

# Management of the dento-periodonto-muscular imbalances in the incisor–canine mandibular region by labiomental weakening surgery and corticotomy

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## ABSTRACT

*Incisor and canine mandibular regions are a key mechanical vault, which strives with strong muscle and occlusal centripetal forces. In cases of dental and / or periodontal weakness and / or excessive mechanical stress, situations of imbalance can affect the stability of orthodontic treatments and periodontal durability.*

*This article reports two surgical techniques to prevent and treat these situations:*

- *The labiomental weakening in growing children and adolescents;*
- *Alveolar corticotomy with vestibular allograft bone in adults;*

*Both techniques allow functional management of mechanical imbalance, improvement of the periodontal biotype, and promote lower incisors' relocation.*

## KEYWORDS

*Lower incisor, periodontium, mentalis muscle, surgical labiomental weakening, alveolar corticotomy*

## INTRODUCTION

The position and axis of the mandibular incisors and canines are often considered a major factor in the success and stability of our orthodontic treatments. In a rather

dogmatic way, we try to respect the inter-canine distance or to obtain an optimum incisor mandibular angle/mandibular plane. These ideas are of course often subject

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*Article received: 23/10/2017.*  
*Accepted for publication: 23/11/2017.*

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to discussion, but unfortunately quite rarely, by addressing their functional aspects and by isolating too easily the teeth of their periodontium.

The incisor–canine region of the mandible is indeed the fundamental starting point of any procedure in a mechanical sense of the term. Like an architectural vault, this area concentrates important centripetal pressure. These are the occlusal forces (OFs) produced by the incisors and maxillary canines at the beginning and end of the masticatory cycle as well as vestibular muscle forces produced by the labiomental muscles. However, under normal conditions, the tongue produces little centrifugal action. It is therefore a fragile mechanical system

in which the notion of balance is paramount.

We often find people with small teeth, an often-fine alveolar bone and a reduced attached gum height. In the event of any imbalances, these elements may become trapped, creating dental or periodontal alterations that jeopardize the success or stability of treatments.

Unfortunately, this situation of imbalance is frequent. It is then necessary to be able to evaluate all the elements involved to propose an etiological treatment to our patients.

In this article, we will focus on surgical options to reduce centripetal mentalis muscle hyperactivity or to manage a loss of balance of the mandibular incisors and their periodontium.

## TOWARD A THEORY OF BALANCE

### Anatomy of the incisor–canine region of the mandible

It comprises three complexes:

- A **dental complex** including incisors and canines. Their ideal position is one that allows functional occlusion, with an inclination that transmits OFs homogeneously to their supporting tissues and centering within the symphysis bone.  
The structure of the dental complex naturally adapts to pressure and is stable in the equilibrium zone known as the “buccal corridor”<sup>2</sup>.
- A **labiomental muscle complex** (Fig. 1) essentially comprising:
  - the buccinator muscle, a pair of muscles whose anterior termination

- at the level of the labial commissure allows the oral orifice to be stretched
- the orbicularis muscle of the labia, a median muscle extending from one commissure to the other which permits occlusion in the mouth
- the mental muscles, a pair of muscles stretching from the fossa of the mental symphysis to the skin of the mentum, allowing the soft parts of the mentum to be raised
- the medial mental ligament, interposed between the two mental muscles, attached to the mental symphysis and the skin of the mental region, creating the mental fossa
- the descending muscle of the lower lip, a muscle evenly extended from the anterior part of the oblique line from the mandible to the lower labia

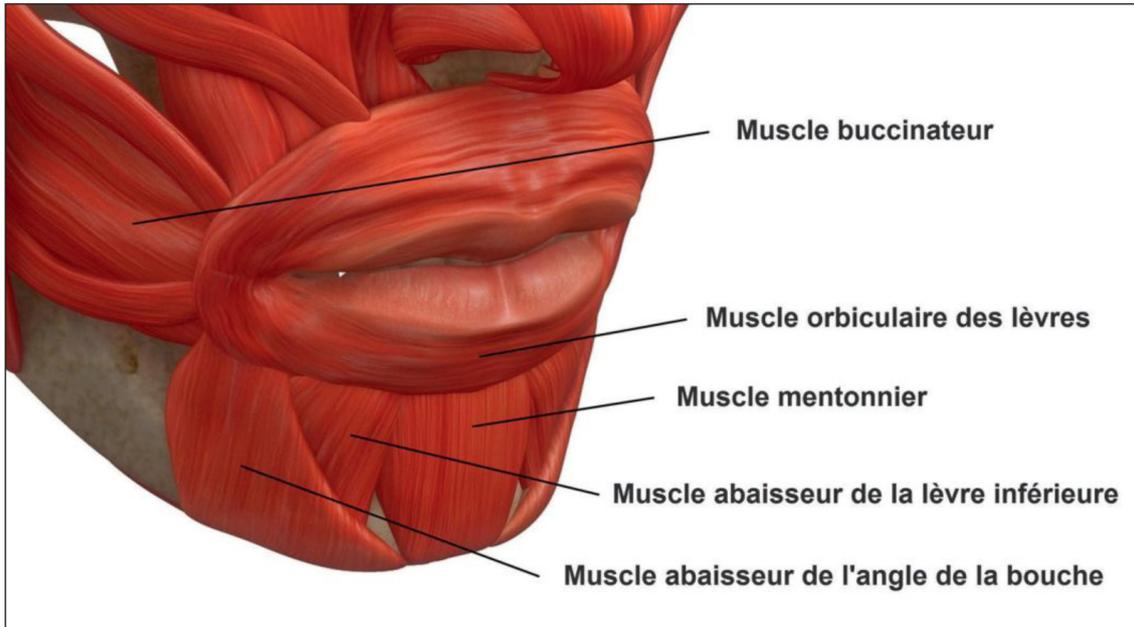


Figure 1  
Anatomy of the labiomental muscle complex

- the depressor anguli oris muscle, a muscle evenly extended from the anterior part of the oblique line from the mandible to the labial commissure

This muscular complex includes a constant tone and has many functions based on it (chewing, swallowing, respiration, speech, and facial expression) that can be modified by the presence of dysfunctions or parafunctions.

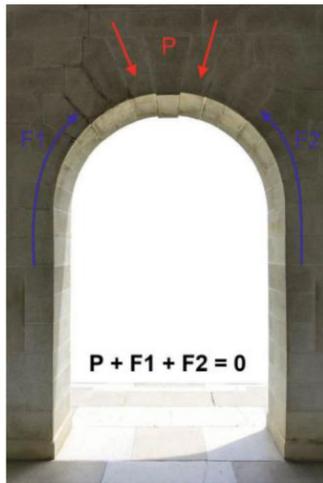
- A **periodontal complex**: cementum, alveo- dental ligament, alveolar bone, and gingiva. These elements provide support and protection to the dental complex, but are also caught in the vice at the interface between the dental complex and muscle complex.

