The Problem of Insufficient Incisal Display: A Case Presentation

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Abstract

Enhancement of facial beauty is one of the primary elective goals of patients seeking dental care. Frequently, improvements in natural beauty can be expected to follow restoration of ideal relationships between the denture and the facial soft tissues. A very important feature in a youthful appearance is the incisal tooth display; the amount of maxillary incisal exposure gradually decreases with age, accompanied by a gradual increase in mandibular incisal exposure. However, this problem could be present in young people where the effects of age should not be apparent yet. There are some other factors that could accelerate this process. The present case illustrates the improvement and rejuvenation of an unesthetic young smile through restorative treatment.

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Introduction

With the advancing of age, the facial receptors, whatever their individual or ethnic particularities, do not undergo profound modifications. However, an exception to this is the mouth, whose spatial relationships are influenced by infraorbital muscle laxness, which generates variations in maxillary and mandibular tooth display.

This aging process will progressively diminish maxillary incisor tooth display, insidiously causing mandibular incisor visibility and excessively loading the lower part of the dentofacial plane. It must also be mentioned that not only age, but also gender and race affect tooth exposure.[1]

Also, patients with skeletal dental class I, II, and III often present with a different amount of tooth display. This is especially the case in class II division 2 and class III malocclusions, where the amount of incisor display with lips in repose does not follow accepted guidelines.[2]

Some parameters of incisal tooth display have been established. Probably the best known study on incisor display at rest was published by Vig and Brundo. This study was a survey of people of all ages with natural teeth to determine an average amount of tooth exposure with the upper lip at rest. This article related tooth exposure by sex, length of upper lip, and age. They found that the average display was closer to 3.5 mm for young patients, female patients, and patients with a short upper lip.[3]

It is important to remember that this study was conducted at a time when the information on esthetic dentistry was found mostly in textbooks on complete dentures. It was brilliant of Vig and Brundo to question whether the established dogma of setting the wax rim in complete denture construction approximately 2 mm beyond the border of the upper lip represented a universal average. Nowadays, some authors have adapted this data to the contemporary esthetic patient; establishing, for a female patient desiring a prominent smile, an incisal display of 3.5 mm to 4.5 mm. On the contrary, for a female patient desiring a discreet smile, an incisal display of 2.0 to 3.0 mm would be adequate. For males, 1.0 to 3.0 mm has been established as a tolerable incisal display.[4]

Case presentation

Introduction and personal background

- Female
- 29 years old
- Architect

Chief complaint

The patient was unhappy with the appearance of her smile. She referred to the length of the canines compared to the four anterior teeth. She also complained about her inverted smile line and the lack of incisal display at rest (Fig 1).

History of the present complaint

The patient went through orthodontics 10 years ago. At that time, she present-

ed an edge-to-edge bite. The orthodontist placed a removable appliance for 4 years to widen the arch. As a result, she is not happy with the way she looks, particularly her smile, and she has lost her self-confidence.

Medical and dental history

Patient has good health and oral hygiene. She talked about her smoking habit (10 cigarettes per day) and feelings of anxiety about dental treatment.

Clinical esthetic evaluation

Facial profile

The patient exhibited a pointed, prominent chin, creating a concave facial profile. In addition, she displayed a brachygnathic appearance and large, well-defined masseter muscles. Her upper lip was short and concave with an average mobility and she had an asymmetric lower lip at rest (Fig 2).

Incisal display

The incisal edges of the maxillary central incisors at rest measured 0.5 mm and 0.3 mm for teeth 11 and 21, respectively. Even with a short concave upper lip there was insufficient tooth display. This characteristic gave this young patient an older appearance, with approximately 4 mm of the mandibular incisors showing at rest (Fig 3).

Incisal plane

The anterior maxillary teeth did not follow the curvature of the upper lip, with very

Fig 1 Patient complained about the appearance of her smile.

Fig 2 Notice prominent pointed chin and brachygnathic appearance with strong masseter muscles.

