A Journal of Advanced Dentistry
Open Access Full Text Article
A CASE REPORT

Evolving Trends in Prosthodontics: A Brief Review

Manjot Kaur[1]
Manu Rathee[2]
Sandeep Singh[3]
Sanju Malik[4]
Prachi Jain[5]
Sarthak Singh Tomar[6]

Assistant Professor[1]
Dr HSJ Institute of Dental Science
Punjab University
Chandigarh, India
Senior Professor & Head[2]
Dept. of Prosthodontics,
Post Graduate Institute of Dental Sciences,
Pt. B.D Sharma University of Health Sciences,
Rohtak, Haryana, India.
Post Graduate Student[3]
Dept. of Prosthodontics,
Post Graduate Institute of Dental Sciences,
Pt. B.D Sharma University of Health Sciences,
Rohtak, Haryana, India.
Senior Resident[4]
Dept.of Prosthodontics,
Post Graduate Institute of Dental Sciences,
Pt. B.D Sharma University of Health Sciences,
Rohtak, Haryana, India.
Senior Resident[5]
Dept. of Prosthodontics,
Post Graduate Institute of Dental Sciences,
Pt. B.D Sharma University of Health Sciences,
Rohtak, Haryana, India.
Post Graduate Student[6]
Dept. of Prosthodontics,
Post Graduate Institute of Dental Sciences,
Pt. B.D Sharma University of Health Sciences,
Rohtak, Haryana, India.

Access this article online
Website: www.updent.in
DOI: 10.4880/zenodo.7838359
Quick Response Code:

Corresponding Author:
Sanju Malik
Senior Resident
Department of Prosthodontics,
PG Institute of Dental Sciences,
Pt. B.D Sharma University
of Health Sciences,
Rohtak, Haryana, India.
Email: smsanju2011@gmail.com
Contact: 9911082248

Abstract

Dental professionals now focus on implementing modern IT solutions in their everyday practice as it leads to increased efficiency, cost reduction, and higher patient satisfaction. The technological advancement such as CAD/CAM software already enables for excellent communication between dentists, technicians, and patients. Specialists need to change their way of thinking about and acting in the future. One has to structure the new Prosthodontics not only by improving traditional Prosthodontic treatment including the development of new materials and clinical techniques, as well as the evolution of a creative Prosthodontics that is linked to the advancement of related fields such as brain science, regenerative medicine, nanotechnology, bioinformatics, sleep science, and nutrition science. Furthermore, epidemiological studies should be used to improve evidence-based methods to prosthodontic care.

Keywords: Bioinformatics, Digitization, Nanotechnology, Stem cell technology.

Introduction

Evolution in technology and science has led to enormous advancement in the field of Prosthodontics especially with the progress in laboratory technology, clinical techniques and the field of biomaterials. Prosthodontics would continue to change with emerging concepts, materials and patient's needs. Prosthodontics is the branch of dentistry concerned with the implications of congenital or acquired loss of oral tissues, as well as the procedures for determining if artificial devices constructed of alloplastic materials do more help than damage.

With the increasing awareness in oral health and improvement in oral hygiene practices there has been a shift in edentulism with more number of people retaining more teeth. The focus of prosthodontics has shifted from removable prosthesis to fixed prosthesis.[1]

Advancements in Technology

Many technological advancements and new techniques have been adopted by the profession of prosthodontics to improve its ability to restore patients' dental health to a level of precision and predictability previously unattainable. Devices with digital or computer-controlled components are used in digital technology.[2]

Digital dentistry will grow more user-friendly in future as technology advances, allowing dental practitioners to work even more intelligently than before. The coming decade would be stormed and effected by digital technology and would seethe following trends. **(Fig. 1)**

- CAD/CAM
- Clinical microscopy and magnification
- Robotics: (patient care, laboratory)

a)Imaging - (I) In office volumetric radiography, (ii) Interactive computer software-s implant etc
(b) Clinical Dentistry - (i) Intraoral impressions, (ii) Cast duplication, (iii) Restoration fabrication, (iv) Customdental implants, abutments, and restorations, (v) Guided implant surgery

- Occlusion: Analysis. Eg-Tekscan, Cardiax compact
- Electronic shade matching
- Lasers-soft and hard tissue
- Nanotechnology
- Genetics
- Information management systems
- Rapid prototyping
- Virtual articulators
- CBCT
- Swept-Source Optical Coherence tomography (SS-OCT)
- Laser-induced Fluorescence
- Laser Photothermal Radiometry (PTR)
- Ultrasonography
- Infrared spectroscopy for multiple inflammatory parameters
- 3D Printing techniques
- Optical scanning of teeth (Digital impressions)
- Direct Metal Laser Sintering (DMLS)
- Tissue Engineering, and
- Computer-aided Educational Systems:
  (a) Haptic Technology
  (b) Just-in-time Learning Digital trends

