Consequences and solutions in agenesis of the lateral incisors

# Partial Anodontia

Otto Prandtner, MDT, Salzburg/Austria, Jacinthe M. Paquette, DDS, and Cherilyn G. Sheets, DDS, Newport Beach/USA

**Agenesis of permanent teeth, also known as partial anodontia, is a common problem. Recent studies have shown that the incidence of anodontia is increasing. When lateral incisors are missing, parents, dentists and orthodontists are tasked to make the right decisions at an early stage – i.e. during the early years of the young patient's life. This early decision will determine the dental health and physical appearance of the patient for a whole lifetime. This article presents three different implant treatment cases.**

If a patient with congenitally missing lateral incisors (see Fig. 3) and, consequently, impaired masticatory function is not treated appropriately, this may lead to TMJ dysfunction, gingival recession, tinnitus, and a collapse of the vertical dimension.

The question facing the treatment team and the dental technician is: Should existing gaps be closed, or should they rather be left alone? By closing gaps orthodontically, prosthetic rehabilitation can be dispensed with, but at the cost of compromising both aesthetics and function. Objective factors and a short-term prognosis, both of which would favor closing the edentulous spaces by moving the canines, include: overbite, lip support, tooth color, tooth shape, and root position.

The long-term prognosis, however, shows that modifying the intraoral static relationship and function will change a patient's overall physical appearance. On the other hand, opening gaps is a very complex endeavor, requiring a lengthy interdisciplinary treatment, where a meticulous analysis of the occlusion and individual treatment planning are determining factors for success.

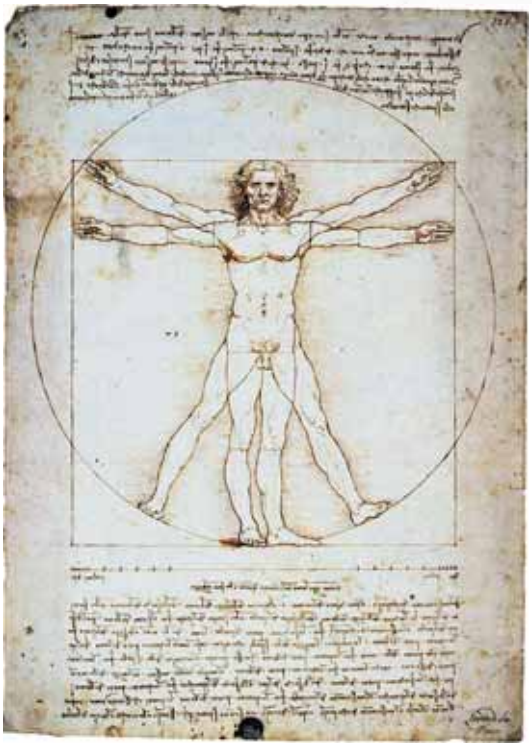


*Fig. 1 Universal genius Leonardo da Vinci had initially studied physics and chemistry, then proceeded to the study of medical science.*

Possible practical solutions:

- Insertion of lateral incisor implants.
- Three- or six-unit bridge.
- Resin-bonded bridge.
- Canine with a mesial cantilevered pontic.

Figures 1 and 2 show what is meant by taking a holistic view of the patient's anatomy.

Aesthetic dentistry frequently means walking a tightrope between rehabilitative (functional) and aesthetic considerations.

Many patients, when consulting a dentist or dental technician, already have very clear ideas of what they would like their teeth to look like after treatment. It

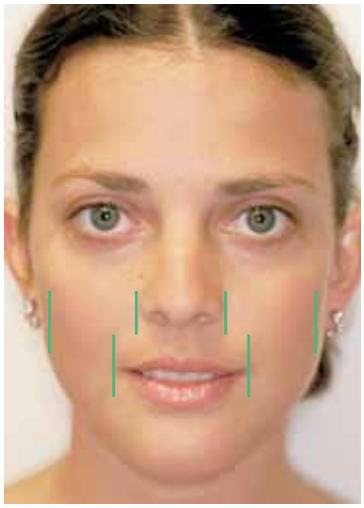


*Fig. 2 Measurements of different faces have shown that the width of the zygomatic arch had the highest correlation with the width of the posterior aspect of the maxillary arch. (A correlation is a relationship between two or more statistical variables.) Any expansion or constriction of the dental arch results in facial deformation.*