Fig 3 Minimal maxillary incisal display at rest position and high display of the mandibular incisors.

Fig 4 Patient exhibits inverted smile line with dominant canines.

pointed dominant canines and short central and lateral incisors (Fig 4).

There was no harmony in the incisal plane and there was a gap between the incisors and canines, due to long canines and short incisors.

Tooth proportion

The tooth proportion was inadequate and the dominance of the central incisors was missing. As previously mentioned, this is an important feature in the smile.[5] The length of the central incisors was 8.5 mm and 8.0 mm for teeth 11 and 21, respectively (Figs 5 and 6).

Soft tissue framework parameters

The patient presented a low smile line when compared to the upper lip, even though teeth 14, 15, and 16 were in a high smile line. Reviewing the facial and dental landmarks, there were two causes for this disharmony: an asymmetric upper lip when smiling and a more coronal position of these teeth.

The gingival margin location relationship between the central and lateral incisors was not ideal nor unesthetic. Nonetheless, the canines were located in an apical position when compared to the central incisors, which is contrary to what is considered esthetically pleasing for most clinicians.[6,7]

The gingival zenith location of the maxillary central incisors, canines and the left lateral incisor were located distal to the long axis, and the right lateral incisor gingival zenith was located along the long axis of the tooth (Fig 7).

Intraoral findings

Dental

- Interproximal caries in teeth 12, 13, 21, 22, and 23
- Acid erosion in anterior maxillary teeth due to lemon-chewing habit (Fig 8)
- Unesthetic composite veneer in tooth 13
- Unesthetic crown in tooth 14 with poor marginal fitting (Figs 9 and 10)
- Wear facets in maxillary anterior teeth due to bruxism
- Recurrent caries in teeth 11, 12, 16, 25, 26, 46, and 47
- Absence of teeth 24, 35, and 44
- Occlusal acid erosion lesions in teeth 26, 36, and 46 (Fig 11).

Periodontal

- Fair plaque control
- Probing depths of maxillary and mandibular anterior teeth all within 3 mm
- Thick gingival biotype

Fig 5 Left lateral view shows short teeth 11, 12, and 13 when compared to canine.

Fig 6 Right lateral view shows pointed canine and short teeth 11 and 12. Deficient crown in tooth 14.

Fig 7 The gingival margin of central incisors is coronally situated when compared to the canines.

Fig 8 Acid erosion in anterior maxillary teeth due to lemon-chewing habit.

Fig 9 Poor marginal fitting in tooth 14 with gingival inflammation.

Fig 10 Unesthetic and overcontoured crown in tooth 14.

Fig 11 Acid erosion lesions in teeth 36 and 46.

Fig 12 Gingival recession in teeth 26, 34, and 36. Absence of tooth 35.

Fig 13 Anterior group function in protrusive guidance.

Fig 14 Maxillary central teeth have been lengthened 2.5 mm with the composite mock-up.

- Gingival recession in teeth 26, 34, and 36 (Fig 12)
- Chronic gingival inflammation in tooth 14, ill-fitting margin
- Lack of keratinized gingiva in teeth 34 and 36
- No bleeding on probing, no mobilities.

Occlusal findings

- Lower 6s (36–46) in class III occlusion
- Lower 3s (33–43) in class III occlusion
- Anterior group function in protrusive guidance (Fig 13)
- Interference in centric relation in teeth 36 and 46
- 30% vertical overlap.

Radiographic findings

- Root canal in tooth 14
- No pathology present (Fig 14).

TMJ and mandibular range of motion

- Within normal limits
- No history of joint noise or pain.

Proposed treatment plan

To propose a treatment plan, all of the esthetic and clinical findings must be analyzed carefully, identifying any factors that may prevent the success of the treatment.

Phase 1: Initial therapy

- Comprehensive oral evaluation
- Pre-treatment photo series
- Oral hygiene instructions
- Periodontal prophylaxis and maintenance
- Caries control.

