Dentofacial aesthetic analysis using 3-D software

Synergy between aesthetic dentistry and aesthetic medicine

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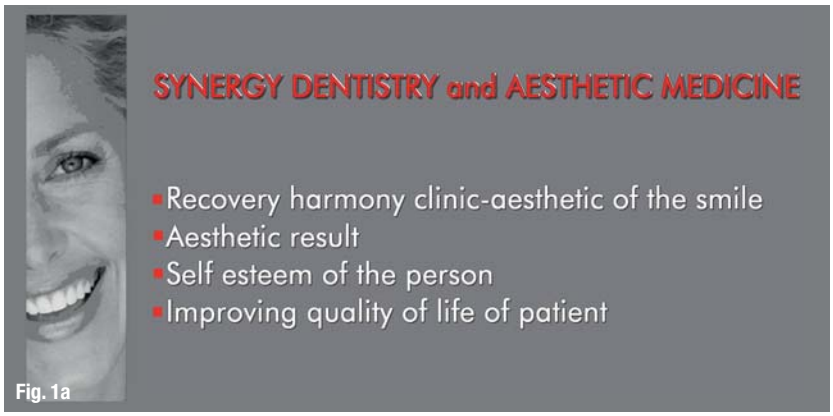


Fig. 1a_Objectives of aesthetic dentistry and aesthetic medicine.
Fig. 1b_Class III/I malocclusion and labial disharmony.

Fig. 2_Dentofacial aesthetic analysis showing incongruent lip relationship with asymmetry.

_Introduction

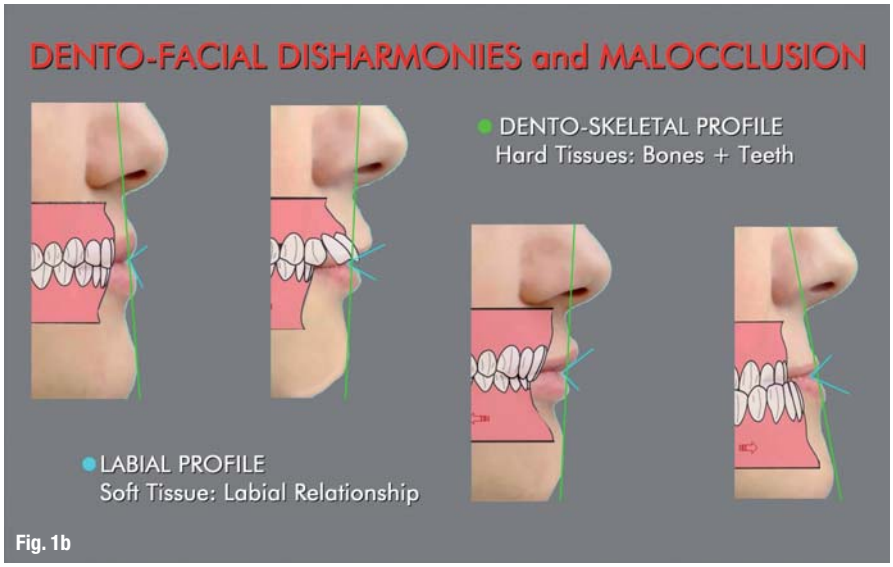
Dentofacial abnormalities are alterations in facial proportion and dental relationships, and such abnormalities in dental and facial appearance often lead to societal discrimination. While orthodontic treatment restores correct dental relationships, it is often not sufficient to solve the facial disharmony and certainly cannot resolve the accompanying psychological difficulties in certain patients (Fig. 1a).

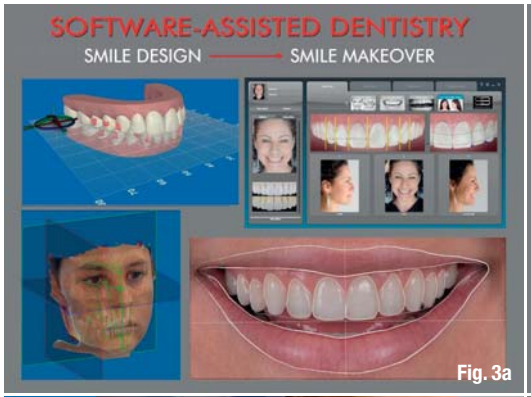
For this reason, aesthetic medicine is utilised to harmonise the final result. Owing to virtual dentistry, the expected smile and face of the patient at the end of orthodontic therapy and aesthetic treatment can be shown to the patient. In order to achieve this, a new diagnostic approach is used in the correction of dental malocclusion: capturing and analysing preoperative photographs in conjunction with CT scans and X-rays with the help of 3-D software specifically for aesthetic dentistry. In this way, the final expected result can be shown to the patient.