*Fig. 3 Maxilla with congenitally missing lateral incisor.*

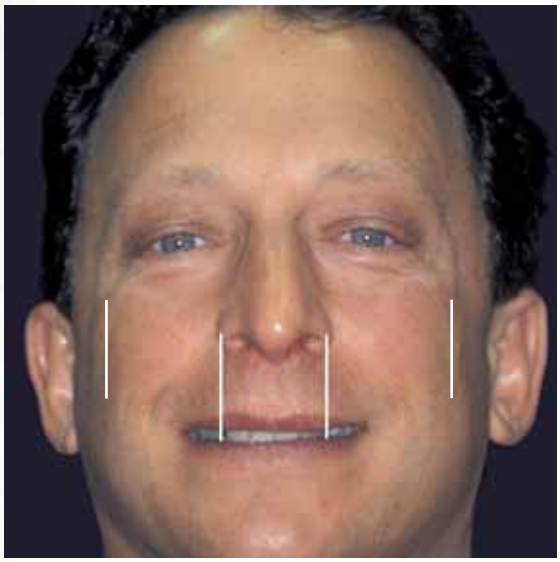


*Fig. 4 This photograph shows how the constriction of the maxillary arch also constricted the zygomatic arch, at the same time widening the buccal corridor. This is most readily recognized by the wings of the nose that have adapted to the canine situation.*

*Fig. 5 The distobuccal line constricts the posterior region; it is moved palatally if the lateral incisors are missing, in an attempt to widen the buccal corridor.*

must be accepted that the aesthetic judgment of each patient – just like the aesthetic judgment of the dentist or dental technician – will always have a subjective component. In many cases, patients will accept our advice in terms of balancing functional and aesthetic considerations. However, there are also patients who will not accept anything but their own ideas. This may well result in the aesthetic rehabilitation no longer meeting the requirements of biomechanical guidelines, possibly leading to tooth overload and, consequently, bone and soft-tissue loss, tooth or ceramic fracture or other problems.

Our current treatment arsenal includes various materials and techniques that have become indispensable.

- Biomimetic restorative materials are materials that attempt to copy nature as closely as possible.
- Regenerative materials and techniques e.g. connective-tissue grafting, bone grafting.
- Integrated artificial (alloplastic) tissue replacement e.g. dental implants.
- Ongoing research into biological solutions. When in 2003 the Human Genome Project succeeded in deciphering the human genetic code after 13 years of research, some dental schools and research institutes at universities – not only in the USA – were quickly getting ready to clone human teeth.

**Key dental elements for reproducing and/or improving on nature:**

- Analysis of orofacial aesthetics.
- Comprehensive diagnosis and treatment plans.
- Interdisciplinary treatment planning: Dental technician, dentist, periodontologist, orthodontists, etc.
- Goal-oriented feedback during the treatment phase.
- Selecting the most conservative treatment to achieve functional and aesthetic goals.
- Establishing realistic patient expectations.

## Case report 1

The baseline situation shows a middle-aged patient (Fig. 4) presenting with many oral and aesthetic deficiencies. In this case, the congenital absence of the lateral incisors had been resolved by early mesial movement of the canines (Fig. 5).

**Diagnosis**

- Congenital absence of the lateral incisors.
- Canines in the lateral incisor position.
- Limited tooth display.
- Deep overbite and collapsed vertical dimension or occlusion.
- Unsatisfactory aesthetics.

With regard to the last point, unsatisfactory aesthetics, it is known that the canines have a very important function within the masticatory systems. Moving the canines to the positions of the lateral incisors results in functional changes and in changes to the hard-tissue profile. The distobuccal line deliniating the posterior region is moved palatally, widening the buccal corridor (Fig. 5). Looking at Figure 4 one more time, it becomes clear that the facial soft tissues, in this case the wings of the nose, have adapted to the new positions of the canines.