The periodontal complex position is dependent on the dental complex position, and its typology (periodontal biotype) is defined by the Maynard and Wilson classification<sup>4</sup>.

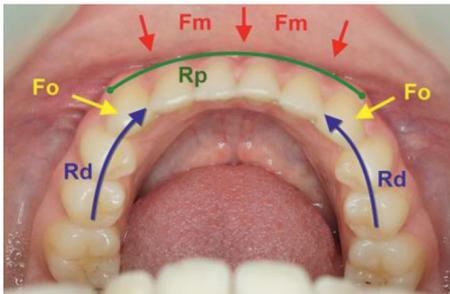
### Biomechanics of the incisor–canine region of the mandible

Several forces act on this region:

- muscular forces (MFs) of the labio-mental complex. They are essentially centripetal and extend along the muscles stretching from canine to canine.
- OFs on incisors and maxillary canines. Besides being centripetal forces, these are also vertical, sagittal in incision, and more transversal during mastication.



a



b

Figure 2

Mechanical similarity between an arch (a) and the incisor–canine region of the mandible (b).

They meet two points of resistance:

- the mechanical dental resistance (DR) or its ability to resist movement
- the mechanical periodontal resistance (PR), which depends on the periodontal biotype

This mechanical system forms an arch in which the teeth are the framework, the periodontium the binder, and MFs and OFs the mechanical load to be supported. This system is comparable to that of an arch in architecture (Fig. 2a and b).

Possible mechanical situations:

- $DR \geq (MF + OF)$  and  $PR \geq (MF + OF)$ : equilibrium situation
- $Rp \geq (MF + OF) > DR$ : mechanical imbalance with dental consequences
- $DR \geq (MF + OF) > PR$ : mechanical imbalance with periodontal consequences
- $(MF + OF) > DR$  and  $(MF + OF) > PR$ : mechanical imbalance with dental and periodontal consequences

### Signs of mechanical imbalance of the incisor–canine region of the mandible

Signs resulting in excess MF:

- mental tension to regain labial competence
- labiomental tension when swallowing
- a high attachment of mental muscle raising the bottom of the vestibule to the traction of the lip (Fig. 3)
- marked labiomental groove with mental ligament opposing a significant resistance to traction (Fig. 4a and 4b)



Figure 3

High attachment of the mental muscle raising the bottom of the vestibule to the traction of the lip.

## Signs causing an excess of OF:

- supraocclusion resulting in mandibular locking with anterior interference during mastication
- signs of bruxism

## Signs of DR defect:

- incisor–canine crowding marked by a lack of coronal resistance
- mandibular incisor proalveolia if there is no root resistance
- global mandibular retroalveolia with prognathism (the basal symphyseal bone remains well positioned) if it is a global defect (Fig. 4c)

## Signs of PR defects:

- fine periodontium with reduced attached gingival height or even recessions (Fig. 4d)
- exposed roots of the incisors visible under the free mucosa
- fineness, fenestration, or absence of bone in the vestibular incisors (on profile telerradiography or CBCT) (Fig. 5a and 5b)

These clinical and radiographic signs will be actively explored during the diagnostic phase. This phase will dictate our treatment goals and treatment plan. It is the simultaneous presence of signs of

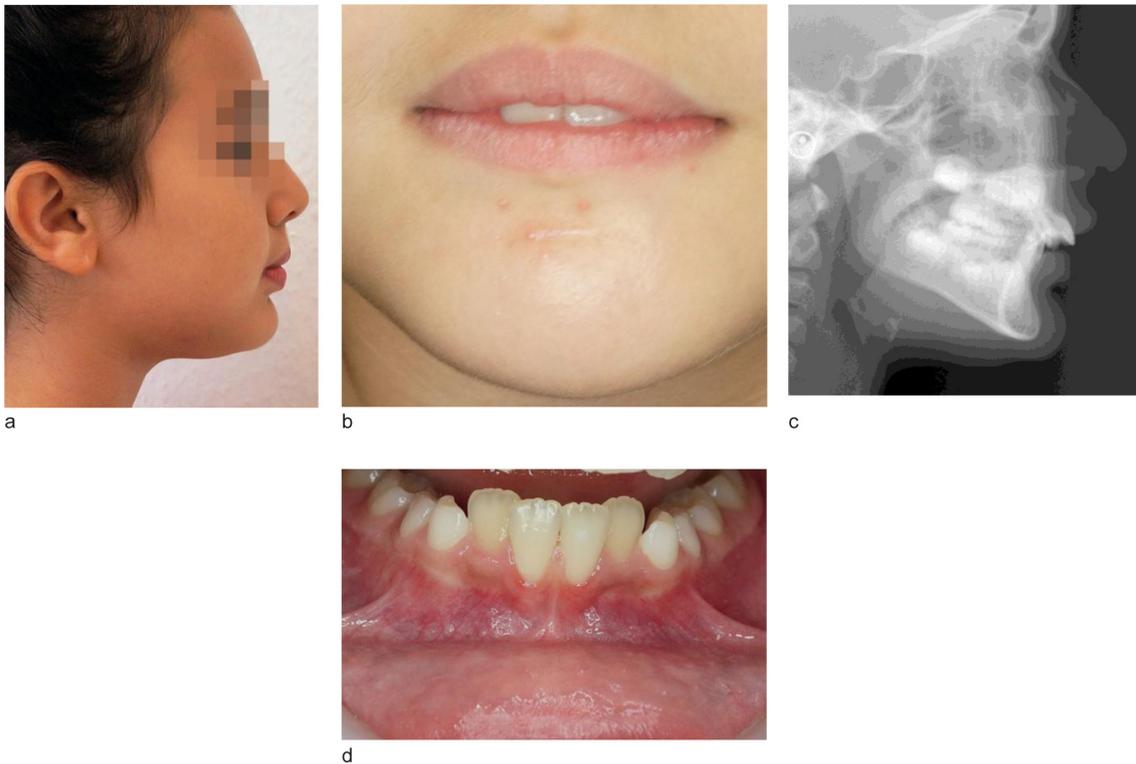


Figure 4

*A 9-year-old patient with mechanical imbalance in the incisor–canine region of the mandible, resulting in a marked labiomental groove (a) with cutaneous impression (b), global mandibular retroalveolia (c), and a weakened periodontium with reduced vestibular depth (d).*

