Digital Orthodontics- A Technology in Modern Practice, Present Scenario with Clinical Implications

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ABSTRACT

The integration of modern technology is essential for the success of an orthodontic practice by increasing efficiency and communication thereby enhancing the ability of the orthodontist to diagnose and plan cases using the high resolution graphics. Globalization in the field of orthodontics, allows us to have access to the best available resources so that we can deliver high quality orthodontic treatment to our patients. Orthodontic treatment starts with diagnosis which includes patient or parent's chief complaint, clinical examination and diagnostic records. Since orthodontic treatment is based on the accurate diagnosis followed by an ideal treatment planning. So it is necessary to understand all diagnostic aids for planning orthodontic treatment. Diagnostic aids include essential and supplement diagnostic aids. Essential aids are dental and medical history, extra oral and intraoral examination, study models, intraoral and facial photographs, radiographs [1].

Orthodontic diagnosis includes 3 components, skeletal, facial and dental. The prime role of an orthodontist is to realign different craniofacial components in anatomical and dynamic balance position so as to make them aesthetically pleasing. However for achieving this process we need information regarding relationship of all these components of the craniofacial complex in three spatial planes. Most of the available conventional diagnostic aids provide only a 2-dimensional representation of patient. Advanced technology gives high quality diagnostic information in three planes to the orthodontist which helps in designing the most ideal treatment plan for the patients [2].

Digital technology started to make its way into dental and orthodontic offices with the introduction of computers in the era of 70's and over the last three decades digital photography and radiography and technological advancements such as digitized dental models, have replaced their analogue counterparts and paved way for alternative options for patient documentation and facilitated imitation of the prognosis of orthodontic treatment. However, two-dimensional (2D) records are still in use, but new technologies have led to a more efficient orthodontic diagnosis and treatment planning. It is now a common place to perform virtual treatment planning as well as translate the plans into treatment execution with digitally driven appliances. Furthermore it is also becoming possible to remotely monitor treatment and control it [3].

RAPID PROTOTYPING

Rapid prototyping (RP) basically means fabrication of a model in 3D using a computer aided design (CAD) which was traditionally built by layering process [17]. The technology was first introduced in mechanical engineering, prototype includes number of steps before the 3D model is fabricated and is mainly used to evaluate the ease of assembly and manufacture of designed products before actual production. "3D" printers allow the designers to quickly create prototypes designs of their choice, rather than just two-dimensional photographs. Frequent

technologies of RP are stereo lithography (SLA); inkjet- based system, selective laser sintering (SLS), and fused deposition modeling (FDM) [18].

Prototype models have various advantages such as it facilitates rapid fabrication of models with minimal time involved, better visualization and without much hassle. For communicating ideas to patients they are an excellent visual aid. Alongwith repeated verification, and the prototype design can also be reused. However, major drawback is that it is too expensive and clinician final decision still remains mandatory.

It can be used for assessment of an impacted maxillary canine as it provides exact anatomical relationship of impacted tooth with other teeth and can be used as visual aids for patient communication [19] .Various other uses of RP models include fabrication of surgical template for TAD's placement, splints fabrication for orthognathic surgery using stereo lithography[20-21]. Pessa revealed the potential use of a high-resolution stereo lithography for the study of facial aging and in preoperative planning of complex dentofacial anomalies [22].

Clinical implications of digital orthodontics

With growing chains of private entrepreneurs in the field of dentistry and opening of clinics at multiple locations, a unique clinical problem faced was of handwritten treatment cards. Patients would frequently tend to visit in offices other than the location where their treatment card was stored. So it used to create lot of hassle and clinician had to spend a great deal of time in faxing copies of treatment cards to outlying locations. But with the perfect marriage between orthodontic and computer technology helped provide us with electronic treatment cards ultimately simplifying our clinical activities by making the patient aware of the next appointment, timings, medications which solved the for problems faced by patient and the doctor.

However this "simplification," posed its own set of problems which required computer terminals needed to be installed at each chair. In addition, there was requirement of high-speed networks to allow patient treatment information to be viewed at any location. A network of computers allowed for easy viewing of photos and radiographs that have been transferred quickly and in a cost-effective manner. Best part of it was patients were impressed with high-tech offices. However all connections to the Internet are susceptible to hackers, so care must be taken to safeguard programs and patient records. The transmission and reception of digital orthodontic records presented the profession with a unique opportunity as diagnostic information is always available on a "real-time" basis. Records taken in one place can be viewed in different locations. Second opinions and diagnostic

help are easily facilitated. Databases may be established and can be used for teaching and clinical support. The opportunities are unlimited and, I believe, it will provide a portal to the new millennium.

CONCLUSION

Digital records provide assessment of patient's dentofacial morphology in three dimensional which is required for orthodontic diagnosis and treatment planning these days. Digital records have helped to improve storage, easy access, of data and further communication with patient .But there are still few limitations. So for an orthodontist it is necessary that they should be well aware of indications, benefits and potential hazards while using these digital diagnostic aids. Thus future of orthodontics looks more promising if these advanced techniques are used innovatively.

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