## Clinical procedures

The study casts were transferred to an articulator adjusted for the functions of the temporomandibular joint, using a centric relation record. The vertical dimension was increased to make room for the functional reconstruction and a balanced occlusion (Fig. 6). Figure 7 shows the patient situation for better comparison. Based on the study casts, a diagnostic wax-up was created, allowing functional and symmetric restorations and a natural-looking tooth display to be designed (Fig. 8). The deciduous canines were extracted and the implants placed in the extraction region using a surgical stent (Fig. 9). The provisional restoration is the first step toward an aesthetic rehabilitation, while at the same time serving to increase the vertical dimension. Once the implants have integrated, they can be loaded with a provisional restoration. The definitive restoration cannot be inserted until after the tissue has matured. Figure 10 shows the situation directly before the treatment, while Figure 11 shows the situation after successful treatment.

**Designing a custom abutment:**

- Idealization of the structural tissue framework.
- "Wavy" margin parallel to the gingival margin, almost comparable with the cementoenamel junction.
- At the crown margin: placement of the crown close to the abutment.

The patient is now happier and more self-assured. Taking the emergence profile into account, it was possible to reduce the buccal corridor using a veneer onlay preparation (Fig. 12). There are several ways of treating cases like this one. With regard to the maxillary central incisors the following width relationship holds: The height of the lower lips (red aspect) is equal to the width of the maxillary central incisors (Fig. 13).

As a rule, the dentist will work with a dental technician in the treatment process; this will add to the cost and require several appointments. However, the faster orthodontic treatment approach – moving the

*Fig. 6*
*The diagnostic casts on the articulator, with a slightly raised bite.*

*Fig. 7*
*Clinical baseline situation. The congenital absence of the lateral incisors had been resolved by early mesial movement of the canines.*

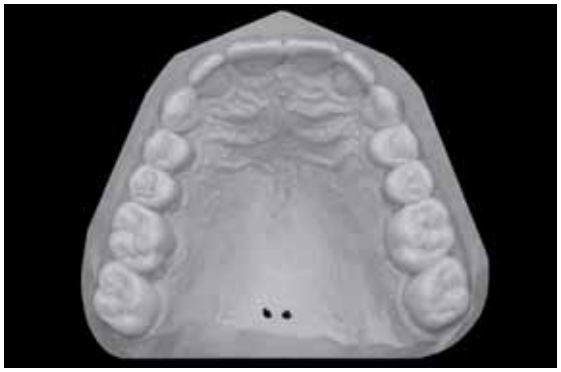


*Fig. 8*
*The maxillary diagnostic wax-up.*

*Fig. 9*
*Based on the wax-up, the central incisors were prepared for veneers and the design of the custom implant abutment was determined.*

*Fig. 10 The situation before ...*

*Fig. 11 ... and after treatment.*

canines to the positions of the lateral incisors – had resulted in added complications in this case.

## Intravenous anaesthesia

Intravenous anesthesia not only simplifies the work of the treatment team, but it also helps the patient to relax during the treatment.

**Advantages:**

- Very suitable for fearful or even phobic patients. They will retain no negative memories of the treatment.
- Patient is free of pain during and for a few hours after the treatment.
- Patient is asleep while the dentist is working.

**Disadvantages:**

- Costs on the order of 300 Euro an hour.
- Patient must present for treatment with an empty stomach.
- Patients may make unexpected or uncontrolled movements.
- Patient will be drowsy for a few hours after treatment and will have to be taken home.

*Fig. 12 The patient could be given an attractive smile, at the same time narrowing the buccal corridor using a veneer onlay preparation, taking the emergence profile into due account.*

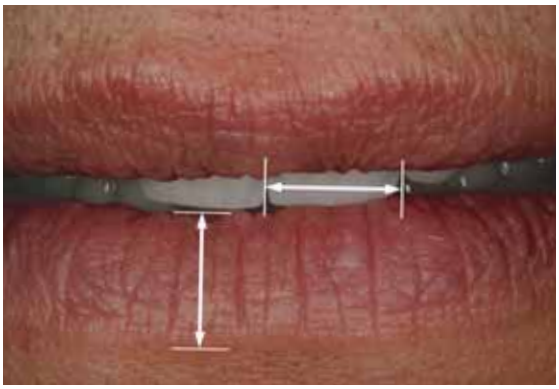


*Fig. 13 Guideline for the width of the maxillary central incisors: The height of the lower lips (red part) is equal to the width of the maxillary central incisors.*



*Fig. 14*
*A picture taken in the patient's youth shows a symmetrical face in which the canines are already in their correct positions.*