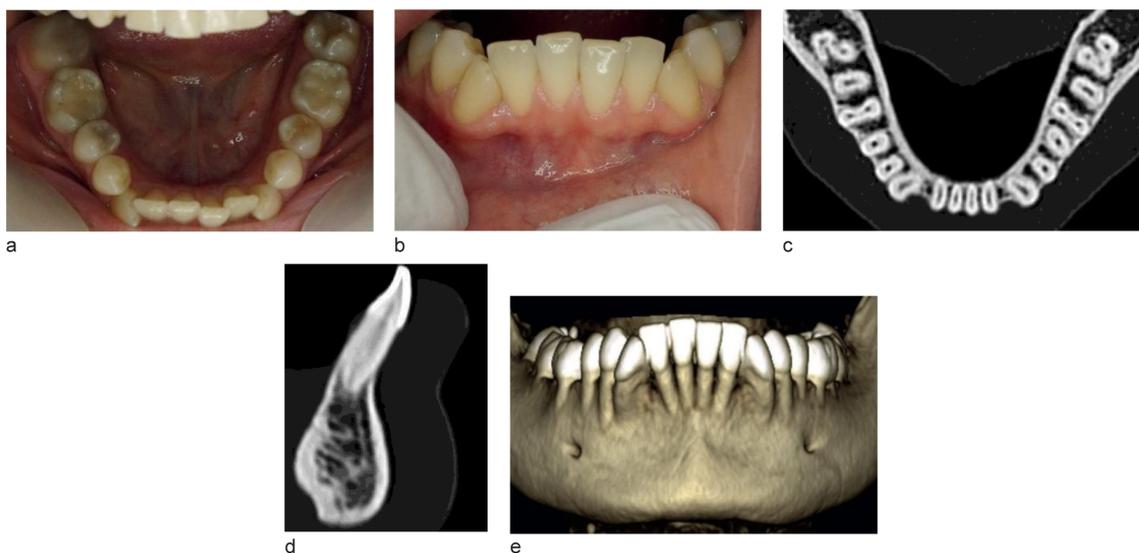


Figure 5

Figure 5: A 38-year-old patient with a mechanical disequilibrium of the incisor–canine region of the mandible, resulting in severe incisor–canine crowding by retroalveolia and incisor regression (a), a fine periodontium and a free mucosa exposing the incisor roots (b), and an absence of vestibular alveolar bone at the CBCT (c, d, and e).

excess strength and lack of resistance that can point us toward a functional imbalance of this region. The accumulation and diversity of these signs will indicate the severity of the imbalance.

Note: there are special cases in which the tongue can also affect the balance of this region:

- primary swallowing with a very low tongue: the tongue will then press on the lingual surface of the mandibular incisors, while a simultaneous and dysfunctional contraction of the mental muscles will create a centripetal pressure along the roots of these teeth. This creates vestibular sloping forces, which affect the mandibular incisors.
- ankyloglossia or macroglossia: the tongue will also create a centrifugal force.

### Therapeutic modulation of the biomechanics of the incisor–canine region of the mandible

Our orthodontic treatments will be able to act on certain mechanical elements of this region:

- reduction of OF: incisal ingression or three-dimensional reorientation of the occlusal plane makes it possible to reduce or eliminate occlusal interferences in incision and chewing as well as to reduce parafunctions
- reinforcement of DR: dental alignment with a suitable arch form and inter-proximal enamel grinding (stripping) creates interdental contact surfaces or the placement of fixed or removable orthodontic braces, reinforcing DR to mechanical stresses.

Unfortunately, it is orthodontically difficult to act on MF and PR.

If we increase DR with our treatment (for example, alignment) without considering MF, the periodontium can be negatively compressed or its resistance PR may decrease and risk causing irreversible

alterations in the short, medium, and long term.

Physiotherapy and rehabilitation may be of interest if MF is decreasing, but they will be insufficient in the face of excessive force and/or an already reduced PR. Surgical management is then indicated.

## SURGICAL REBALANCING IN CHILDREN AND YOUNG ADOLESCENTS

At this age, we see labiomental weakness with vestibular deepening. The surgical technique we use is an adaptation of the techniques proposed by Waroquy et al.<sup>7</sup> and Bedhet et al.<sup>1</sup>

### Surgical technique

- Intra- and extraoral decontamination
- Local anesthesia at the bottom of the vestibule.
- Arciform epithelial incision along the lower labial mucosa from 34 to 44 (Fig. 6a).
- Partial thickness dissection of the epithelium from the vestibular floor up to the muco-gingival junction line (Fig. 6b). At the level of the latter, the incision will be continued deep down until it reaches the bone.
- The muscular attachment is stretched over the entire height of the mental symphysis (Fig. 6c).
- The insertion of the mental ligament is resected with the scalpel (Fig. 6d).
- The partial thickness flap is sutured at the bottom of the periosteal vestibule with absorbable sutures to prevent muscular reattachments (Fig. 6e and 6f).

- The inner side of the lip and vestibular floor show second-intention healing (Fig. 6g and 6h).

### Results (Figs. 7, 8, 9, and 10)

#### Periodontal technique

This technique allows us in to attach the cicatricial mucosa to the periosteum the short term and thus **increase the height of the attached gingiva**. A sufficient amount of attached gingiva prevents recessions and inflammation of the gingival margin in case of oral hygiene issues. In the medium term, we also observe **vestibular alveolar bone apposition** on profile teleradiography with a point B advance. Therefore, there is an improvement in PR at both the gingival and alveolar levels.

#### Muscular technique

Muscle detachment and resection of the mental ligament **increases the flexibility of the lower labia, decreases muscular contractions** in "orange-peel" mental cases, and softens **the labial-mental furrow** if it is too pronounced. There is therefore a decrease in MF. However, we do not observe any sagging of the mentum