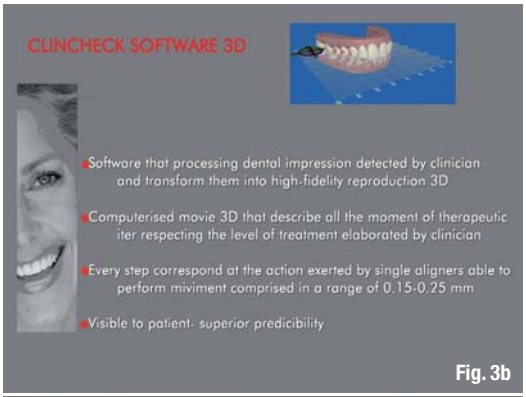
_Aesthetic analysis

Often the patient is directed to a dental consultant because he or she does not like his or her smile and this has affected him or her psychologically such that aesthetic dentistry is inevitable.

The role of the dentist today should be to ensure that the reasons for intervention will be agreed upon with the patient and to ensure predictability of the aesthetic result.







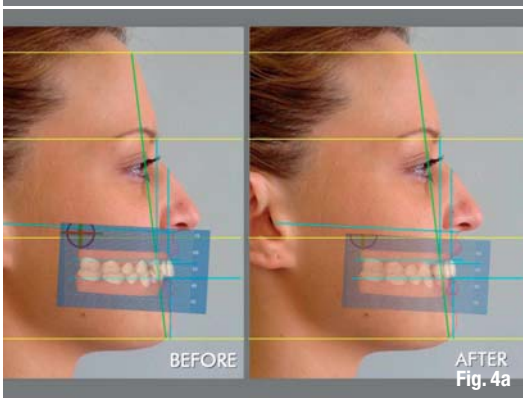
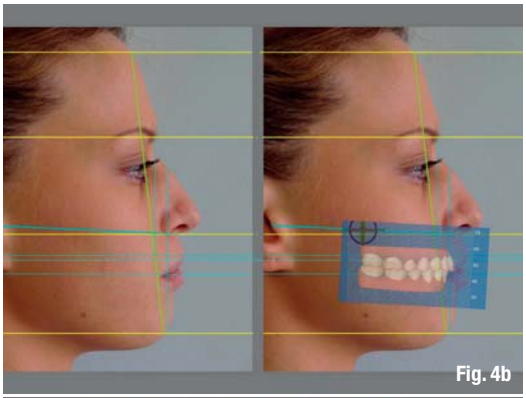
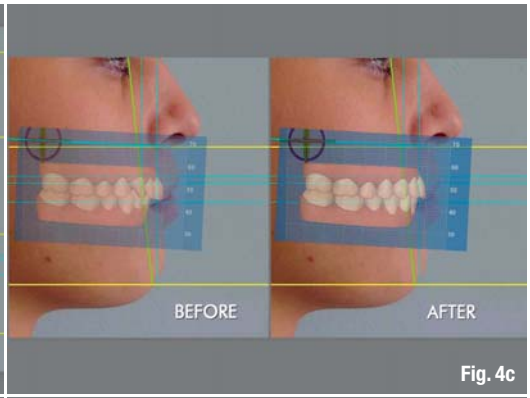


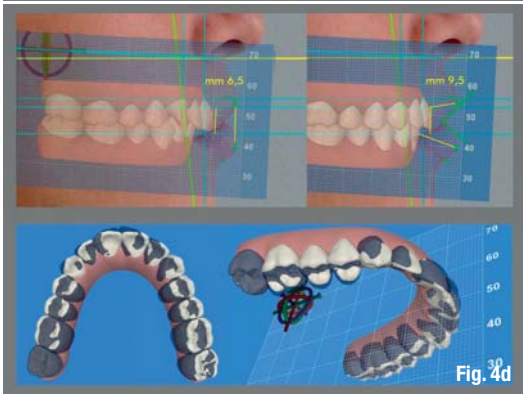
Fig. 3a_Software-assisted aesthetic dentistry.
Fig. 3b_Use of ClinCheck 3-D in dentistry.
Fig. 3c_Superimposition of ClinCheck 3-D image over a 2-D image.
Figs. 4a & b_Dentolabial profile analysis while smiling and with closed lips.