*Fig. 15*
*The patient's smile was characterized by a high lip line.*

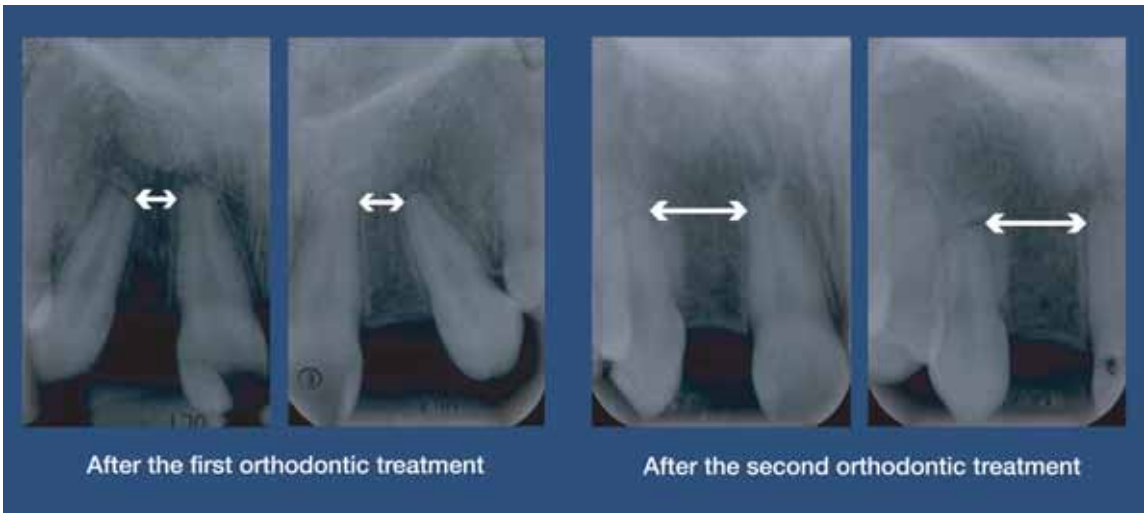



*Fig. 16*
*Convergent roots surrounding the prospective implant site following the first orthodontic treatment. The second orthodontic treatment created appropriate spacing and root angulation.*

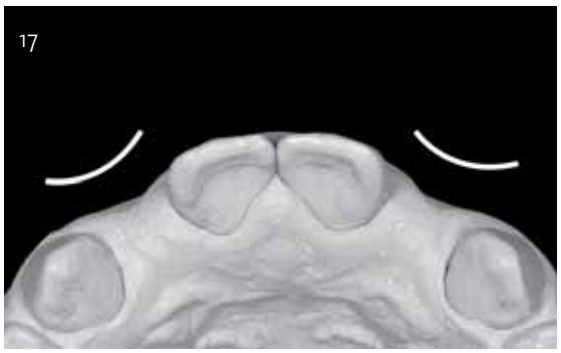




*Fig.17*
*An insufficient alveolar ridge was found in the regions of the lateral incisors, as well as passive eruption of teeth 13, 11, 21 and 23.*

*Fig. 18*
*Resin-bonded bridges used as guides for the required bone augmentation and the regions of teeth 12 and 22. They also support the ovate pontics and shape the emergence profile.*

## Case report 2

**Patient history**

The patient in this case was a fully-grown 19 year old woman. She had undergone orthodontic treatment at an early age. During this treatment, she had been provided with orthodontic single-tooth removable retainers taking the place of the congenitally missing maxillary lateral incicors.

**Diagnosis**

Figure 14 shows the symmetrical face with the canines already in their correct positions; however, the patient exhibited a high lip line (Fig. 15). Figure 16 shows convergent roots surrounding the prospective implant sites following the first orthodontic treatment. In addition, an insufficient alveolar ridge was found in the regions of the lateral incisors, as well as passive eruption of teeth 13, 11, 21, and 23 (Fig. 17).

**Treatment plan**

Clinical crown lengthening was refused by the patient's mother. A diagnostic wax-up was created. The inclination of the roots had to be corrected, and adhesive non-invasive resin-bonded bridges were fabricated (Fig. 18). The bone was examined radio-

*Fig. 19 The provisional custom abutment.*

*Fig. 20 The provisional crown.*




*Figs. 21 to 23 The completed restoration one month after insertion.*

logically in order to determine whether the jawbone was still growing. Following augmentation of the alveolar ridge, the implants were inserted and fitted with temporary abutments (healing caps) for conditioning the soft tissue (Figs. 19 and 20). The definitive restoration was placed on the fully matured tissue.

