilson lingual arch, quadhelix, hyrax expander and trans-palatal arch.

2. Intra-aligner treatment auxiliaries

The most important part of the HAT is the integration of auxiliaries with concomitant use of aligners. A significant portion of these auxiliaries is composed of lingual partial appliances, which are indirectly bonded to the lingual tooth surfaces. These modules are composed of lingual brackets and wires, on which the aligner can be placed in a custom-fit way. The movement of teeth is controlled by the interaction between the aligner and the fixed modules. Teeth that serve as anchorage units, are fixed by the interaction between the aligner and the fixed partial appliances. Certain distalisation, expansion and constriction appliances can be used as part of a comprehensive treatment plan before the initial use of aligners. Examples include such appliances as the Beneslider, Wilson lingual arch, quadhelix, hyrax expander and trans-palatal arch.

Virtual brackets and wires were part of the treatment plan according to our concept. The sequential movement that should be achieved by the aligner and the planned movement induced by the fixed partial appliances are synchronised using computer technology. The extent and the distance of the movement of the auxiliaries can be mapped and simulated using 3-D tracking. This technique can be reviewed in detail in the relevant patent specification (process for the production of an orthodontic set-up, WO 2014135599). Tooth movements can also be made possible by creating suitable movement channels within the aligner using special computer processes.

Creating fixed auxiliaries

Virtual modules (brackets and wires) are placed on a virtual set-up model (Fig. 2a). The teeth with the fixed attachments are then returned to the original position (Fig. 2b). The data gained in this way forms the basis of the real models, which are necessary for the fabrication of the transfer tray. The auxiliaries are fixed to the teeth using the transfer tray. Special brackets (i-TTR, Rocky Mountain Orthodontics) with rounded contours and without undercuts allow for easy handling in combination with aligners (Figs. 3a–d).

With the i-TTR bracket, up to three archwires can be used. The central slot can receive a 0.016 × 0.022 in. archwire (ribbon-wise), while two rounded archwires (maximum of 0.016 in.), one gingival and one incisal, can be pulled under the wings. The possibility of using archwires on three different vertical levels significantly broadens the spectrum of use. Heat-activated nickel-titanium archwires are ideal for this purpose. Once the teeth have been partially straightened, another archwire can be used in another slot in order to sustain the movement. This makes a change to a stronger archwire unnecessary.

Pre-activated and pre-loaded auxiliaries for faster and easier use are already being developed by the Ortho Caps company. With this variant, it would no longer be necessary to ligate the archwires after attaching the brackets, as these pre-loaded archwires together with the brackets would be provided via the transfer tray as a single unit for indirect bonding.

3. Post-aligner treatment auxiliaries

Using aligners for the orthodontic closure of gaps in extraction cases is a great challenge, since the adjacent teeth may tip into the extraction space. Once the space closure has been completed with aligners, special auxiliaries help to upright the roots. Another special auxiliary for anterior tooth torque after aligner treatment is currently in the trial stage at Ortho Caps.
The treatment concept discussed, which entails the combination of different techniques and appliances, can also be used for the finishing and retention phase. Use of a bite maintainer may also be advantageous in special cases, for example for functional occlusal balancing, occlusal interferences and undesirable lateral malocclusion caused by aligner treatment.

The orthocaps BiteMaintainer is a type of positioning device made from dental silicone. For cases treated with the orthocaps system, only a lateral cephalometric radiograph, along with centric bite registration, is needed. The design for the BiteMaintainer is modelled in a CAD software after the localisation of the mandibular hinge axis (Fig. 4). This method not only saves time for the orthodontist, but also allows for an exact reconstruction compared with former methods. The BiteMaintainer can be used as a retention device and a finishing device.

Discussion

As the history of orthodontics shows, most of the techniques and appliances used today, including the aligner, are not new concepts or even inventions. We also know as orthodontists, that every technique and every appliance has its advantages and disadvantages. In order to offer our patients the best possible treatment that delivers a guaranteed good long-term result that is both aesthetically and clinically acceptable, we must make the most of all techniques and appliances. The orthocaps HAT uses modern technologies that integrate various treatment processes and methods in order to
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The methods discussed here broaden the indication for the orthocaps aligner system and avoid some of the inherent limitations that all aligner systems share. With the use of the orthocaps HAT, the number of treatment steps and the treatment duration are reduced. HAT also allows for invisible aligner treatment and demonstrates efficacy and shorter treatment time in complex cases. The results achieved with this method are comparable to those of conventional lingual or labial appliances.