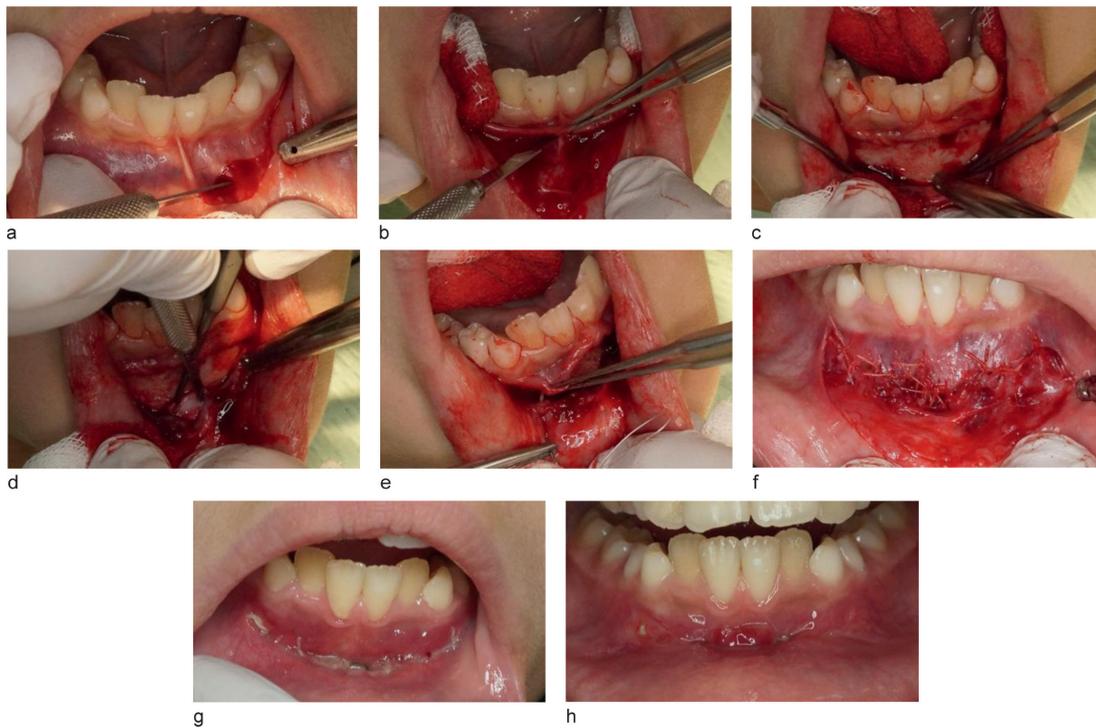


Figure 6

*Surgical technique of labiomental weakening with vestibular deepening. Arciform epithelial incision (a), dissection of the upper flap in partial thickness (b), muscle detachment down to the bare bone surface(c), resection of the medial mental ligament (d), partial thickness sutures of the mucosal flap at the lower part of the orbicular fibers by separate sutures (e, f). Second-intention healing at 1 week (g) and at 2 weeks (h).*

or lower labia as opposed to the lifting action of the mental muscle.

#### **Orthodontic technique**

Thanks to the reduction of centripetal muscular stresses, practiced interception, at the beginning of treatment or during orthodontic treatment, makes

it possible to achieve a **spontaneous anterior repositioning of the root of the incisors in the symphysis**. Mandibular proalveolias were corrected by approximately 10° in 6–12 months. We also observed a **new burst of mandibular growth with** an onset of spontaneous correction of retromandibulia.

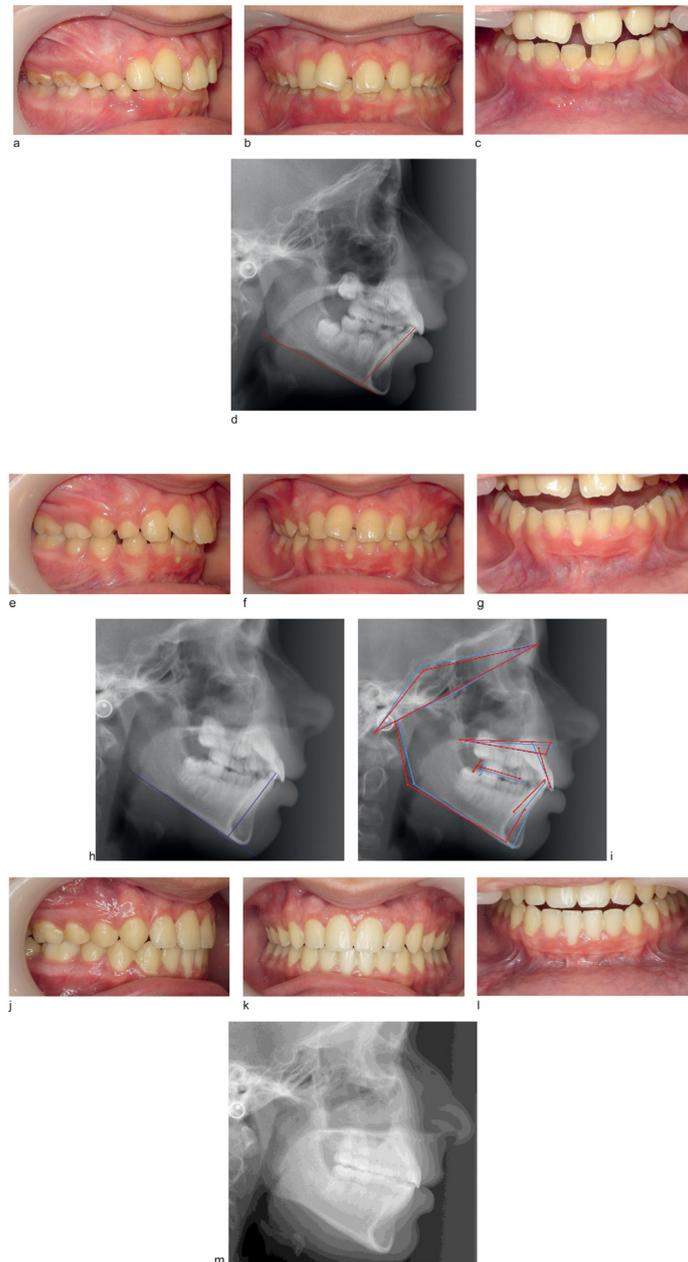


Figure 7

*Interception of a mandibular proalveolia with gingival fenestration at 10 years through labiomental weakness. Intraoral views (e, f, g) and profile teloradiography (h) 1 year after the surgery (without orthodontic treatment) showing spontaneous rectification of the mandibular incisors with IMPA = 94° and an advance of point B; superposition with the Procrustes software (red = before/blue = after) showing incisal repositioning and mandibular growth (i); intraoral views (j, k, l) and profile teloradiography (m) at postoperative 4 years, with orthodontic treatment with multiple attachments and 1 year of restraint; the IMPA remained stable at 94°.*



Figure 8

Management of retroalveolia and mandibular retrochelia at age 13 by labiomental weakness and orthodontic treatment. Profile before treatment (a) and profile after 2 years of treatment and 1 year of restraint, showing labial progress and decrease in prognathism (b).

