# Face Scan for Ceph 3D: a green way for diagnosis in children

PRESENTATION

*This column will walk us through technological developments, innovations in materials and tools, as well as new operative trends in paediatric dentistry of today and tomorrow.*
*The goal, rather ambitious, is to explore, with a very practical approach and a broad clinical vision, which "avantgarde" actions we can implement to take care of our little patients.*
*We want to promote solutions, not only for treatment and achievement of specific therapeutic goals, but for the well-being of children and their families where, more often than not, "how" is more important than "what".*

Luigi Paglia
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ABSTRACT

*Background* The aim of this paper is to illustrate how new opportunities offered by technology and diagnostic imaging can more easily create a 3D integration of soft tissue Face Scan and IOS (intra oral scan) for orthodontic evaluation in children.
*Clinical report* Through TrueDepth technology, a software commonly used for digital devices such as smartphones and tablets, the authors illustrate the acquisition of facial scans by means of different applications, and their integration with IOS to perform diagnostic evaluations and treatment planning at zero biological cost for patients.
*Conclusion* TrueDepth technology is both accurate and easy to use for all clinicians, even those less accustomed to digital innovations. In the past, stereophotogrammetric systems and devices were used, and they are the gold standard for three-dimensional acquisitions. However, there is a major drawback associated with this technology as it is expensive and non-portable. Truedepth technology is an effective substitute, as smartphone applications are portable, cheaper, and more accessible, giving each orthodontist the ability to take advantage of the benefits of facial scanning in their daily practice.

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FIG. 1A

FIG. 1B

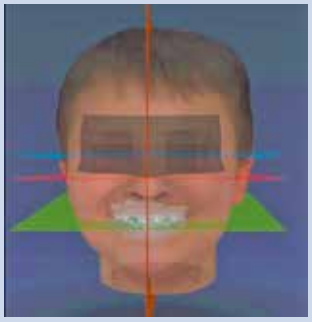

FIG. 2

FIG. 3

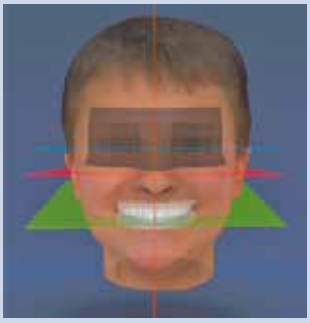

FIG. 4

FIG. 1A Bellus3D interface on smartphone. FIG. 1B Bellus3D Facescan and IOS at T0.
FIG. 2 Bellus3D Facescan and IOS at T0 with Ceph3D.
FIG. 3 Bellus3D Facescan and setup of IOS at T0.
FIG. 4 Bellus3D Facescan and setup of IOS at T0 with Ceph3D.
FIG.5A Superimposition of Bellus3D Facescan after maxillary expansion with the Leaf Expander appliance.
FIG. 5B Facescan by Planmeca Proface® and superimposition made before T0 and after T1 maxillary protraction with face mask.
FIG. 6 Heges Facescan3D, maxillary and teeth segmentation, IOS and Ceph3D.

## Introduction

The aesthetic evaluation of soft tissues is one of the fundamental steps for a correct diagnosis and for the formulation of the orthodontic treatment plan in adult and young patients [Ayoub, 1996 and 2003; Littlefield, 2005]. The interpretation of the morphology and position of soft tissues with three-dimensional analysis supplies full information for facial aesthetic analysis [Khambay, 2008]. Compared to 2D analysis, the three-dimensional evaluation allows for an unlimited number of possible projections on which to perform the analysis of the face and predict the aesthetic and functional outcomes at the end of a treatment.

The recent acquisitions of technology and diagnostic imaging have made it possible to create three-dimensional (3D) reconstructive systems, with considerable diagnostic advantages over any two-dimensional technique [Beretta, 2021; Beretta, 2021]. In fact, the evaluation of the patient can be carried out by simultaneously visualising the three plans of the space, eliminating any possible distortion resulting from the use of 2D images.

Facial analysis is a fundamental aspect in orthodontic diagnosis [Zecca, 2016]. One of the most commonly used technologies for 3D imaging of the facial surface is digital stereophotogrammetry. This system offers a variety of advantages over other facial analysis methods; for example, it is minimally invasive, radiation-free, fast and easy to use. Therefore, the system is considered the gold standard for 3D analysis of the face for diagnostic purposes. In fact, its high accuracy has been proven by various authors.

Today, a valid alternative with significantly reduced costs and other ergonomic benefits, is represented by the use of Truedepth technology, typical of common digital devices, (smartphones or tablets), associated with dedicated and specific applications for facial scanning.

## Clinical report

In this paper, the authors illustrate the three-dimensional scans and integration with IOS using two different smartphone applications, based on TrueDepth technology (iPhone 11 ProMax; Apple, Cupertino, California) for the Bellus3D ProFace application (version 1.6.11; Bellus3D Inc, Campbell, California) and the TrueDepth technology (iPad Pro; Apple, Cupertino, California) for the Heges application (version 1.6.3; Capture STL and PLY models Marek Simonik).

