Invisalign ClinCheck and the Aesthetic Digital Smile Design Protocol

LUCA LEVRINI, MD, MSc
GIULIA TIEGHI
VALERIO BINI, MD

Most currently available orthodontic software programs, including Invisalign’s ClinCheck,* allow the clinician to visualize only the occlusal results of treatment. Today, however, new technologies developed for prosthetic and conservative restoration make it possible to display the expected outcome within the context of the patient’s overall facial esthetics.

Coachman’s esthetic digital smile design (DSD) is one of the most widely used programs.1,2 Based on photographs and video clips of the patient and subsequent digital processing, DSD and similar programs permit careful analysis of the patient’s smile, dental esthetics, and facial proportions for precise multidisciplinary treatment planning.3-8 Depending on the aesthetic parameters taken into consideration, DSD can help clarify treatment limits and possibilities for patients, thus reducing the likelihood of unexpected outcomes.

McLaren and colleagues have described a DSD protocol using Photoshop** software.9 Because DSD is not applicable in all orthodontic cases, however, Bini developed a method called Aesthetic Digital Smile Design (ADSD), combining a simplified esthetic analysis with new orthodontic software that projects the clinical outcome.10 The aim is to create an image of the expected smile, taking into account the physiological limits of the patient to ensure that the smile remains natural. ClinCheck can be used in conjunction with ADSD for more precise esthetic treatment planning.

Diagnostic Procedure

The ADSD protocol is illustrated in a 12-year-old female patient who presented with a Class I molar relationship, agenesis of the upper lateral incisors, a diastema between the upper central incisors, and a skeletal Class I malocclusion (Fig. 1).

The first step is to take all the photographs needed to analyze the patient’s teeth (micro-esthetics), smile (mini-esthetics), and face (macro-esthetics). In addition to the standard photographs required for orthodontic diagnosis, ADSD uses informal photographs showing a broad and natural smile with the patient’s head turned at a three-quarter angle to the camera, as well as a frontal view of the upper dental arch with a piece of black cardboard inserted to conceal the background soft tissue. It is important to maintain the esthetic plane, which is perpendicular to the center of the angle between the Camper and Frankfort planes.

Another option is to make a video (starting from a natural, relaxed position) to assess lip movement when the patient is speaking and smiling broadly.

To process the images, we suggest using Photoshop CC or PS1.** The first step is to import and position the photograph of the patient’s face as if it were a map aligned to the cardinal points. This is followed by a tracing of the bipupillary line, which the software recognizes as

---

The face and smile are mapped using extraoral and intraoral morphological landmarks (Fig. 2A). For assessment of symmetry, it is crucial to evaluate the relationship between the vermillion borders with the lips closed and from the frontal and profile views. It is also important to note the size of the lips in regard to the vertical dimension of the face, as well as any bruxism, maxillary atrophy, micro- or macrodontia, malocclusion, or simple lack of lip firmness. Intraorally, the iconographic (micro-esthetic) analysis focuses on a close-up of the mouth, the details of which are related to the horizontal and vertical lines already traced on the patient’s face. It is thus possible to analyze the occlusal plane—ideally parallel to the bipupillary line—and the main vertical lines, including the facial midline, the interincisal line, and the subnasal areas.

The DSD process involves accurate dynamic simulation of the projected dental movements. ClinCheck software allows the displacement of the teeth to be calculated in three dimensions, making...
Invisalign ClinCheck and the Aesthetic Digital Smile Design Protocol

Fig. 2 A. Aesthetic digital smile design (ADSD) face mapping. B. Integration of ClinCheck frame through superimposition of landmarks.
it possible to predict the outcome of orthodontic treatment. The ClinCheck grid, graduated in millimeters (Fig. 1B), makes it possible to check and modify orthodontic movements on an analog scale. It can also be used as an aesthetic plane to be superimposed on the image of the smile.

After the ClinCheck frame is transposed onto the image of the patient’s face (Fig. 2B), the macro-esthetic landmarks are used to position a close-up of the mouth. ADSD involves a precise

---

**Fig. 3 A.** ClinCheck imported onto virtual close-up of mouth (first aligner). **B.** ClinCheck simulation of bridge elements.
conversion of the patient’s actual measurements from analog to digital form (a process called Analogic Transfer System Communication), using measuring tools such as Face Analogic Transfer Support (FATS); in practical terms, this means that a millimeter scale is applied to an image of the face, replacing the ClinCheck grid. The FATS technique is useful for working on the computer screen, allowing millimeters to be used as the measurement scale instead of pixels, while the

Fig. 4 A. Digital Dental Image Distortion of ClinCheck-processed frame (last aligner). B. ADSD image editing with orthodontic treatment simulation. C. Face markers and outlines used in esthetic virtual treatment planning.
During the first visit, this patient and her parents were informed of the diagnosis and proposed treatment plan and offered the opportunity to view the photographs created with the ADSD program. At the patient’s request, an esthetic Invisalign*** treatment plan was designed. We recommended prosthetic rehabilitation of the teeth affected by agenesis, since the patient had not yet reached a sufficient level of bone maturation to allow implant-supported prosthetic rehabilitation. The estimated treatment time was 18 months.

Impressions were taken for fabrication of the aligners. Composite attachments were bonded to the canines and central incisors and adjusted at subsequent visits as necessary. When the last aligner in the series was reached, the patient underwent final esthetic prosthetic rehabilitation, using a zirconia ceramic Maryland bridge to close the gaps created by the incisor agenesis. Removable Vivera*** retainers were delivered. It is interesting to compare the ADSD virtual projection with the actual clinical outcome (Fig. 5).

Invisalign ClinCheck and the Aesthetic Digital Smile Design Protocol

Discussion

This ADSD protocol allows orthodontists to preview the desired occlusal result within the context of the face as a whole. It is simple and quick to perform during the initial examination. Moreover, by enhancing the predictability and precision of ClinCheck technology, it enhances the relationship between orthodontist and patient. The patient’s history and the initial consultation are fundamental to this process; through effective communication, the orthodontist learns what the patient and parents want to change and what their expectations are in both esthetic and financial terms.\textsuperscript{11,12}

Esthetics is a concept that embraces not only beauty but also health, technology, and efficiency. It no longer makes sense to propose a cosmetic treatment simply because it will give the patient a beautiful smile, without considering that today’s orthodontic instruments are technologically advanced and highly efficient, promoting natural health and prevention. From that perspective, their use must be regarded as a part of ethical orthodontic practice.

REFERENCES