Many dentofacial disharmonies are caused by malocclusion, classified according to Angle's molar relationships (Fig. 1b). The soft tissue of the vestibule and the lips lies over the dental hard tissue and is therefore influenced by the molar relationships.

In examining the patient, we could consider, for example, his or her profile from the labial view. When a patient comes to my office for examination, in recording his or her medical history I pay much attention to preoperative photographs in seeking to determine the cause of aesthetic disharmony.







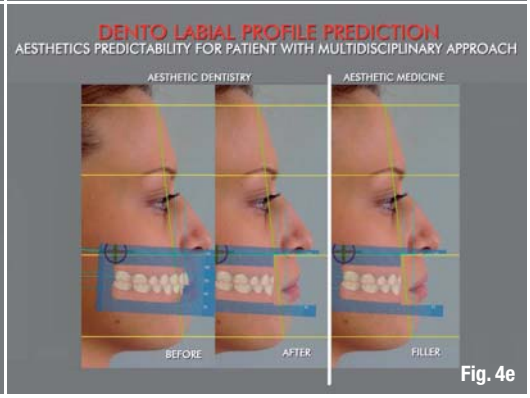


Fig. 4c_Analysis with superimposition: prediction after orthodontic treatment of lip–tooth relationship with closed lips.
Fig. 4d_Prediction of future dentolabial relationship after orthodontic therapy to align dental elements.
Fig. 4e_Aesthetic predictability: the labial relationship with or without cosmetic intervention with a filler.


Fig. 5a


Fig. 5b


Fig. 5c

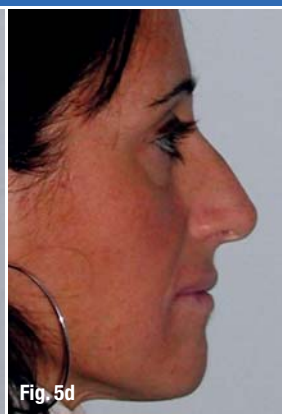


Fig. 5d

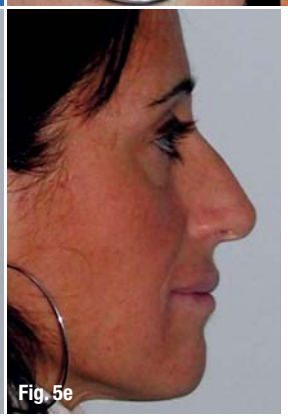


Fig. 5e

Fig. 5a_Initial and final phase of alignment shown using ClinCheck.
Fig. 5b_Lateral intra-oral view before and after orthodontic treatment.
Fig. 5c_Lateral extra-oral view at the start of treatment.
Fig. 5d_Virtual prediction of labial profile after orthodontic treatment.
Fig. 5e_Virtual prediction of labial profile with remodelling.

In the case presented here, three extra-oral photographs were taken from the front and three extra-oral photographs were taken from the side (Fig. 2). Intra-oral examination found that the patient presented with a Class III/I malocclusion with a pronounced overjet. From the extra-oral photographs, the macroscopic incongruity in the labial relationship is evident because although the patient had her mouth closed and lips soft the lips are not touching. The face is asymmetrical in the inferior third and the smile line is not aligned with the occlusal plane, and is oblique and does not run parallel to the bipupillary line.

_3-D software in aesthetic dentofacial analysis

Today, we can design smiles more reliably and in a more sophisticated manner to correct the smile of our patients (smile makeover) using 2-D and 3-D dental software (Fig. 3a). ClinCheck 3-D software (Align Technology) for use by dentists to create transparent orthodontic and dental aligners has proven to be an excellent tool in dentofacial aesthetic analysis, not only from an orthodontic perspective but also from an aesthetic perspective.

In this case, orthodontic therapy using Invisalign (Align Technology) was proposed. Impressions taken of the dental arches, X-rays, photographs and diagnosis with a treatment plan were processed by ClinCheck 3-D, which converts everything into 3-D images to allow the dentist to see and change all the therapeutic orthodontic steps necessary to align the teeth.

ClinCheck is sophisticated software that processes data captured by clinicians, allowing high-fidelity 3-D reproduction, where each step corresponds to the action by a single aligner able to perform movements of 0.12 to 0.25 mm (Fig. 3b).

