Esthetic harmony despite hypodontia

Teamwork – from treatment planning to provisionals and the all-ceramic restorations

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IPS e.max Smile Award 2016: The winning entry in the " America" category describes the procedure used to restore esthetics and function in a patient showing tooth agenesis of the lateral upper anterior incisors. The consistent approach to planning and implementation, the outstanding functional and esthetic result and the exceptionally illustrative documentation of this case set it apart from the other projects.

Hypodontia (tooth agenesis) of the lateral incisors is quite a common dental anomaly. In planning the treatment, various diagnostic considerations should be taken into account, and the different restoration options should be examined from an interdisciplinary perspective. Depending on the initial situation and the patient-related factors, various possibilities are available for redressing this deficiency: for example, adhesive bridges, orthodontic measures and implant-supported restorations. The aim in every case is to satisfy the patient's individual esthetic and functional requirements in the best possible way.

Pre-operative situation

The patient treated in this case showed missing lateral incisors. The oral hygiene of this esthetically conscious patient was excellent. Her gums were in outstanding condition, and she did not have any carious lesions. Her skeletal and craniofacial development was completed. Three years before the patient first consulted our practice, she had undergone restorative treatment for her condition. At that time, teeth 13 to 24 were treated with ceramic restorations (Figs 1a and b). Nevertheless, the patient was dissatisfied with the shapes, proportions and shades of these restorations. She wished for a solution that would harmoniously blend into her face. In the old restoration, wide anterior teeth were used to compensate for the missing teeth 12 and 22. However, the dimensions of the second and third incisors were comparatively large. The teeth looked disproportionately wide. Furthermore, they lacked the contours, ridges and angles that impart teeth with a natural appearance. In addition, the restorations showed light-optical defects. The teeth looked too dark, and they were relatively opaque. These characteristics did not match those of the naturally light teeth of the patient, which showed high translucency in the incisal region in particular. As a result, the decision was taken to fabricate new restorations for the upper anterior teeth of the patient.

Treatment planning: esthetic and functional parameters

First, a tooth shape had to be chosen which would best match the facial proportions. The aim of the new restoration was to achieve a facial and oral balance.

Objective initial assessment: The esthetic parameters were established by evaluating the facial proportions with the help of the Photoshop Smile Design software. For this purpose, a series of standardized photos were taken. Standardized refers to the fact

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Figs 1a and b: Patient with agenesis of the lateral incisors. Disharmony of the tooth shape and imbalances and deviations of the tooth shade after the restoration of the upper anterior teeth

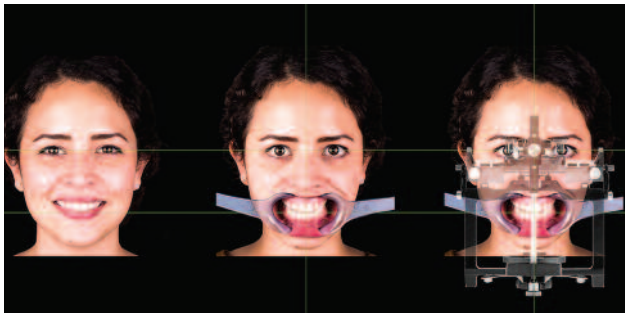


Fig. 2: Determination of the vertical and horizontal reference lines

Fig. 3: Virtual outline of the desired tooth shapes

that the intraoral, close-up and portrait pictures were taken under the same conditions. In the " en-face" images it was important to carefully align the camera and the patient's head. The photos were imported into the Photoshop image processing software. Subsequently, horizontal and vertical reference lines were drawn and the portrait picture was transferred to the virtual articulator (Fig. 2). The photo analysis highlighted the inharmonious appearance of the "white esthetics". The wide teeth did not match the face of the patient and looked unnatural. The desired tooth shape was traced on the close-up picture. In order to compensate for the missing second incisors and to achieve and even arrangement of the teeth, the new restoration needed to extend beyond the anterior teeth, and therefore, the molars would have to be included. The lateral incisors and the canines were made to look narrower but more pronounced, and they were adjusted to the buccal corridor (Fig. 3). The virtual outlines helped the patient to understand the changes that would be taking place. Since the photos only provided a one-dimensional impression of the result, a three-dimensional wax-up was created of the virtual design (Fig. 4). The teeth looked strong, and selectively created ridges and effectively placed concave and convex surfaces imparted the teeth with a natural-looking shape.

