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REVIEW ARTICLE

DIGITALIZATION IN DENTISTRY

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ABSTRACT

Digitalization in dentistry has made dentistry easier, faster, better, and overall most enjoyable. It has increased the horizons by incorporating computer-controlled components in contrast to that of mechanical or electrical alone. Digital imaging techniques have minimised the time needed for processing with extremely low radiation exposure. It also allows for necessary image magnification and measurement. Today's dental practice ranges from the detection, diagnosis and treatment of the disease with special emphasis on the regeneration, reconstruction and replacement of dental tissues. These new therapies have increased the need and demand for more standardized approach in dentistry. This article is an effort to highlight the latest technologies and their applications in field of dentistry.

INTRODUCTION

Digital dentistry refers to the use of dental technologies or devices to carry out dental procedures rather than using conventional electrical or mechanical tool. God father of Digital dentistry is the French professor Francois Duret. New technologies integrate a myriad of options in dental practice to ensure high standard of care to patients. Therefore, digitalization in dentistry has become an integral part of all aspects of dental treatment. The desires of patients in the final outcome of treatment is aimed towards achieving success. Digitalization meets the esthetic challenges and ensures accurate and successful outcome. Digital radiography minimizes the problems associated with conventional radiographs and generate digital images, thus allowing for necessary image magnification and measurements. A conventional radiographic source is used to expose the digital detector which converts the X-ray to a visible image immediately on a video monitor. Digital radiography allows sending radiographic images for interdisciplinary approach, however, it requires a skilled operator to manoeuvre the software (Mouyen *et al*., 1989).

Radiovisiography (RVG)

offers an alternative and instant method for measurement of intraoral radiographs with approximately 80% reduction in radiation dosage as compared to conventional X- ray films (Reddy, 1992) Digital Subtraction Radiography (DSR) was introduced by *B.G. Zeides des Plantes* in the early 1920's (Shah *et al*., 2014). It determines qualitative changes between the baseline image and the second image that shows the changes that have occurred since the time the first image was taken (Webber *et al*., 1982). It accurately identifies alveolar crestal change from standardized pairs of radiographs, and is useful in monitoring periodontal therapy (Hausmann *et al*., 1985) However, the major limitation is that it does not reproduce images with similar projection geometry every time (Jeffcoat *et al*., 1991).

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CADIA

(Computer-assisted densitometric image analysis) is a form of DSR that allows investigator to quantify changes by comparing the radiographic density between the baseline and follow-up radiographs (Braegger *et al*., 1987). It has the highest correlation with clinical bone fill and provided the highest level of accuracy (Toback *et al*., 1999).

CT

(Computed tomography) scanner developed by *Sir Godfrey N Hounsfield*, (Shah *et al*., 2014). has been described as the greatest advancement in radiology. It allows visualization of both hard and soft tissues of the facial bones by image processing enhancement and the ability to acquire multiple, non-superimposed cross-sectional images with simultaneous display through many regions of the maxilla and mandible, usually in the 1 mm intervals. However, it is associated with high radiation exposure, high cost of the scans and scatter because of metallic objects and poor resolution compared to conventional radiographs. 3D (three-dimensional) radiographic data acquisition scheme based on the concept of to mo-synthesis and optical-aperture theory as described by *Ernst Pohl of Kiel*, (Ziedses des Plantes, 1973) led to the introduction of tuned-aperture computed tomography (TACT) (Webber *et al*., 1997). It is a promising and effective alternative to other conventional modalities. The overall radiation dose of TACT is not greater than 1 to 2 times that of a conventional periapical X-ray film and the resolution is stated to be similar with 2D radiographs. Artefacts associated with CT, such as starburst patterns seen with metallic restorations, do not exist with TACT (Shah *et al*., 2014).

CBCT

(Cone beam computed tomography) is a major advancement in providing a true 3D imaging. Based on a cone shaped X-ray beam centred on a 2D detector, it performs one rotation around the object and produces a series of 2D images which are reconstructed in 3D using a modification of the original cone beam algorithm developed by Aboudara, *et al*., 2003. It provides a high spatial resolution of bone and teeth which allows accurate understanding of the relationship of the adjacent structures and produces images with a voxel resolution range of 0.076-0.4mm (Kasaj and Willershausen, 2007). Radiation dose of one CBCT scan may be as little as 3% - 20%. It significantly increases the X-ray utilization and the image quality is high, when compared to helical CT, for the highest resolution modalities (Shah *et al*., 2014). CBCT has proved to be a practical clinical tool to detect intrabony and furcation defects, dehiscence, fenestration, and periodontal cysts.It provides detailed morphologic description with minimal error margins. 3D sectional images in the axial, frontal and sagittal plane can be obtained at one examination with tomographic slices of width ranging from 0.125 to 2mm (Kasaj and Willershausen, 2007). CBCT is affected by the scatter and high density structures such as enamel and radiopaque materials which reduces the contrast and limits the imaging of soft tissues. Because of distortion of Hounsfield Units (HU), CBCT cannot be used for estimation of bone density. Scan times for CBCT are lengthy at 1520 s and require the patient to stay completely still (Shah *et al*., 2014).

