3D world in orthodontics: Diagnosis, planning and great challenges

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Currently the importance of accurate records is broadly recognized also in orthodontic treatment plans. The diagnostic imaging takes an important part in reaching effective and steady orthodontic results.

More significant field in which imaging is actually involved is the diagnosis of particular alterations of teeth position or affections of dento-facial structures, as well as combined treatment plans.

In this scenario, the introduction of 3D diagnosis obtainable by CBCT technology opened the doors to new possibilities in treatment of challenging pathologies in maxillofacial complex [1-3]. Cleft palates, as well as cleido- cranial dysplasia and other syndromes involving the skull and alveolar bones, can be approached successfully thank to the feasibility to obtain 3D images that allow pre-treatment visualization with minimal errors.

In planning phase, it is crucial to evaluate every aspect of deformity in order to catch the right timing to take action. Often cranio-facial pathologies need more than one surgery during the life of patient, because of this, a correct surgery and orthodontic planning is essential.

In cleft palate syndrome, for example, young patients received many surgical operations during their life. The most important and significant moment in cleft palate is the secondary alveolar bone graft, on which the following effective orthodontic treatment is based. This phase needs to be planned and monitored in order to be as most effective as possible in grafting surgery. In order to obtain a good healing is of course needed a perfect fitting of graft in bone defect [4,5]. CBCT evaluation makes possible to understand perfectly the anatomy of bone defect and, where it is requested and possible, create a custom-made scaffold.

Surely, nowadays it is more difficult to do it in cleft defects because their irregular and particular anatomical characteristics, but studies are updating the challenge.

However, in other pathologies where it is needed to understand anatomic condition in order to approach with a planned surgical procedure, CBCT with 3D images is of course the best opportunity to use.

An important focus is that 3D images nowadays can be used also to create scaffolds useful in bone graft: this becomes very significant syndromes or in particular diseases in which orthodontic patients need to be grafted [6]. In this way, with just one radiographic examination, this means minimal x-rays exposure in growing patients, the clinician can obtain all information requested in order to perform a correct diagnosis and an effective treatment.

3D technology is not only CBCT and imaging diagnosis, but this concept is expanding its fields of application an many great aims are now yet reached.

An important goal it was the introduction of intraoral scanners giving the possibility to "take impressions" obtaining accurate steady data and sharing these in real time. From this important target it is born the great universe of CadCam technologies in orthodontics.

A crucial turning point was the introduction of digital set up and subsequently the obtained feasibility to perform digital orthodontic treatment on the software [7,8]. This made possible to have the great scenario of removable orthodontic aligners that have revolutionized the modern concept of orthodontics.

This meant that, from a simple and easy to obtain image, orthodontists could have a perfect preview of treatment results both for fixed therapy, both for removable. This is very important also in well explaining informed consent to our patients: the opportunity to see 3D reconstructions and different phases of treatment is surely an added value in order to have a really informed consent.

Of course the possibility to obtain 3D images allowed to ensure more accurate diagnoses and orthodontic treatment results. It is also possible to monitor constantly our results with a vision very close to real conditions. The validity of images derived by intraoral scanners and possibility to use them to take measurements are considered clinically significant and therefore recommended to perform treatment.

But what about cons?

The first difficulty in using the 3D intraoral scanning is the possible to share information. If we use at chair side intraoral scanners to take impression, we have to do a laboratory able to manage captured images.

The learning curve to be able to use intraoral scanners is sometimes long especially when the tool is not used frequently. Instead it is necessary to do more and more practice in order to make this instrument really effective [9,10]. The possibility to obtain satisfactory results depends on our capability to use the scanner, so we have to do more and more practice.

The costs could be a problem nowadays because this technology is still expensive. However, this obstacle may be reduced by a group purchase, for example, where the office organization allows it.

Many questions and challenges are sleeping in this field, but orthodontics need to open their doors to the new and to the high-tech everyday, because the success passes through these doors.

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