Preparation and shade selection

The existing restorations were removed and the teeth were suitably prepared in the transitional areas (Fig. 5). The aim was to treat teeth 15 and 16 as well as 25 and 26 non-invasively. In view of the prospective adhesive cementation, the prepared areas were coated with a fine layer of dentin bonding agent (immediate dentin sealing). The dentin of teeth 11, 13, 14 as well as of teeth 21, 23 and 24 was sealed according to the UCLA (University of California) guidelines. The tooth colour was determined on the basis of photos taken of the prepared teeth.

Fig. 4: Transfer of the digital plan to the wax-up

Fig. 5 After the removal of the old restorations

Figs 6a and b: Photographic determination of the tooth shade with and without a polarizing filter

Fig. 7: Provisional restoration made of composite resin (for soft tissue conditioning and other purposes)

Figs 8 and 9: Transfer of the plan to the alveolar model and pressing of the frameworks for teeth 14 to 24

In the fabrication of all-ceramic restorations in particular, it is important for the dental technician to know the colour of the prepared tooth.

A close-up picture was taken of the teeth and the shade samples, including a standardized grey card (Figs 6a and b). One photo was taken with a polarizing filter, which would allow the tooth shade to be evaluated without the interference of reflections, etc.

Impressions and provisional restorations

The double cord technique was used to take the impressions with an addition silicone (light body and heavy body). A functional and esthetic provisional restoration was produced on the basis of a wax-up or mock-up using the Bonded Functional Esthetic Prototype (BFEP) technique (Fig.

7). A flowable, high-strength composite resin was used for this purpose. Each tooth was individually treated. This would enable the patient to floss between the teeth. During the two-month wear period, the soft tissue was suitably conditioned and the functional and esthetic situation was evaluated.

Laboratory fabrication of the all-ceramic restorations

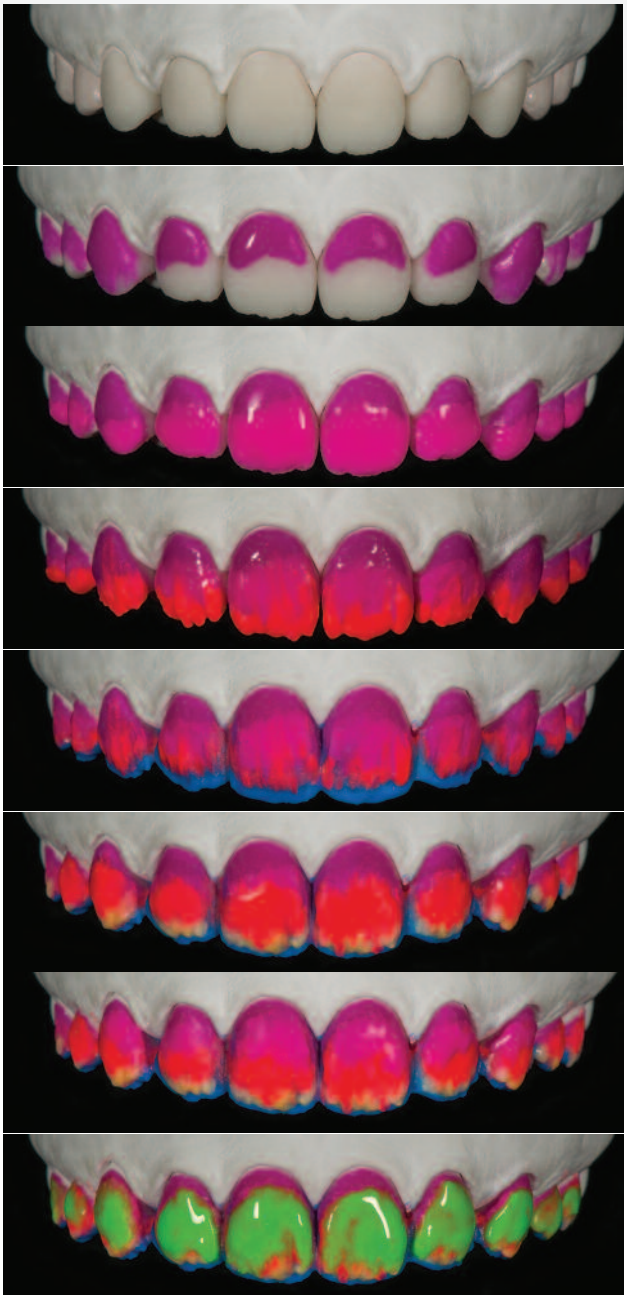
In the dental lab, an alveolar model was produced from the impression. With this type of model, the dies can be fabricated using different materials. The availability of these options is immensely helpful in the fabrication of veneers in particular. The dies can be individually created using the material that is most useful in any given step of the fabrication process: for example, plaster (master cast), refractory die material (dies for layering non-prep veneers) or composite resin (dies for evaluating the shade) (Fig. 8). In this case, the decision was taken to use a model with individual dies (without gingival portions) and an uncut model with gingival portions for the assessment of the contacts.