MRI

(magnetic resonance imaging) scan is a specialized imaging technique which does not use ionizing radiation. It offers the best resolution of tissues with low inherent contrast like soft tissue lesions in salivary glands, temporo-mandibular joint (TMJ) and tumour staging. It can also detect joint effusions, synovitis, and erosions and associated bone marrow oedema. In case of an infective lesion like a periapical abscess which expands fast in the jawbones and soft tissues, later degenerating into osteomyelitis, MRI is the diagnostic method of choice (Webber *et al*., 1982). MRI due to the presence of a strong magnetic field, can cause movement of ferromagnetic metals in the vicinity of the imaging magnet. Therefore, it is not indicated in patients with cardiac pacemakers, implantable defibrillators, some artificial heart valves, cerebral aneurysm clips, or ferrous foreign bodies in the eye. Also, its high cost limits its use to cases where it is specifically indicated.

Ultra sonography

(US) first reported by Baum *et al*., (2014) in 1963 is a non-invasive, inexpensive and painless imaging method which can be used for both hard and soft tissue detection and is an important diagnostic tool for patients in whom MRI is contraindicated. US is based on the reflection of sound waves (echoes) with a frequency above the range of human hearing (120 kHz), at the interface of tissues which have different acoustic properties. US waves are created by the piezoelectric effect within a transducer (probe) and transmit energy, as X-ray does, but it requires a medium for its transmission, The echoes are detected by a transducer which converts them into an electrical signal and a real time black, white and shades of gray picture is produced on a computer screen.

CAD/CAM

An increase range of restorative options have become available with CAD/CAM coupled with intraoral and laboratory scanners for conventional impressions. It includes biocompatible, high strength all ceramic zirconia frameworks for full coverage crowns and fixed partial dentures; customizable implant abutment, milled titanium coping for titanium porcelain crowns and bridges. The vertical integration of digitalization between clinicians and the laboratory technicians have offered the opportunity to exceed the patients' expectations with predictable outcomes in a more simplified process.

Conclusion

With recent trends and advances in dentistry the practitioner is able to integrate the most sophisticated modalities of treatment in a more comprehensive team approach for the patient to receive the highest level of dental care.

REFERENCES

Aboudara, C.A., Hatcher, D., Nielsen, IL. and Miller, A. 2003. A three dimensional evaluation of the upper airway in adolescents. *Orthod Craniofac Res*, 6:173–175.

Braegger, U., Litch, J., Pasquali, L. and Kornman, KS. 1987. Computer assisted densitometric image analysis for the quantitation of radiographic alveolar bone changes. *J Periodontal Res,* 22:227-229.

Hausmann, E., Christersson, L., Dunford, R., Wikesjo, U., Phyo, K. and Genco, RJ. 1985. Usefulness of subtraction radiography in the evaluation of periodontal therapy. *J Periodontol*, 56:4-7.

Jeffcoat, MK., Page, R. and Reddy, MS. 1991. Use of digital radiography to demonstrate the potential of naproxen as an adjunct in the treatment of rapidly progressive Periodontitis. *J Periodont Res*, 26:415-421.

Kasaj, A. and Willershausen, B. 2007. Digital volume tomography for diagnostics in periodontology. *Int J Comput Dent*, 10:155–168.

Koutayas, S.O., Vagkopoulou, T. and Pelekanos, S. 2009. Zirconia in dentistry: Part 2. Evidence-based clinical breakthrough. *Eur J Esthet Dent*, 4:348-380.

Mouyen, F., Benz, C., Eberhard, S. and Lodter, JP.1989 Presentation and physical evaluation of Radiovisiography. *Oral Surg Oral Med Oral Pathol,* 68:238-242.

Reddy, MS. 1992. Radiographic methods in the evaluation of periodontal therapy. *J Periodontol*, 63:1078-1084.

Shah, N., Bansal, N. and Logani, A. 2014. Recent advances in imaging technologies in dentistry. *World Journal of radiology*, 6:794-807.

Toback, GA., Brunsvold, MA., Nummikoski, PV., Masters, LB., Mellonig, JT. and Cochran, DL. 1999. The Accuracy of radiographic methods in assessing the outcome of periodontal regenerative therapy. *J Periodontol*, 70:1479-1489.

Webber, R.L., Horton, R.A., Tyndall, D.A. and Ludlow, J.B. 1997. Tuned aperture computed tomography (TACT). Theory and application for three-dimensional dento-alveolar imaging. *Dentomaxillofac Radiol,* 26:53–62.

Webber, R.L., Ruttimann, U.E. and Grondhal, H.G. 1982. X-ray image subtraction as a basis for the assessment of periodontal changes. *J Periodont Res,* 17:509-511.

Ziedses des Plantes B.G. 1973. Selected works of BG Ziedses des Plantes. Amsterdam: *Excerpta Medica,* 137-140.

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