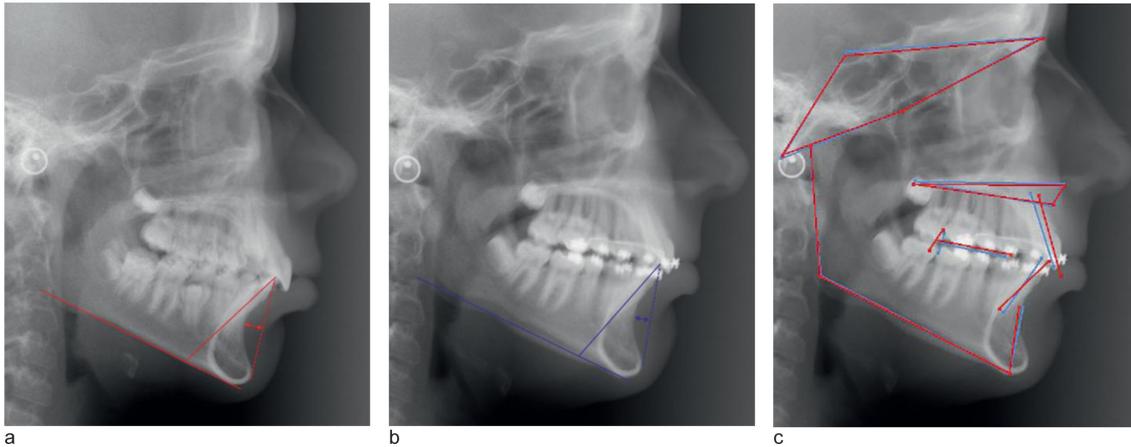


Figure 9

Management of a mandibular proalveolia at 12 years by labiomental weakening 3 months before orthodontic treatment. Initial profile teleradiography,  $IMPA = 108^\circ$  (a), at postoperative 11 months with 8 months of leveling on a round arch, the mandibular incisors straighten spontaneously by  $11^\circ$  ( $IMPA = 97^\circ$ ), and the concavity of the symphysis decreases significantly (b), superposition with the Procrustes software (red = before/blue = after) (c).

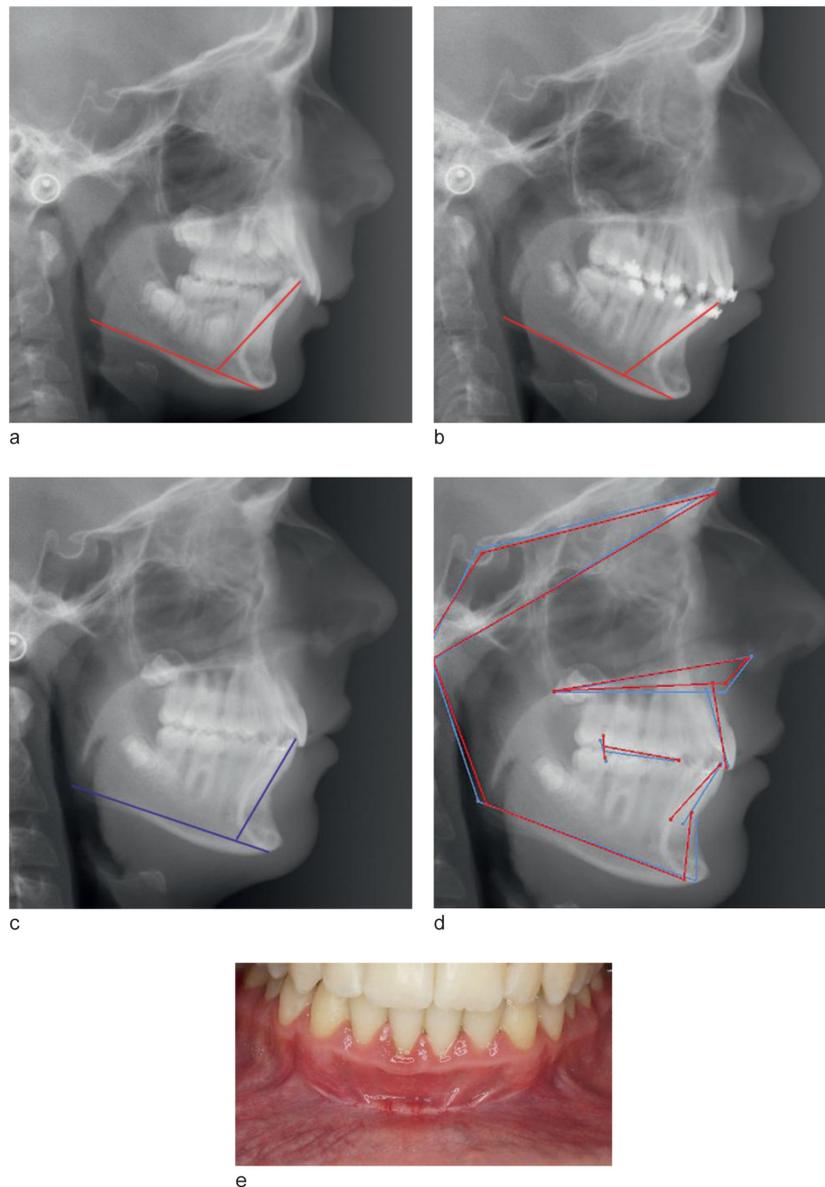


Figure 10

Management of retromandibulia with mandibular incisor proalveolia in a 12-year-old with labiomental weakness during orthodontic treatment. Teleradiography of profile before treatment (a), reevaluation profile teleradiography following 12 months of multi-attachment treatment showing a worsening of mandibular proalveolia with  $IMPA = 110^\circ$  (b), labiomental weakness is established at this time, teleradiography of the profile at the end of treatment after 9 months following the removal of the multi-fasteners and 1 year of restraint, the  $IMPA$  is reduced to  $100^\circ$  and the mental muscle has relaxed (c), superposition with the Procrustes software (red = before / blue = after) showing the root straightening of the mandibular incisors and mandibular growth (d), periodontium at the end of treatment (e).

## SURGICAL MANAGEMENT IN ADULTS

Once the patient has stopped growing, bone management seems necessary. We then use a graft corticotomy technique, based on the technique of the Wilcko brothers<sup>5,9</sup>. A CBCT is carried out initially to identify and quantify bone defects.

### Surgical technique

- Intra- and extraoral decontamination
- Local anesthesia at the bottom of the vestibule. Horizontal gingival incision while maintaining an attached gingival band of 2 mm from 35 to 45 mm. If the height of the attached gingiva is insufficient, the incision is intra-sulcular and coronal displacement of the flap is used instead. Root covering techniques can be considered as well.
- Elevation of a vestibular flap of full thickness in the symphyseal region.
- Detachment of the mental muscles on the symphysis and resection of the mental ligament (Fig. 11b).
- Incision of the periosteum at the bottom of the vestibule to provide enough room for the flap necessary for passive coronal replacement.
- Interdental incisions of the vestibular alveolar bone, traversing the entire thickness of the cortical lamina, but barely penetrating the medullary bone: combination of straight incisions and points, with the round bur or fine piezoelectric insert, without damaging the alveolo-dental ligament or the dental roots under abundant irrigation (Fig. 11c).