Treatment plan

The plan was to treat teeth 14 to 24 with lithium disilicate frameworks, which would serve as a basis for the veneering ceramic. The non-prep veneers on teeth 16 and 15 as well as on teeth 25 and 26 would be layered on refractory dies.

Fabrication

Teeth 14 to 24 were waxed up on the basis of the mock-up and then cut back by about 0.5 mm. They were invested and then the copings were pressed (IPS e. max® Press, shade LT BL3) (Fig. 9). The veneers for the vestibular parts of the molars were layered on refractory dies according to the envisaged tooth shape (mock-up). IPS e.max Ceram was used for this purpose (Figs 10a to h). The crown copings for the anterior teeth were veneered on the model (with gingival mask). Since the frameworks had been carefully reduced, this task could be carried out quickly and accurately. Nevertheless, the shape and layering scheme are not the only factors that determine the esthetic outcome of a restoration. The surface morphology must also be properly reproduced. Therefore, delicate concavities, a fine micro-texture and lifelike macro-texture were incorporated into the restoration. For visualization purposes, the restorations were sprayed with gold powder and then the result was evaluated (Fig. 11). The gloss level was individually adjusted by mechanical polishing. Finally, the proximal contacts were checked on the uncut model.



Figs 10a to h: Ceramic layering of the anterior teeth

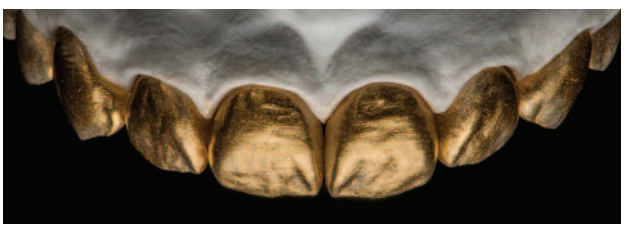


Fig. 11: Evaluation of the surface morphology with the help of gold powder

Figs 12a and b: Conditioning of the ceramic surface for the adhesive cementation of the crowns and veneers

Fig. 14: The picture of the teeth framed by the lips clearly shows the success of the treatment. The teeth look strong and healthy. The agenesis of the lateral incisors has been successfully managed

Fig. 15: Optimum management of hypodontia

Placement

After the try-in, the individual ceramic units were prepared for the adhesive cementation process. The inner surfaces of the restorations were etched with hydrofluoric acid and then silanized (Figs 12a and b). The tooth surfaces were conditioned according to the UCLA protocol: chlorhexidine solution (disinfection), etching with phosphoric acid, application of the primer and the bonding agent, cementation of the restoration. Variolink® II was used for this purpose, since it is an esthetic and very reliable luting composite. The outcome showed healthy soft tissue and an overall harmonious appearance.

Fig. 13: The placed restorations: The tooth shape and shade seamlessly blend into the oral environment.

Fig. 16: The satisfied patient

Result

The restorations successfully concealed the agenesis of the two lateral incisors. The patient was highly satisfied with the result. The restorations seamlessly blended in with the oral and facial situation in terms of their shape, shade and function (Figs 13 to 16). Due to very careful planning – by means of the Photoshop Smile Design program and the physical mock-up – the problem of disharmony was successfully solved. The teeth look strong and strikingly beautiful. The light-optical properties of the natural teeth have been effectively reproduced. The restorations show a lifelike interplay of colours emerging from within, with just the right level of translucency, transparency and opacity.

Conclusion

In general, the treatment of anterior hypodontia requires an interdisciplinary approach. In the case presented, the patient was treated with all-ceramic restorations (IPS e.max) to attain the desired result. The close collaboration of the dentist and the dental technician and a carefully developed restorative treatment plan are integral requirements for this type of treatment.

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