The role of 3-D imaging systems in present orthodontics

**Abstract**

Traditionally, the diagnosis in orthodontics gives a lot of importance to cephalometry and the analysis of the dental casts. The development of new technologies does not intend to discard traditional concepts, in fact, it intends to provide more information allowing a wider approach of our patients and resulting in a more thorough diagnosis.

**Introduction**

Adapting to new three-dimensional concepts is not an easy task and is even harder considering that the information is so vast that it can result overwhelming. That is why when evaluating a patient for orthodontic treatment, it is intended to use a systematic method so that we can obtain the most essential information that these methods provide.

The method consists of the following:

- Coronal, sagittal and axial general visualisation
- Teeth and surrounding structures
- Airways and paranasal sinuses
- Soft tissues
- Temporomandibular joint (TMJ)

**General visualisations**

To perform a general exploration, it is necessary to know the three anatomical planes: coronal plane, sagittal plane and axial plane.
Coronal plane (Figs. 1 & 2)

The coronal plane is located in the anterior part of the face, approximately parallel to the buccal surfaces of the anterior teeth. It divides the skull into two; anterior and posterior. Structures can be seen from back to front or front to back.

Sagittal plane (Figs. 3 & 4)

The sagittal plane divides the skull into two symmetrical parts. It has a transversal orientation allowing examining two segments: right and left.

Axial plane (Figs. 5 & 6)

The axial plane is parallel to the floor and the occlusal plane. It divides the skull into two equal parts: superior and inferior, allowing the view of structures from top to bottom and bottom to top. The overview of these three anatomical planes should give the specialist a complete exploration of the 3-D anatomy. The result is a deeper knowledge of the anatomy of the patient or, like in some cases, a number of findings that might result in the modification of our treatment plan.

Teeth and surrounding bone structures

For obvious reasons, one of the main areas to check is the dental zone. Images that allow to check the teeth that are present and the ones in process of eruption, if that is the case, should be generated. As well as the characteristics of the adjacent bone and even take some numeric references.

Airways and paranasal sinuses

Breathing is the foundation of life. CBCT scans offer a precise visual of the airways and surrounding craniofacial structures that influence them, such as the mandible, palate, paranasal sinuses, facial relations, adenoid tissue, tonsils and more.

This view of the airway completely changes the perception of the specialist and, most important, the life of the patients.

Soft tissues

The evaluation of the soft tissues in a three-dimensional system and without magnification is ideal for the orthodontist because he/she can now evaluate the patient fully with one exam, completely changing his perspective. Previously, with 2-D images we only had the possibility of making a unilateral evaluation of the skull and structures unless, of course, several X-rays were taken and complementary analysis in each of them. The other option was performing photographic analysis to see the facial aesthetic from different photographic angles and requiring a major number of shots that surely resulted difficult for the patient. The diagnostic evaluation with 3-D systems allows in one exam to evaluate the patient from the angles necessary as well as evaluating the soft and hard tissues resulting visually stunning and attractive for the patient, being this extremely positive considering that the patient has a better understanding of his/her aesthetic problems and how the specialist will proceed to eliminate them.
Temporomandibular joint

The TMJ is, by definition, a ginglymus diarthrodial complex joint. This complexity is reflected in the knowledge and importance that each professional gives it. There are a number of specialists for whom the TMJ is remote from the teeth and does not interfere with orthodontic treatment. On the extreme opposite side, for the other group of specialists, the TMJ is the foundation on which they base all their treatments. Whichever concept the doctor has on this, the evaluation of the TMJ should be included in the diagnosis.

Conclusion

The specialist cannot be unaware of the constant advances in technology. Of course, these developments have to be taken in moderation and with responsibility because it does not substitute the knowledge acquired during ones professional training and even less the experience obtained from treating patients. Needless to say, an effort is required for the training and understanding of these new systems but such systems are every time easier and perceptibles and the quality, quantity and usefulness of the information it generates is unquestionable.

It is important to remember the concept that we are healthcare providers and our goal is more than to just straighten teeth. Therefore, it is mandatory to diagnose our patients fully and when necessary, seek consultation from other specialists, since nowadays a great number of our patients require multidisciplinary treatments.

Acknowledgement

The author would like to thank the Group Cedirama Digital, for their constant support in the realisation of the exams and software managing; especially to Elie Matta Haddad, BBA.

Dr Enrique González García is a member of the World Federation of Orthodontics, Academia Mexicana de Ortodoncia and Colegio de Ortodoncia y Ortopedia del D.F. Has specialised in the interpretation and handling of images in the areas of: Maxillofacial Surgery, Orthodontics, Implants, Prosthodontics and Endodontics. Professor of Imaging for Postgraduate of Restorative Dentistry and Prosthodontics at UNITEC. Invited professor of the Facultad de Odontología División de Estudios de Posgrado e Investigación of the UNAM, Posgrado de Ortodoncia de la UABC Campus Mexicali and Posgrado de Ortodoncia de UNITEC. Author of many scientific articles and magazines in Mexico, Spain and USA. Author of the books: “Tomografía Cone Beam. Atlas de Aplicaciones Clínicas” 1º and 2º edition and “Oclusión Práctica. Conceptos Actuales” and the 3º chapter of the book “Ortodoncia y Microimplantes”. Advisor for KaVo Kerr Group in the area of Imaging and for Cedirama Digital. Currently runs his exclusive practice of Orthodontics and TMJ Dysfunctions in Mexico City and is a national and international speaker.