Biomechanical steps ensure greater predictability in orthodontic clinical cases for both the clinician and the patient. The initial phase of aligner movement and the final situation can be superimposed on a photograph of the face of the patient using 2-D software (Fig. 3c). ClinCheck has among its options a millimetre grid that can be superimposed on the photograph and the steps shown according to conventional reference lines (Figs. 4a–c). In this way, one can obtain a predictable dentofacial analysis from both a dentoskeletal perspective (alignment) and a dentolabial perspective (labial/perilabial repositioning).

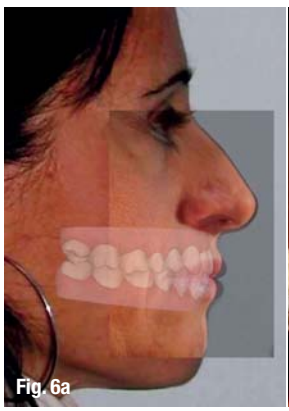


Fig. 6a


Fig. 6b

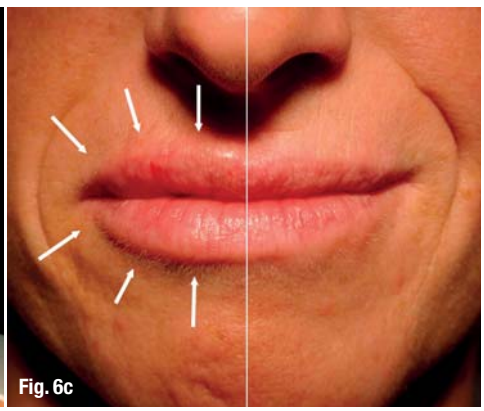


Fig. 6c

Fig. 6a_Aesthetic analysis with superimposition of all the available elements after treatment.
Figs. 6b & c_Immediately post-treatment with labial hyaluronic acid.

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Fig. 7a


Fig. 7b


Fig. 7c

Fig. 8

Figs. 7a–c_Patient after completion of aesthetic dental treatment and aesthetic medical treatment.
Fig. 8_Digital verification of treatment outcome.

The analysis of the clinical case in question demonstrated a drastic closure overjet of about 3 mm as the final post-orthodontic treatment outcome (Fig. 4d). Since the soft tissue of the lips and of the vestibule lie on the skeletal structures, it is possible to predict the future dentolabial relationship (Fig. 4e). At this point, aesthetic predictability for the patient is important because at this stage the combined results of dentistry and aesthetic medicine are shown. In fact it is possible to simulate virtually the new labial dimension following aesthetic dental treatment and cosmetic labial or perilabial surgery.

_Clinical case: Orthodontic treatment and hyaluronic acid

A 47-year-old female patient presented with malocclusion with crowded teeth in the maxilla and mandible and an incongruous dentolabial relationship. The clinical case was treated with 28 upper and 20 lower aligners, with interproximal reduction and attachments in both arches. The superior/inferior midline was moved during the process of sagittal correction (Fig. 5a).

In keeping with the protocol described above, and at the explicit request of the patient, it was decided to approach treatment in accordance with the dentofacial aesthetic analysis obtained using ClinCheck 3-D (Fig. 5b). Using software to show the predicted movement on the grid allows the patient to see the expected changes (showing the lips with or without surgical remodelling; Figs. 5c & d). The preoperative analysis can be verified at the end of therapy by superimposing all of the images available (Fig. 6a).

Once the dental treatment had been completed, we decided together with the patient to increase the lip volume using hyaluronic acid (Figs. 6b & c). About two weeks after surgery, it was possible to verify what had been expected in the analytical aesthetic phase (Figs. 7a–c & 8).

_Conclusion

Combined aesthetic dentistry and aesthetic medicine can offer optimal and predictable treatment in the majority of clinical aesthetic cases.

Using digital technology, the predicted outcome of such treatment for smile design can be shown to the increasing number of patients presenting for aesthetic treatment._

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

_about the author

cosmetic dentistry

Dr Valerio Bini, DDS in dentistry and dental prosthetics from the University of Genoa in Italy, is a cosmetic dentist. He is a member of the European Society of Cosmetic Dentistry, a fellow of SIED (Italian society of aesthetic dentistry), a fellow of the Italian Academy of Esthetic Dentistry, and Align Technology Invisalign certified. He regularly attends courses for specialist clinicians in aesthetic dentistry and aesthetic medicine. He has been a speaker at international conferences on aesthetic dentistry and aesthetic medicine. He is also the author of many articles published in international journals.

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