Editorial note: This article was first published in the December 2015 issue of KOMPENDIUM.
According to Dr Christian Coachman, orthodontics is a specialty that should be integrated into digital smile design (DSD) and it is essential to understand the importance of this. For better DSD, it is necessary to understand orthodontics as a specialty, firstly, to know which cases could benefit from tooth movement and how, secondly, to convince the restorative dentist about this benefit, and lastly, to help the dentist educate and motivate the patient about this option, to increase case acceptance.

Because to Coachman aligners are the future when it comes to moving teeth, coming to Venice in Italy for the second Congress of the European Aligner Society (EAS) was a good opportunity to participate in an event dedicated to aligners and orthodontics. He presented a post-congress course on DSD and aligners, with a whole-day programme of lectures and a live patient demonstration.

Dr Coachman, you just arrived in Venice, so thank you for taking the time to sit and talk with me. I’d like to start by asking how you got started in dentistry and later the DSD concept.

I started in dentistry because my whole family is in dentistry. My father, my uncle, my grandfather are all dentists. I decided just to follow in that line. My father never pushed me to follow in his tracks. As a teenager, I never went to his office or thought of becoming a dentist; it was more a last-minute decision for me to try dental school. My dream was to become an architect and designer, but for some reason, I decided that I would probably have a better life if I was to become a dentist. I don’t remember why I picked dentistry over architecture; it feels now as if I just ended up in dental school.

Anything related to art and visual skills always attracted me and, somehow, maybe my intuition, lineage, guided me to decide to go into dentistry. So I picked dentistry without knowing that I could become an architect of the smile and it took me a few years to actually find myself happy in the dental profession.

At first, I thought I had made a mistake. I did not enjoy the beginning of my dental studies, and once I finished dental school, I went on to art school because I realised I did not want to become a dentist, but in my first year of art school and with teachers explaining the principles of harmony, proportion, design, arrangement and illusion, the first thing that came to my mind was the smile. I realised I could be an artist of the smile and went back to dentistry and started DSD. One never knows how destiny will guide you. One just has to trust that everything happens for a reason.

It seems that many dentists specialised in restorative dentistry have either studied or worked as dental technicians. Do you think it is a prerequisite for becoming a great restorative dentist or is it enough if one works with a talented dental technician?

It is impossible to be a good restorative dentist without understanding dental technology. Many dental technicians have gone to dental school to become dentists. The difference for me is that I was both, but decided to keep working as a dental technician. Most people become dentists who are also dental technicians, but I did the opposite. It gave me the opportunity to work with many great dentists and partner them as a technician. In this way, I worked with most of my mentors and that was an interesting decision because it made me unique. Even though I could work as a dentist, I prefer to work as a technician for a dentist.

This knowledge and understanding of the other’s specialty allows for better and faster communication. We can create plans together at a different level.
I think that, before being a very good specialist, one needs to be an amazing generalist. One needs to understand a little bit of everything, have a comprehensive, global understanding. It is then possible to choose what we like the most and specialise in that field. The problem is that sometimes people specialise without seeing the big picture and I think it is a limitation.

What do you see as being the most important skill or skills to become a smile designer?

A problem in dentistry that we need to address is the separation between the specialties. An example would be that, for me, it is a great honour to be here. Orthodontics is a new world to me. It makes me understand, realise, that I knew very little about it and orthodontists know very little of my world, restorative dentistry. We need to close this gap and that is one of the things that are very important to become a smile designer.

If one is an orthodontist, one is a smile designer; if one does restorative dentistry, one is a smile designer; if one performs orthognathic surgery, one is a smile designer, but a true smile designer connects everything, and unfortunately, there is still a separation. We need to understand better that the patient does not care what one’s specialty is. As a dentist, one needs to become an orofacial expert, to go beyond dentistry, to understand the face, the lip dynamics, plastic surgery, dermatology, a little bit of all the specialties, because the patient deserves a comprehensive planning, and to understand what is best for the patient, one needs an understanding beyond the specialties to have a complete picture. That is the main skill for a modern smile designer, understanding the big picture. It is necessary to understand the basics to be able to educate the patient about the possibilities. I think we will become modern smile designers when we can understand a little bit about all these pieces and then be able to work as a team with specialists in all the different specialties.

Therefore, continuing education is very important. Is it a requirement in Brazil for dentists?

Unfortunately, it is not an obligation in Brazil. I think that the market itself will push people into it. I see that being a complete orofacial expert makes total sense for the patient and I think people understand that. When one goes to a physician, one doesn’t want one who understands only the area where one’s pain is; one wants a physician with a greater vision, to understand the connections of one’s pain with one’s whole body. So too with a dentist: before going to a specialist, one wants a dentist that sees everything and can refer one based on this.