**Orthodontic objectives**

The objective of the orthodontic treatment is to provide the space needed for the restoration and to create or preserve an ideally shaped alveolar ridge, taking the inclinations of the roots into account.

**General requirements of implants and surgical stents:**

- The implant should follow the natural tooth axis.
- The implant should be centrally positioned, i.e. keep the same distance both on the mesial and distal sides.
- The implant should have an ideal depth.
- The implant should be suitable for custom abutments.
- The implant should have ideal 3D placement.

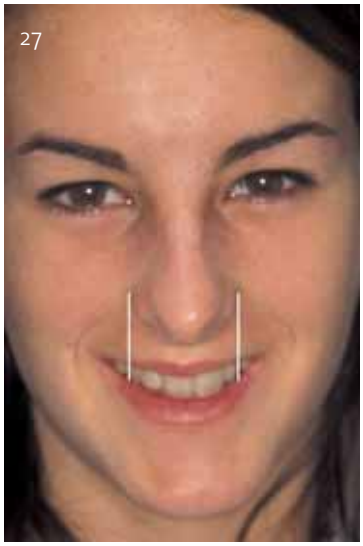
Figures 21 to 23 show the result one month after insertion. Two years after insertion, the situation was unchanged (Figs. 24 and 26). The discrepancy in width between the gaps at 12 and 22 was concealed by slightly different designs of the mesial and distal interdental spaces of the tooth crowns (Fig. 23). The overall tooth shapes were preserved.

Figures 25 and 26 show the aesthetic outcome of two separate implant cases with prosthetic superstructures, differing in overlying hard/soft tissue thickness. This illustrates the importance of maximizing hard/soft tissue thickness around implants.

*Fig. 24*
*The patient's smile, two years after restoration of the two missing incisors. The problem with the differently sized gaps at positions 12 and 22 was resolved by maintaining tooth shape while varying the shapes of the mesial and distal interdental spaces. See also Fig. 26.*


*Figs. 25 and 26 Insufficient bone augmentation results in the implant manifesting itself as a gray shadow on the labial side. This problem cannot be resolved by using a "white abutment" but only by providing sufficient wall thickness on the labial aspect (minimum thickness of the hard and soft tissues: 1.7 mm on lateral incisors). In a patient with thin bone and gingiva (Fig. 25) more tissue bulk would have created a more aesthetic outcome.*


*In Figure 26, only the soft tissue was augmented on the labial aspect. To be able to work with hard tissue of sufficient thickness, it is recommended to use a smaller-diameter implant.*





*Figs. 27 and 28 Another patient, baseline situation. The maxillary and mandibular arches are constricted. Here, too, the relationship between the wings of the nose and the canine is evident. Tooth 13 showed passive eruption in canine position, whereas tooth 23 also showed passive eruption, but in lateral incisor position. A diastema presented between teeth 11 and 21.*


*Fig. 29 The shape of the face has changed compared to the baseline situation.*


*Fig. 30 An orthodontic wire doubled as a retainer for the provisional teeth 12 and 22.*

## Case report 3

**Patient history**

According to the orthodontist's diagnosis, tooth 22 was congenitally missing. He recommended either a single-tooth restoration or extraction of tooth 12 and subsequent orthodontic tooth movement, moving the canines into the position of the lateral incisors. It was ultimately decided to extract the tooth. However, the patient and her family were unhappy with the result, which is why the patient presented at our practice for a second opinion.

**Diagnosis**

The maxillary and mandibular arches were constricted. Here, too, the relationship between the ala of the nose and the canine is evident (Fig. 27). Tooth 13 showed passive eruption in the canine position, whereas tooth 23 also showed passive eruption, but in the lateral incisor position. A diastema presented between the upper central incisors (Fig. 28).

**Clinical steps**

As space was created for the restorative recreation of the lateral incisors and the canines were orthodontically moved to their original position, the facial appearance of the patient changed (Fig. 29). The change followed the progress of the orthodontic tooth movement.