Phase 2: Diagnostic workup

- Composite mock-up
- Records taken: maxillary and mandibular casts (×2), arbitrary facebow transfer and centric relation records (×2)
- Waxup.

Phase 3: Provisionalization

- Preparation for crowns with the clear stent from the waxup
- Maxillary arch preparations: from tooth 15 to 25
- First homemade provisional crowns set from the waxup
- Second set of provisionals elaborated by the lab technician
- Wait 3 months to check occlusion stability and patient satisfaction
- Transfer of the final esthetics and function to the lab technician.

Phase 4: Definitive restorations

- Cementation of the final restorations, in this case Procera® crowns (Nobel Biocare, Barcelona, Spain)
- Delivery of a nighttime appliance.

Phase 5: Post-treatment care

- Every 6 months the gingival and hygiene status would be evaluated. During the first year, then subsequently according to findings, a therapy of periodontal maintenance would be established.

Active clinical treatment

Phase I

After the appropriate data were gathered, the initial phase of treatment began with oral hygiene instructions and periodontal prophylaxis to create and maintain a healthy stable periodontium. The patient followed all of the instructions, thereby improving the health of the periodontium and preventing caries.

Phase II

A composite mock-up was constructed (Figs 14, 15, and 16) with the aim of lengthening the central incisors to improve the incisal display with respect to the resting upper lip. Also, the maxillary lateral incisors were lengthened, obtaining a display of 10.5 mm of the central incisors and 8 mm of the lateral incisors.

Fig 15 Patient smiling with composite mock-up in place.

Fig 16 Full view of composite mock-up.

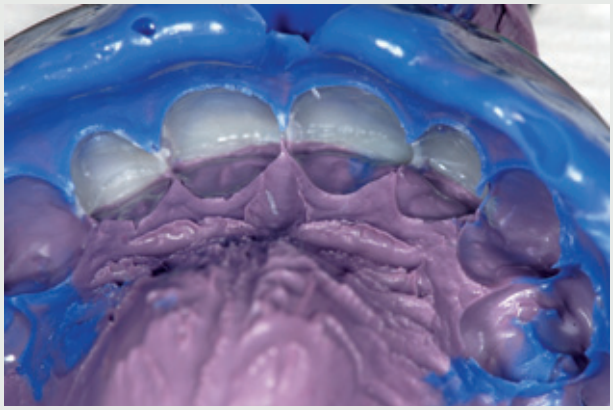

Fig 17 A polyether impression is taken with the composite mock-up in place.

Fig 18 A stone model is poured.

The smile showed a clear improvement. Pictures were taken and an arbitrary facebow was positioned with the composite mock-up in place. A polyether impression was taken (Fig 17) to allow the composite pieces to stay in the impression material. The author has found this technique particularly accurate in transferring the changes made in the mouth to the lab. The lab technician then poured the model leaving the composite pieces in place (Fig 18), resulting in a facially generated stone model (Fig 19).

Then, models were mounted in the articulator to build a waxup, improving the teeth proportions and shape. It was decided to raise the vertical dimension in the posterior teeth by 0.5 mm (Fig 20).

Fig 19 Composite mock-up has been replaced in the stone model.

Fig 20 A waxup is made based on the facially generated stone model.

Fig 21 A stac vac is created from the waxup; the improvement of contour is evident. There is plenty of space to make a minimally invasive restoration.

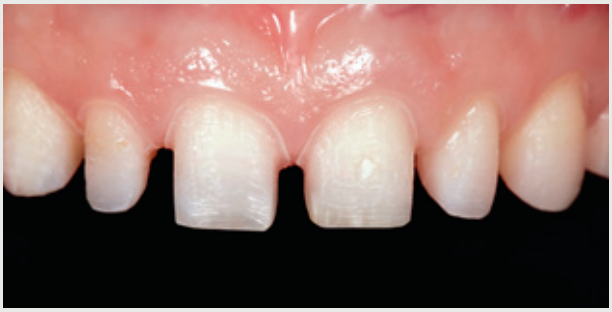

Fig 22 Minimally invasive preparations are made using the stac vac.