The dentist can help his or her patients much more than what people imagine. I like the concept of orthodontist Dr William Arnett, who became one of the top orthognathic surgeons. He said that if one wants to become a real dentist, one needs to take care of the face from the aesthetic standpoint, the airway because the patient needs to breath well to be healthy and the bite because occlusion is essential and that connects the whole body as well in terms of posture and balance, etc. We need to extend our vision to take care of all of this.

You are usually at congresses to lecture. Do you sometimes attend to learn, expand your knowledge?

I don’t know about orthodontic congresses, since this is one of the first I have attended, but in my area, restorative dentistry, periodontics, implantology, etc., many lectures are becoming kind of boring because people seem to have been talking about the same things for the last ten years. I think an ideal congress should provide three aspects, three types of speakers: the ultra-specialised speaker, going in depth about the details and exploring better ways to do the same things that we have been doing—usually congresses are too focused on having these presenters only—and I believe that another third of the presenters should be generalists who see the big picture and talk about a comprehensive vision, holistic integration, for example here connecting the orthodontic world with taking care of the human being as a whole, health in general, and finally, another third of the speakers should be there to talk about innovation, about thinking outside the box, and trends. These three aspects for me are important to give quality to a congress.

I am not sure though that what is presented during congresses is actually widely used by dentists. To what extent do these trends and new technologies really find their way into practices do you think? I do hope, but am not certain that the digital approach is as widely used as it should be.

I think there is a tendency to over-complicate things. The reality on the podium, in research, at universities and in lectures compared with the reality in the dental office, where one needs to make the patient happy, follow basic ethical principles, as well as make money and run a business, means one needs to find a balance between it all to deliver care that one can be proud of.

The digital approach is just starting; it is a huge paradigm shift and it will take time. People fight against changes and don’t like to change, preferring their comfort zones, but that is not just in dentistry. There is a time of shift, then there are the early adopters, the people who have a business vision, who really make money out of these new ideas, and after a few years, the majority start to really come on board. That is the process of life. The smart people and the people who will really benefit from these changes and innovations are the ones that understand how to incorporate these ideas and create a business model around them.

Thank you very much for your time.
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Second EAS Congress proves its worth

From an expected 400, the number of attendees at the second Congress of the European Aligner Society (EAS) rose to 550, confirming that, with a committed and passionate board, the meeting is, indeed, much needed by dental professionals. The programme included pre- and post-congress courses, in addition to the general session, as well as posters and short presentations. The Journal of Aligner Orthodontics, published by Quintessence, was launched as the official journal of the EAS at the event, which took place in Venice, Italy, at the Hilton Molino Stucky hotel from 16 to 19 February.

Under the theme of “Are you ready to become invisible?”, the three-day meeting covered current trends, directions, possibilities and techniques in aligner treatment. It opened on Friday with pre-congress courses and a short communication programme.

The EAS concept is to give dentists a platform for presenting their research and cases. This serves as an opportunity to discover new talent, but also as a wonderful way for all to be able to present their work, in line with one of the goals of the EAS: to offer a forum for showcasing the latest developments in and with aligner treatment.

In the main programme on Saturday and Sunday, international speakers presented on a range of topics. Their papers covered cases treated with different systems, the treatment of malocclusions, understanding tooth movement, an interdisciplinary approach to treatment, technical issues such as biomechanics, and digital smile design and the need for restorative dentistry to understand and incorporate orthodontics as well. Eleven posters were also presented during the congress.

During the plenary session on Sunday, Dr Gabriele Rossini received the best research award for his short paper titled “Clear aligner orthodontic optimization through finite element analysis”. During a full-day post-congress course on 19 February, Dr Christian Coachman gave lectures on the digital smile design revolution, with a live patient demonstration.