It should be noted that a change like this often requires some adjustment on the part of the patient and his or her relatives, as the "new face" looks unfamiliar.

Treatment was initiated by orthodontic tooth movement in the maxilla and mandible, followed by a diagnostic wax-up. The orthodontic wire doubled as retention element for the provisional restorations at positions 12 and 22 (Fig. 30). The patient's jawbones were analyzed radiologically, and an augmentation of the alveolar ridge was performed. Following implant insertion, the clinical crowns of teeth 13 and 23 were



*Fig. 31*
*The provisional abutment shows that the labial thickness of the tissue is sufficient to permit an aesthetic restoration.*

*Fig. 32*
*Long-time provisionals for shaping the emergence profile.*

lengthened. An analysis of soft-tissue thickness showed that enough space was available for an aesthetic rehabilitation (Fig. 31). The implants received therapeutic provisionals to shape the emergence profile (Fig. 32). The definitive restoration was inserted after the tissue had completely healed.

Figure 33 shows that the spatial situation was different on the left and right sides, which is not unusual following orthodontic treatment. Optical allowance for this fact can be made by adjusting the shapes and positions of the artificial crowns and by appropriate placement of the marginal ridges (Fig. 34). Designing the marginal ridges of teeth 12 and 22 identically creates some leeway, interdentally and with regard to tooth width. This application can be utilized to conceal the differences, although an onlooker would probably never perceive the differences anyway (Figs. 35 to 37).

The treatment presented here is highly conservative, protecting the hard tissues of the teeth. No tooth substance had to be reduced; orthodontic tooth movement and the insertion of two implants were fully sufficient (Figs. 38 and 39).

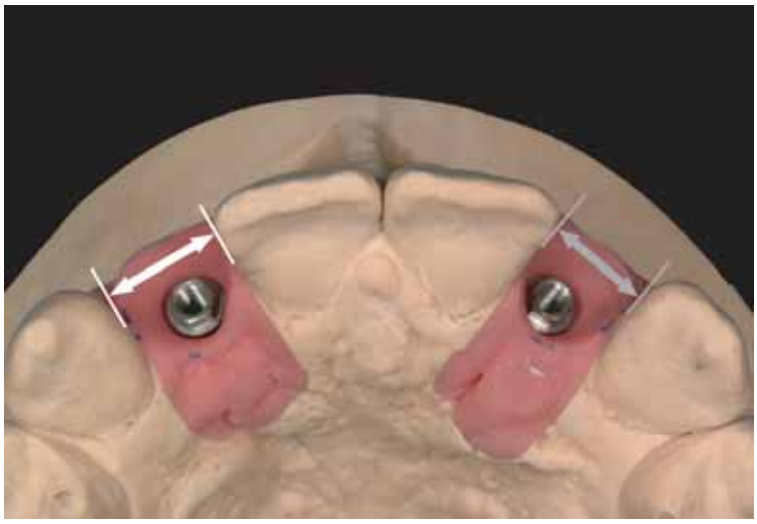


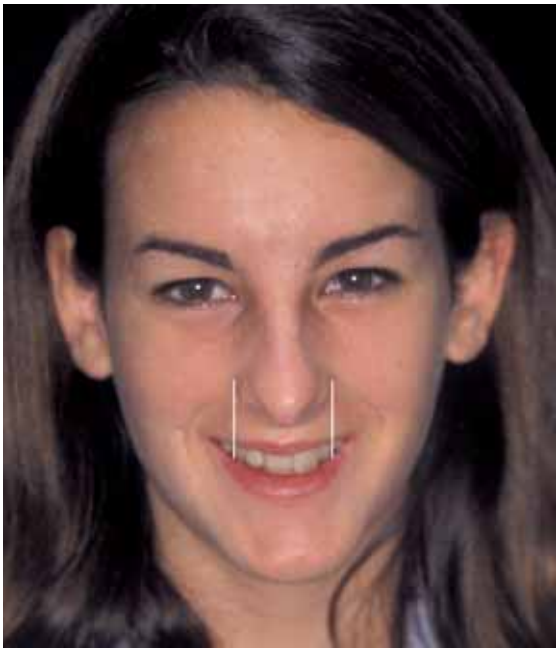
*Fig. 33 The situation as seen on the cast, showing the different amount of space available.*

*Fig. 34 The mirror image of the module ridges shows that a symmetrical design in this area creates the optical illusion of identically-sized teeth.*

## Acknowledgements

I would like to thank *Dr Cherilyn Sheets* for her collaboration in cases 2 and 3 and *Dr Jacinthe Paquette* for her collaboration in case 1, as well as *Dr Peter Nordland*, responsible for the implant treatment and bone augmentation in case 2.