Phase III

A transparent stent was fabricated based on the waxup to guide the clinician during tooth preparation (Figs 21 and 22). A first set of provisionals was made from the waxup, and composite was added to the posterior mandibular teeth to open the vertical dimension 0.5 mm (Fig 23). These interim composites were to be replaced by definitive anterior restorations with final composite or ceramic onlays. Two weeks later, the patient was recalled for a provisional checkup to evaluate comfort, biocompatibility, occlusion, and esthetics. At this stage, the patient was able to provide any feedback with regard to specific esthetic changes. The patient reported no difficulties with her occlusion or speech. However, she requested major esthetic changes in the

Fig 23 First set of provisional crowns. Note the gingival health; however, these present bulky contours.

Fig 24 Patient complained about insufficient incisal display.

Fig 25 Provisional crowns during full smile.

Fig 26 A second set of provisional crowns was designed with longer teeth.

form of longer and squarer teeth (Figs 24 and 25). Therefore a new set of provisional crowns was made (Fig 26). At this time, central incisors were lengthened 2 mm and lateral incisors 1 mm, obtaining a 12.5 mm and 9 mm length for central and lateral incisors, respectively. This change in tooth dimension would increase the steepness of the angle of guidance, probably create interferences with the envelope of function, and likely cause a phonetic problem[8] (Fig 27). Again the patient was recalled for a provisional checkup 2 weeks later. She expressed high satisfaction with her new appearance and no discomfort or even minor problems (Fig 28). It was decided to keep her in provisional crowns for 3 months to analyze the impact of the increase in overbite and the presence of

Fig 27 Second set of provisional crowns in place.

Fig 28 Patient is satisfied with this new smile design. The smile looks very prominent.

Fig 29 Biske bake try-in: some improvements in length and shape are necessary in teeth 12 and 22.

Fig 30 Final crowns have been glazed and cemented with Fuji Plus.

parafunction. After a new evaluation of the case, final impressions (Virtual®, Ivoclar Vivadent, Schaan, Liechtenstein) as well as alginate impressions of the current situation and an arbitrary facebow were taken. Two different occlusal records were made (maxillary provisionals/mandibular teeth, maxillary preparations/mandibular teeth) to allow the working cast and provisional cast to be cross-mounted.

Phase IV

The definitive restorations were tried in to verify fit, occlusion, and esthetics, and adjusted as needed (Fig 29). Following occlusal adjustment and polishing, the restorations were cemented with a resin-modified glass-ionomer cement (Fuji Plus, GC America, Alsip, IL, USA) (Figs 30 to 36). Following the completion of

Fig 31 Complete view of the final crowns and teeth showing a beautiful integration.

Fig 32 Incisal display at rest increased 4 mm.

Fig 33 Left lateral view.

Fig 34 Right lateral view.

Fig 35 Photograph showing the excellent esthetic result.

Fig 36 Final full-face photograph shows a very natural result, with harmonious smile.

restorative treatment, a full-coverage maxillary occlusal splint was fabricated and seated.

Phase V

The patient was placed on a 6-month recall to monitor and maintain the health of the dentition and periodontium. This maintenance phase would also control any occlusal changes that might occur and that could possibly jeopardize the longevity of the treatment. After 6 months, the stability of the case and the integrity of the composite increments were evaluated. Only small occlusal changes were noticed. No functional, structural, or muscular alteration was found.