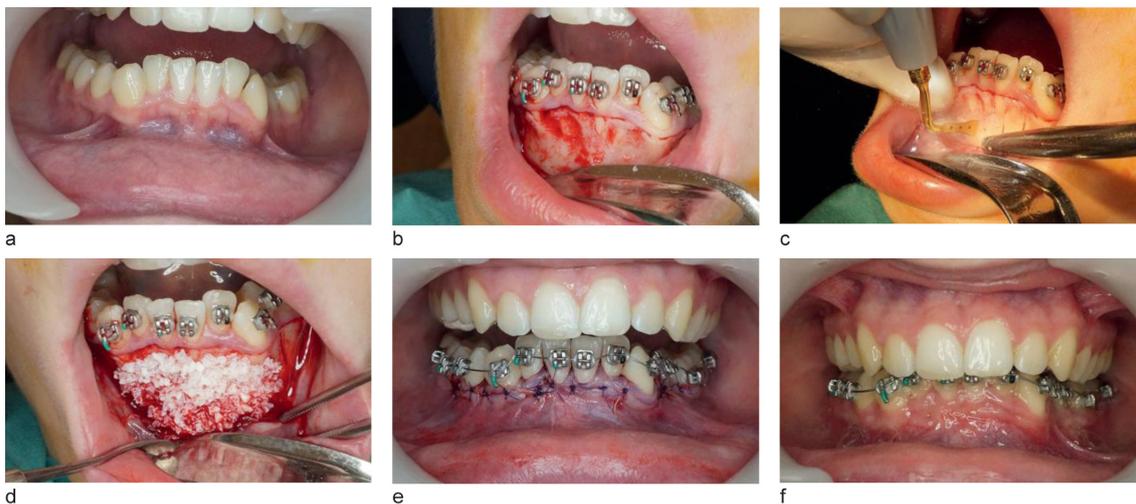


Figure 11

*Corticotomy technique with a flap to preserve the periodontium. Preoperative view (a), full-thickness vestibular flap with papillary preservation (b), inter-radicular corticotomy features in the piezotome restricted to the vestibular cortex (c), vestibular allogeneic bone graft (d), microsurgical sutures with O points and sustentation points (e), healing after 1 month (f).*

- Allogeneic vestibular osseous bone graft bone augmentation: mostly in dehiscence areas or where significant expansion is expected (Fig. 11d).
- Mattress and microsurgical sutures to close the wounds. The sutures allow for the coronal displacement of the flap and a tight closure of the edges without tension (fig. 11e).
- Immediate orthodontic loading.
- The sutures will be removed 15 days after the procedure (Fig. 11f).

## Results (Figs. 12, 13, and 14)

### Periodontal technique

- Mucosal appearance

The detachment of the mentum muscle and the mental ligament allows for a healing mucosal attachment to the bone surface and therefore an **increase in the height of the attached gingiva**. Suppressing the muscle attachment straps also reduces the risk of recessions.

- Bone appearance

The bone allograft holds the periosteum and the muscle attachments at a distance. The orthodontic movement of the roots of the incisors and canines biologically and mechanically stimulates this bone, which is then transformed into a true stable alveolar bone.

This thickening of the vestibular cortical lamina combined with the increase of the attached gingival height allows a **real transformation of the periodontal biotype** and therefore increases the PR.

### Muscular technique

The effects are the same as those for the labiomental impairment achieved in children and young adolescents: **decreased muscular contractions and labiomental furrow** if they were too pronounced.

### Orthodontic technique

Corticotomies **accelerate tooth movements** through regional acceleration or RAP3: any bone trauma causes an increase in the anabolic and catabolic bone activity and localized osteopenia. This reversible phenomenon is limited in time and space, but maintained by the orthodontic movement of the teeth and lasts about 6 months. Severe congestion alignment treatments then last on average 5–6 months with monthly orthodontic reactivation required and an acceleration factor of about 3.

The contribution of the vestibular bone graft **significantly increases the potential degree of the expanding tooth movements**. This technique allows for the treatment of severe congestion without avulsions.

Finally, we discover that **the roots of the mandibular incisors can ideally reposition themselves without using active torque** as in 2D lingual treatments.

## Discussion

Diagnosis is an essential step in any medical treatment. The quality of this phase will again determine the success of the treatment. It is not a question of wanting to surgically treat any mandibular incisor congestion, but it is important to be able to detect when this congestion is linked