This work would not have been possible without the interdisciplinary collaboration and fruitful exchange of views with *Dr Cherilyn Sheets, Dr Jacinthe Paquette, Dr Jean Wu* und *Dr Peter Nordland*. This collaboration makes each clinical experience a positive memory. It is the conviction of this team that nothing is impossible. ■



*Figs. 35 and 36 Before (left) and after.*

*Fig. 37 Close-up of the completed restoration.*

## CONTACT ADDRESS:

Otto Prandtner, MDT,
Instructor, Newport Coast Oral Facial Institute,
IDEA San Francisco
prandtner.creative@hotmail.com



*Figs. 38 and 39 The lateral incisors one year after insertion. The patient's tooth substance required no reduction. The final result was achieved by orthodontic means and by way of two dental implants.*

## REFERENCES

[1] H. G. Sergl, R. Reinhardt, A. Zentner und J. Schmidt, „Ein zahngrößen- und gesichtsbreitenbezogener Zahnbogenindex", Journal of Orofacial Orthopedics/ Fortschritte der Kieferorthopädie, 10.1007/BF02341484.

[2] Kinzer GA, Kokich VO Jr., „Managing congenitally missing lateral incisors", Part III: single-tooth implants. PMID:16231491.

[3] Kokich VG, Kokich VO, „Congenitally missing mandibular second premolars: clinical options" PMID:17045142.

[4] Vogel RE, Wheeler SL, Casellini RC, „Restoration of congenitally missing lateral incisors: a case report" PMID: 10709484.

[5] Talip Afsar, „Das Verhältnis zwischen der Jochbogen- und Zahnbogenbreite" SSN1434-5293 (Print) 1615-6714 (Online).

[6] Grunder U., Gracis S., Capelli M., „Influence of the 3-D bone-to-implant relationship on esthetics" Int J Periodontics Restorative Dent 2005; 25:113-119.

[7] Carrion JB, Barbosa IR, „Single implant-supported restorations in the anterior maxilla" Int J Periodontics Restorative Dent 2005; 25:149-155.

[8] Belser UC, Schmid B., Higginbottom F., Buser D., „Outcome analysis of implant restorations located in the anterior maxilla: a review of the recent literature" Int J Oral Maxillofac Implants. 2004; 19 Suppl:30-42.

[9] Kois JC, Kan JY „Predictable peri-implant gingival aesthetics: surgical and prosthodontic rationales" 2001:13(9):691-698.

[10] Grunder U., „Stability of the mucosal topography around single tooth implants and adjacent teeth: 1-year results" Int J Periodontics Restorative Dent 2000; 20:11-17.

[11] Salama H., Salama MA, Garber D., Adar P., „The interproximal height of bone: Aguidepost to predictable aesthetics strategies and soft tissue contours in anterior tooth replacement" Pract Periodontics Aesthet Dent 1998; 10:1131-1141.

[12] Jemt T., „Restoring the gingival contour by means of provisional resin crowns after single-implant treatment" Int J Periodontics Restorative Dent 1999;19:20-29.

[13] Small PN, Tarnow DP, „Gingival recession around implants: a 1-year longitudinal prospective study" Int J Maxillofac Implants 2000; 15:527-532.

[14] Kinzer GA, Kokich VO Jr., „Managing congenitally missing lateral incisors. Part II: tooth-supported restorations" J Esthet Restor Dent. 2005; 17(2):76-84.

[15] Richardson G., Russell KA, „Congenitally missing maxillary lateral incisors and orthodontic treatment considerations for the single-tooth implant" J Can Dent Assoc. 2001 Jan; 67(1):25-8.

[16] David A. Garber, BDS, DMD, „The edentulous Ridge in fixed Prosthodontics", Continuing Education Article #2, 212 Vol. 11, No. 4, July/August 1981