Discussion

In the present case, the main complaint was the lack of incisal display and the presence of an inverted smile line. The patient desired longer anterior teeth and dominant central incisors, which resemble a "cover girl" smile. Therefore, to achieve this goal the central anterior teeth had to be lengthened by 4 mm to create a prominent smile. Also, the enamel surface presented damage caused by acid erosion; hence, some islands of dentin were already present on the facial surface of the maxillary anterior teeth. In addition, some leaking anterior composites needed to be replaced and covered by the restorations. Furthermore, the patient smoked 10 cigarettes per day, had a bruxing habit, wear facets, and a brachygnathic constitution. Since the goal is always to use the most conservative restoration that satisfies the patient's esthetic and functional needs, treatment planning consisted of evaluating the patient for any contraindications to using the most conservative restorations.[9]

Many dental problems were found in the present case, as mentioned before. Three kinds of treatments were considered to rehabilitate this smile: composite veneers, porcelain laminate veneers, and ceramic crowns.

The most conservative treatment plan would be composite veneers; however, direct composites have limitations.There are two reasons for these limitations.

First, it is extremely difficult to simultaneously master marginal adaptation, form, and shade on several restorations; and second, extensive enamel replacement with the more flexible composite does not allow recovery of crown stiffness.[10] In addition, composite resin has an unfavorable failure mode compared to ceramics and is prone to fast discoloration, early fatigue, wear, and chipping. For that reason, an esthetic result cannot be guaranteed in the long term using direct composite additions.[11-14] In the present case, the patient had high expectations of the outcome of the treatment. She wanted a durable esthetic restoration that looked always beautiful and natural. For these reasons, this kind of restoration was not considered a good option.

The second possible treatment plan was porcelain veneers. However, before electing this type of restoration some important clinical findings were extrapolated and compared with the existing dental literature and scientific evidence, such as the heavy parafunctional activity and the heavy bite force due to her brachygnathic constitution. Another fac-

Fig 37 Preservation of tooth structure with composite increments: **(a)** the 0.5 composite increments were polished and refined, **(b)** occlusal view of the restorations, **(c)** left lateral view of final restorations in occlusion, and **(d)** right lateral view of final restorations in occlusion.

tor considered was the amount of unsupported porcelain when finishing the restorations; in the present case it would have been 4.5 mm. It is also important to consider the substrate the porcelain veneer will be bonded to. This means that sufficient enamel must exist in the preparation to obtain the highest bond strength (20 to 30 mPA).[15-20] In this case, there were already some "windows" of dentin, and also some leaking composite restorations that had to be replaced and covered by the final restoration. In addition, the increase in the steepness of the angle of guidance, which could have the potential to create a traumatic occlusion with horizontal wear pattern and potential failure, was taken into account.[8]

Even though bruxism and lengthening of teeth are not considered at this point to be contraindications to electing this conservative treatment plan, ceramic crowns were the treatment of choice. The occlusal parafunctional patterns and the necessary patient compliance in wearing a night guard every night to protect the final restorations were the key points in choosing this option.

The design of very conservative preparations were carefully planned, as shown in Figures 21 and 22. Crowns were chosen to provide both high

strength and good esthetics. In this case, a densely sintered high-purity aluminum oxide core material (Procera® Alumina, Nobel Biocare) was selected.[21,22] These restorations would meet the necessary requirements to achieve a functional, esthetic, and long-lasting treatment.

Final evaluation

After 6 months, the stability of the case and the integrity of the composite increments were evaluated. No functional, structural, muscular, or TMJ alterations were found. In order to preserve tooth structure, the 0.5 mm composite increments in the posterior teeth were refined and polished instead of replacing them with the ceramic onlays proposed in the treatment plan (Fig 37). The occlusal contacts were checked as well as the protrusive and lateral guidance. The anterior guidance was in complete harmony with the neuromuscular envelope of function and an adequate stable posterior support was present. A panoramic radiograph was obtained to evaluate the fit and biocompatibility of the restorations (Fig 38).

Conclusions

Treatment planning definitely is the starting point to develop a predictable dental case; however, it is also necessary to know and understand the different modalities of treatments available, comprehend the psychological status of the individual, and take time to listen his/her esthetic wishes. Once understood, esthetic dental treatments can fulfill the patient's and dentist's expectations.

Fig 38 After 6 months, a panoramic radiograph was obtained. It shows adequate fit and biocompatibility of the restorations.

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