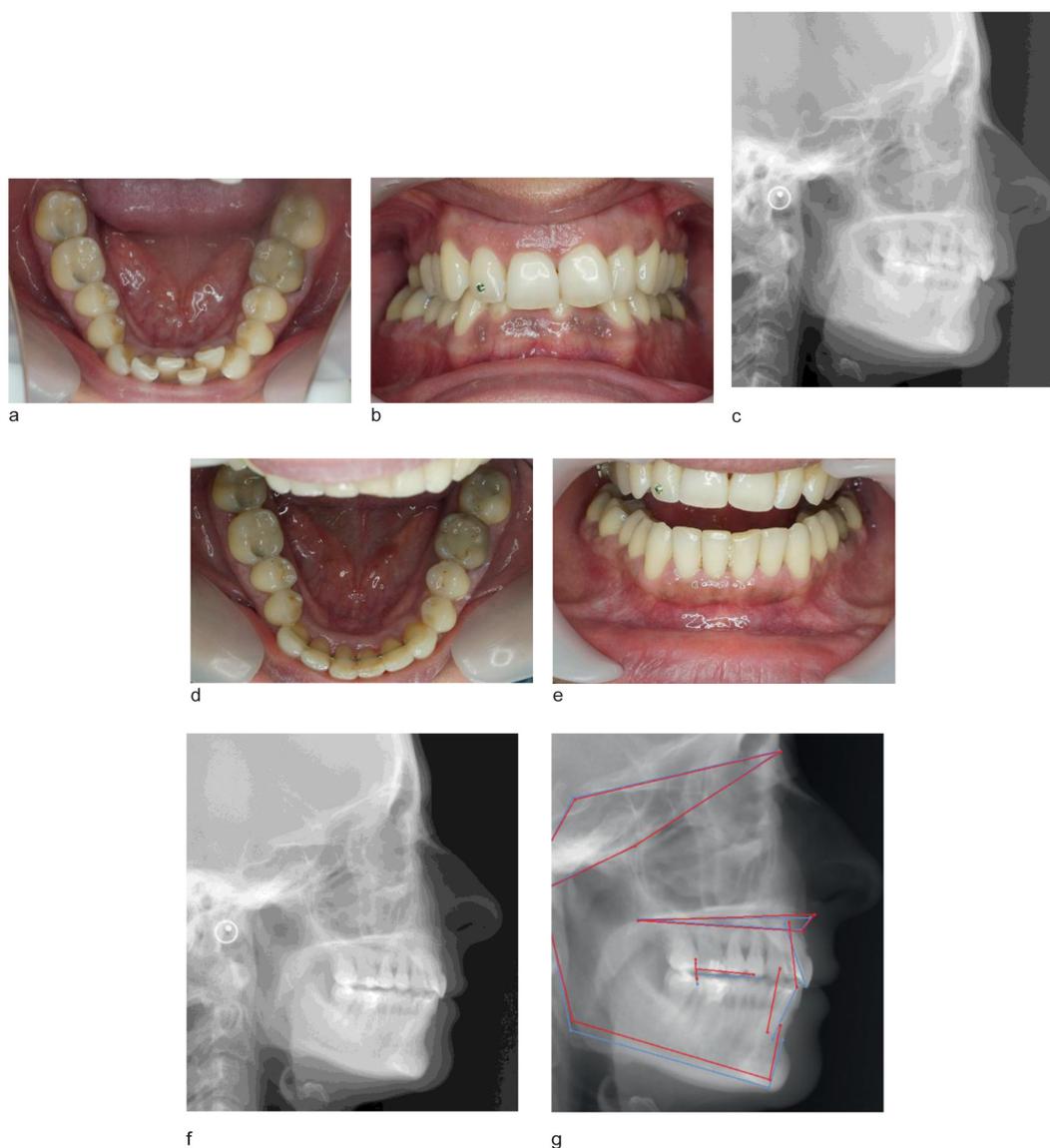


Figure 12

Management by corticotomy and vestibular multi- fasteners of severe crowding with an overbite in a 40-year-old adult. Intraoral views (a, b) and profile telerradiography (c). Before treatment, intraoral views (d, e) and profile telerradiography (f) after a 7-month multi-attachment treatment, the periodontium is of excellent quality, superposition with the Procrustes software (red = before / blue = after ) showing the clear advance and ingression of the mandibular incisors (g).



Figure 13

Management by corticotomy and vestibular multi-attachment with severe crowding with an overbite and a loss of prosthetic space of 44 in a 56-year-old adult with a weak periodontium with many recessions. Intraoral views (a, b). Profile telerradiography (c) before treatment. Immediate postoperative intraoral view (d): a coronally displaced flap technique was used to cover recessions, intraoral views (e, f) and profile telerradiography (g) after 5 months of orthodontic treatment and prosthetic rehabilitation of 33, 34, and 44, the periodontium is of better quality despite the incisors advanced, superposition with the Procrustes software (red = before/blue = after) showing the clear advancement and ingression of the mandibular incisors (h).

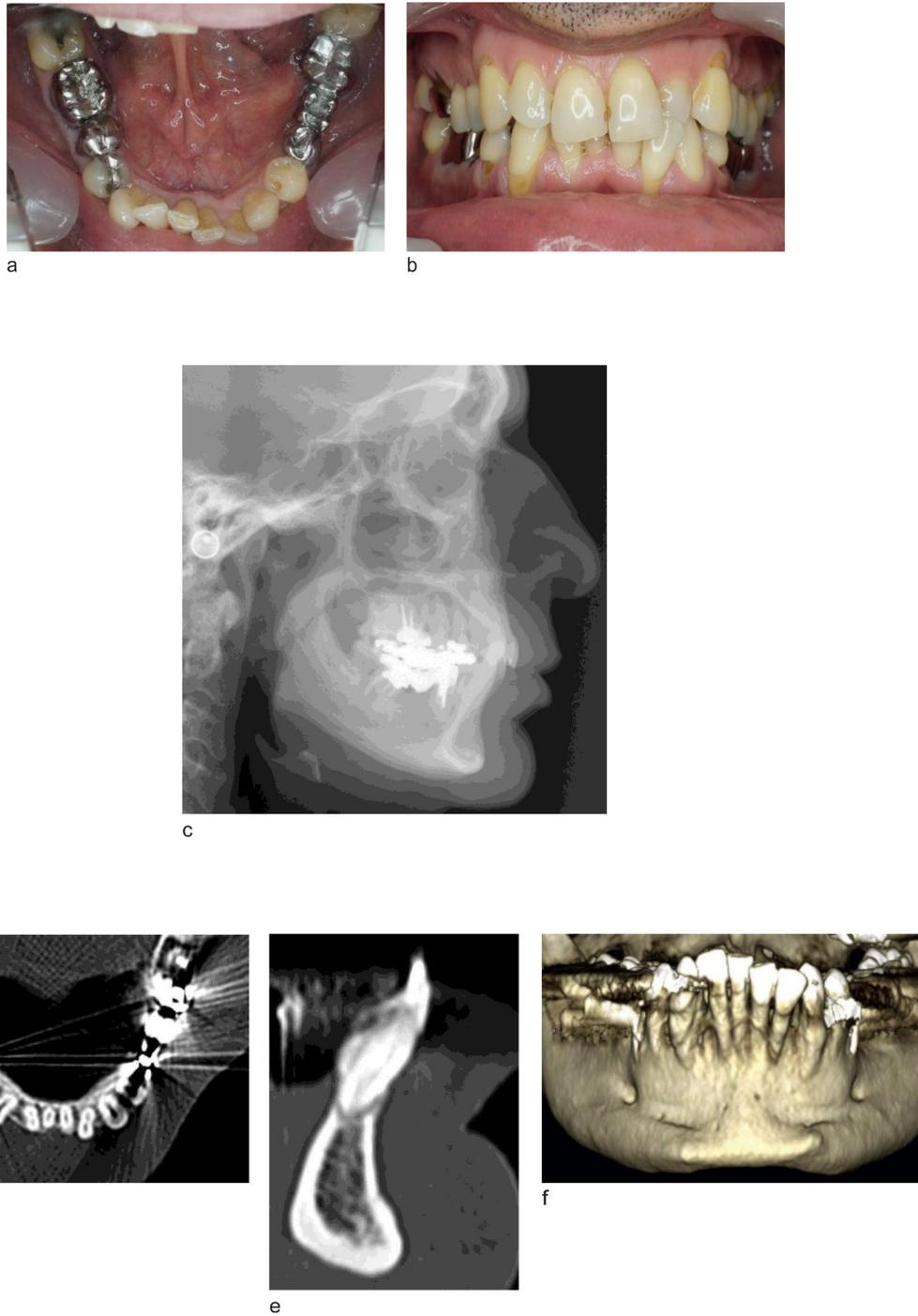


Figure 14

Management by corticotomy and 2D lingual multi-attachments Of a severe congestion in a 48-year-old adult with a weakened periodontium with many recessions. Intraoral views (a, b), profile (c) and CBCT teleroadiography showing absence of vestibular bone (d, e, f).