Aiming to be the main continuing professional development provider for allied professionals involved in aligner treatment delivery, the EAS holds educational events, including its biennial meeting. Before the next EAS Congress, to take place in 2020, the second EAS interim congress will meet next year in the spring. The locations of both events are yet to be announced.
Board members: Drs Alain Souchet, Clemens Fricke, Francesco Garino, Graham Gardner and Tommaso Castroflorio (Credit: Mauro Calvone).
meetings

International Events

11th Asian Pacific Orthodontic Conference – APOC
5–7 March 2018
Boracay, Philippines
www.apoc2018.org

26th Australian Orthodontic Congress
9–12 March 2018
Sydney, Australia
www.aso2018sydney.com.au

SIDO International Spring Meeting 2018
16–17 March 2018
Naples, Italy
http://eventi.sido.it/spring2018/

International Association for Orthodontics
Annual Meeting
25–29 April 2018
Kauai, Hawaii, US
https://www.iaortho.org/2018-annual-meeting/

American Association of Orthodontists – AAO
Annual Session
4–8 May 2018
Washington DC, US
www.aaainfo.org

2018 Latin American Carriere Symposium
30 May–1 June 2018
Cartagena, Colombia
www.carrieresymposium.com

94th European Orthodontic Society Congress – EOS
17–21 June 2018
Edinburgh, Scotland
www.eos2018.com

2018 CAO 70th Annual Conference
6–8 September 2018
Vancouver, BC, Canada
https://cao-aco.org/orthodontics/events/cao-annual-conference/overview/

10th World Implant Orthodontic Conference 2018 – WIOC
6–8 September 2018
Bali, Indonesia
www.wioc2018.com

2018 European Carriere Symposium
20–22 September 2018
Paris, France
www.carrieresymposium.com

British Orthodontic Conference 2018 – BOC
27–29 September 2018
London, UK

Southern Association of Orthodontists 2018 – SAO
Annual Meeting
4–7 October 2018
New Orleans, US
www.saortho.org

Pacific Coast Society of Orthodontists – PCSO
82nd Annual Session
11–14 October 2018
Monterey, US
www.pcsortho.org/Educational-opportunities/annual-session.aspx

49th SIDO International Congress 2018
11–13 October 2018
Florence, Italy
www.sido.it/img/media/131845_Congresso_flyer.pdf

77th Annual Meeting of the Japanese Orthodontic Society – JOS
30 October–1 November 2018
Yokohama, Japan

NESCO 97th Annual Meeting
2–3 November 2018
Uncasville, US
www.nesco.org/meetings-and-education/future-meetings/

21es Journées de l’Orthodontie
9–12 November 2018
Paris, France
www.journees-orthodontie.org

35th BDO Annual Meeting
23–24 November 2018
Berlin, Germany
www.bdo-jahrestagung.de

5th Scientific Conference for Aligner Orthodontics
23–24 November 2018
Cologne, Germany
www.dgao.com

18th International Orthodontic Symposium – IOS
29 November–1 December 2018
Prague, Czech Republic
www.ios-prague.com
Submission Guidelines

Please note that all the textual components of your submission must be combined into one MS Word document. Please do not submit multiple files for each of these items:

- the complete article;
- all the image (tables, charts, photographs, etc.) captions;
- the complete list of sources consulted and
- the author or contact information (biographical sketch, mailing address, e-mail address, etc.).

In addition, images must not be embedded into the MS Word document. All images must be submitted separately, and details about such submission follow below under image requirements.

Text length

Article lengths can vary greatly—from 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an unusually long article in multiple parts, but this usually entails a topic for which each part can stand alone because it contains so much information.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

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We also ask that you forego any special formatting beyond the use of italics and boldface. If you would like to emphasise certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface is reserved for article headers. Please do not use underlining.

Please use single spacing and make sure that the text is left justified. Please do not centre text on the page. Do not indent paragraphs, rather place a blank line between paragraphs. Please do not add tab stops.

Should you require a special layout, please let the word processing programme you are using help you do this formatting automatically. Similarly, should you need to make a list, or add footnotes or endnotes, please let the word processing programme do it for you automatically. There are menus in every programme that will enable you to do so. The fact is that no matter how carefully done, errors can creep in when you try to number footnotes yourself.

Any formatting contrary to stated above will require us to remove such formatting before layout, which is very time-consuming. Please consider this when formatting your document.

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Please place image references in your article wherever they are appropriate, whether in the middle or at the end of a sentence. If you do not directly refer to the image, place the reference at the end of the sentence to which it relates enclosed within brackets and before the period.

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- These images must be no smaller than 6 × 6 cm in size at 300 DPI.
- These image files must be no smaller than 80 KB in size (or they will print the size of a postage stamp!).

Larger image files are always better, and those approximately the size of 1 MB are best. Thus, do not size large image files down to meet our requirements but send us the largest files available. (The larger the starting image is in terms of bytes, the more leeway the designer has for resizing the image in order to fill up more space should there be room available.)

Also, please remember that images must not be embedded into the body of the article submitted. Images must be submitted separately to the textual submission.

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Questions?

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\(^1\) Study data on file
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