The acquisition methods are the following.

Bellus3D App: the smartphone is fixed on a tripod in front of the patient at a distance of 30 cm. The patient is asked to rotate the head with specific directions and speeds as indicated by the graphical interface and voice instructions.

Heges App: the patient is asked to remain motionless. Starting the scan with the internal camera facing the patient, the iPad Pro is moved by the operator to capture all aspects with a ''cross'' movement from right to left, from behind to the centre and towards the top and bottom of the face.

Before the scans, the patient is asked to remove glasses and jewels, so as not to interfere with the results of image capture. The aim of this work is to illustrate the multiple possibilities of using Face apps.

With the Bellus3D Pro app (Fig. 1 a) it is possible to superimpose the scan of the patient's face with the initial intraoral scans (Fig.1b) and to insert sagittal, horizontal and

FIG. 5A

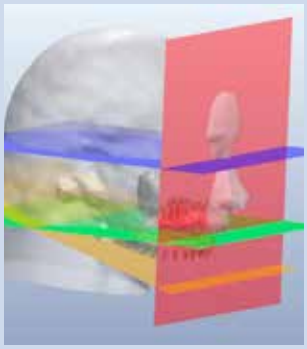

FIG. 6

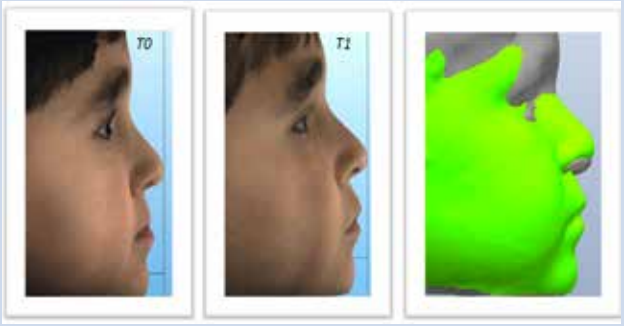


FIG. 5B

oblique reference planes, simulating a possible Ceph3D (Fig. 2), that allows to evaluate on all planes of the space the soft tissues of the patient, integrable with IOS too.

Taking advantage of the same facial scan and the same reference planes, the virtual setup of the dental arches can be superimposed to them (Fig.3–4); in this way a three-dimensional simulation is created to facilitate the clinician for the therapeutic choices.

Another opportunity for the digital diagnosis process of Bellus3D Pro is the facial scans superimposition of T0-T1. The example shown (Fig. 5a) represents the overlapping scans of the face of a child before and after orthopaedic expansion of the upper jaw with the Leaf Expander appliance [Lanteri et al., 2018], that we can compare with a superimposition obtained with 2 face scan at T0 and T1, made (Planmeca Proface®) integrated in a CBCT unit, after a Face Mask treatment for a Class III malocclusion in a child (Fig. 5b)

The last example (Fig. 6) is the creation of a Ceph3D that comes from the combined use of multiple softwares for processing and displaying .stl files. In this case the facial scan is performed with the Heges app from which we exported the .stl file that was uploaded to the Meshmixer Autodesk opensource platform with the IOS models [Federici Canova, 2021] and reference planes created by us with the same software. The visual result is comparable to that obtained with Bellus3D Pro, but with a steeper learning curve, given the required knowledge of multiple software.

## Discussion and conclusion

Stereophotogrammetric systems or other digital devices integrated in radiological units for dentistry are expensive and non-portable. In contrast, smartphone applications are portable and less expensive, giving to every professional the ability to introduce the benefits of facial scanning into their clinical daily practice.

Through smartphone's or tablet's applications, based on True-Depth technology, it is possible to easily obtain 3D facial models with a good level of accuracy to be used for various purposes in orthodontic clinical practice, such as pre-evaluation of the patient, diagnosis, treatment simulation and aesthetic analysis.

Both Bellus3D and Heges have shown accurate results for the purposed scope in this paper, although Bellus3D is, in our opinion, easier to manage than Heges.

This kind of 3D face analysis leads to explore a new way for a green diagnosis in paediatric orthodontics, where our responsibility is possible to use the lowest radiation dose to evaluate our patients and their growth [Kühnisch, 2020] without losing any important detail. In our provocatory thinking and speculation, if the morphological face characteristics of a little patient are suitable to be analysed without a lateral or a postero-anterior cephalogram [Durão, 2013] still allowing an evaluation of the underlying skeletal structures, integrating dental arches by IOS, can represent a valid option. Furthermore, by being able to repeat the facial scan several times, at zero biological cost, both during therapy or during growth monitoring, and by correctly overlapping the different files, we can easily obtain a dynamic virtual control of facial development with or without therapy, allowing for diagnosis, communication and engagement of the patient and his/her family, in a green, smart and easy way.

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