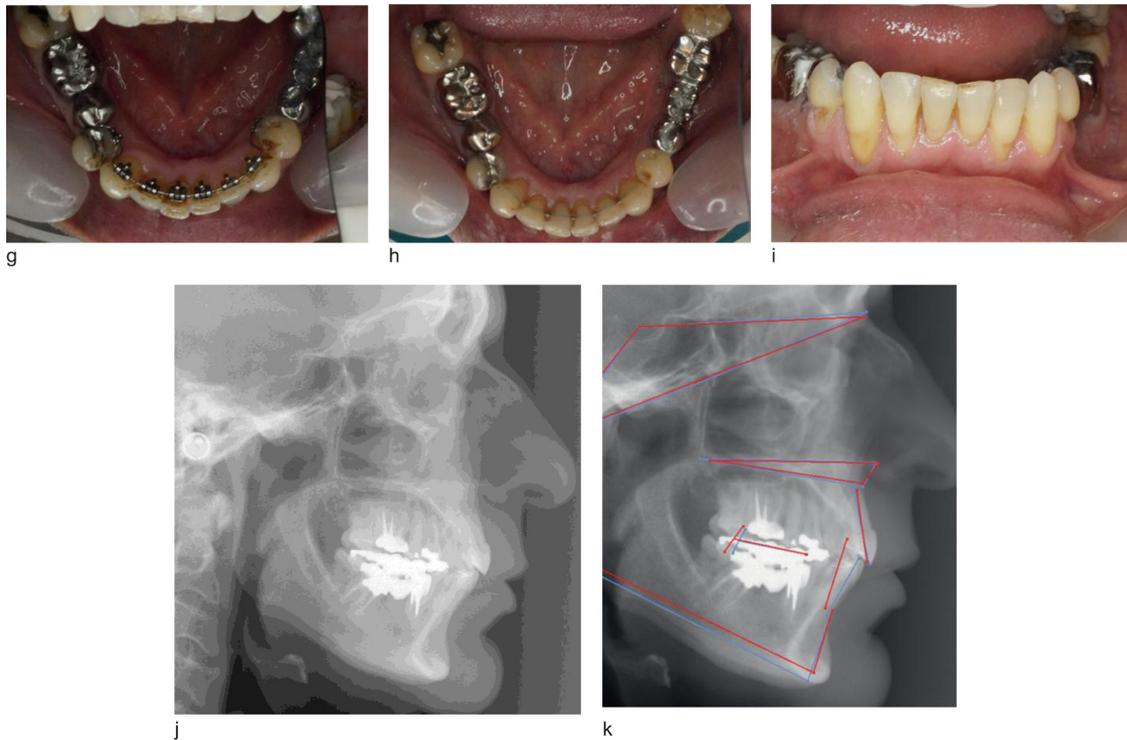


Figure 14

*Management by corticotomies and 2D lingual multi-attachments a severe congestion in a 48-year-old adult with a weakened periodontium with many recessions. Before treatment, intraoral view during lingual treatment 2D Forestadent (g): the device is very limited, intraoral views (h, i) and profile teleroadiography (j) after a 6-month treatment: the periodontium stabilized despite the advancing incisors, superimposed with the software Procrustes (red = before / blue = after) showing the clear advancement and ingress of the mandibular incisors (k): this movement occurred spontaneously with only three successive NiTi arches (.012, .014 then .016) on 2D lingual from 34 to 44.*

to an imbalance, or when the conventional treatment of congestion risks creating an imbalance! The current reduction in the use of premature avulsions is laudable in itself, but it should not be at the expense of the periodontium, which can be irreversibly altered if unbalanced expansion is undertaken.

Surprisingly, the functional balances of the incisor–canine region of the mandible have been studied very little.

Aside from Waroquy<sup>7</sup> and Bedhet<sup>1</sup>, no author has been interested in this area on its orthodontic and periodontal functional aspects, while many more publications on the local muscular and periodontal consequences of symphysis specimens in implantology have been found.

The equilibrium theory that we have tried to introduce here is probably not yet exhaustive, but it reflects our daily clinical observations.

The difference between the two treatments that we propose is based on the fact that children and young adolescents are still growing. Dental or periodontal changes at these ages are often reversible. The mental weakening procedure with vestibular deepening performed in interception demonstrates this: a favorable spontaneous evolution is then frequently observed. This surgery is relatively simple and fast. It is possible as soon as the child is sufficiently cooperative. It lasts about 20 min and the follow-up is very weak and very well tolerated. Our clinical results confirm those of the Waroquy<sup>7</sup> study, which showed an attached gingival gain of 3–4 mm in 100% of cases and an apposition to B in 60% of cases.

In adults with mature bone, bone grafting is necessary for four reasons:

- to completely remineralize the peri-radicular bone matrix after corticotomies
- to repair an already weakened alveolar bone that is no longer growing
- to allow an expansion of the incisor–canine region
- to prevent muscle reattachment without using staggered sutures of the flap as well as for labiomental weakness.

The “conventional” technique of full-flap corticotomy seems undeniably better than minimally invasive techniques such as that of Sebaoun,<sup>6</sup> which does not allow for muscular management, has limited bone grafting possibilities, and causes more serious postoperative consequences and scars in our experience.

However, we have significantly modified the technique of the Wilcko brothers<sup>5,9</sup> by intervening only in the vestibular area, where grafting or acceleration is necessary and by introducing a flap to preserve the epithelial attachment and papillae. Here again, our clinical results confirm those of their studies<sup>8</sup> with a stable bone apposition over time, thanks to the biological transformation of the bone graft by the movement of the teeth. This increase in PR coupled with a decrease in MF allows us to push the limits of expansions and reshape the buccal corridor. The dental alignment is really amazing: the incisors are brought forward both at the coronal and root level, without using heavy forces or trying to twist them. The stability of dental movements is also improved by both muscle management and by more extensive post-surgical bone remodeling.

## CONCLUSION

These two techniques, namely labiomental weakening with vestibular deepening and corticotomy with bone grafting, help us on several points:

- to push the limits of treatments without avulsions and without orthognathic surgery that we can offer to our patients

- to improve the stability of treatments
- to prevent age-related and dental and periodontal changes
- to improve our knowledge of the physiology of this area, which is so important from a functional point of view but so often forgotten. They

are safe, reproducible, and have a limited operational risk, making them perfectly applicable in routine practice.

*Conflict of interest: The authors declare no conflicts of interest.*

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