Fig1: Advancements in Digital Technology

Nanotechnology

In recent years, nanomaterials have gained more and more attention because of their unique properties and structures. The concept of "nonmaterial" formed in the early 1980s, referring to zero-dimensional, one-

Received : 14-05-2022
Accepted : 25-06-2022
Published : 08-09-2022

How to Cite This Article: Kaur et al: Evolving Trends in Prosthodontics: A Brief Review AJOAD.2022;July-December(2):05-07.

dimensional, two-dimensional, and three-dimensional materials with a size of less than 100 nm.[3]

Nanomaterial has small size, large surface area, high surface energy, a large proportion of surface atoms, and four unique effects: small size effect, quantum size effect, quantum tunneling effect, and surface effect. Development of nonmaterial has greatly enriched the field of research in materials science including biomaterials. As people understanding of natural biological material properties and microstructure at nanoscale is gradually deepening, the role of nonmaterial in biomedical material science is gaining more importance.[2,3]

Modification of titanium implant surfaces into nanostructures has been found to improve their biological integration with surrounding soft and hard tissues. Dorkhan et al. modified the surface of titanium implant by anodic oxidation into nanoscale with pores in the 50 nm range and found that both the vitality and the adherence level of soft-tissue cells, such as keratinocytes and fibroblasts, on the nanostructure surfaces were similar to those on pure titanium, while the attachment of oral streptococci on the nanostructure surfaces was significantly lower than on the pure titanium, suggesting that the nanostructure surfaces of metal implants might be capable of improving surrounding host tissue cell adherence while minimizing bacterial attachment.

Nanoceramics Materials in Prosthodontics

Nanoceramic means ceramic material with nanoscale dimensions in the microstructures phase. Nanoceramics exhibit unique features when compared to traditional ceramics, making them a popular topic in material science research.

To begin with, nanoceramics are super plastic. Ceramic is a brittle material in general, however nanoceramic has good toughness and ductility. Although the atom arrangement in nanoceramics interfaces is perplexing, the atoms are relatively easy to migrate under force deformation situations.[4]

Secondly, compared to the conventional ceramics, nanoceramic has the superior mechanical properties, such as strength and hardness increasing significantly. Many nanoceramics have a hardness and strength four to five times greater than traditional materials.[2] Because of their excellent mechanical and electrical properties, carbon nanotubes (CNTs) have gotten a lot of attention as material reinforcements. Furthermore, CNTs have been considered as reinforcing elements in ceramic matrix composites due to their unique mechanical proper.

In dentistry, plaque formation onto PMMA-based resins is a common reason of oral cavity infections and stomatitis. Some researchers showed that the incorporation of metal nanoparticles such as TiO_2, Fe_2O_3, and silver to PMMA resins could increase the surface hydrophobicity to reduce bimolecular adherence. In current years, metal oxide nanoparticles (e.g., TiO_2, silver) have been extensively studied for their performances as antimicrobial additives. Mainly, TiO_2 nanoparticles are now considered as a low-cost, clean photocatalyst with chemical stability and non-toxicity.[5]

Laura et al. prepared the PMMA composites, adding TiO_2 and Fe_3O_2 nanoparticles, for simultaneously colouring and/or improving the antimicrobial properties of PMMA. As compared to standard PMMA, PMMA containing nanoparticles showed a less Candida albicans cells adhesion and a lower porosity. Because high porosities have been considered a major drawback for PMMA in Prosthodontics applications, metal oxide nanoparticles can be a suitable additive for the improvement of PMMA formulations. These findings suggested that nanostructured metal colouring additives could be a promising way to create nontoxic hybrid materials with antibacterial properties for use in dentistry. Despite the large number of studies on nanoresins, the majority of them are basic research. We anticipate that nanoresin will be widely employed in clinical prosthodontics in the near future.[5]

Stem Cell & Tissue Engineering

Oral epithelial and mesenchymal stem cells can be easily collected as discarded biological materials. Their outstanding regeneration abilities can be used in a variety of regenerative medicine fields, not just dentistry.

The oral stem cells show their capability to repair cornea, dental pulp, periodontal, neural, bone, muscle, tendon, cartilage, and endothelial tissues without neoplasm formation. Despite these experimental studies confirming the regenerative potential of oral stem cells, the majority of them lack strict quantitative analysis for examining these cells' ability to self-renew, proliferate, and differentiate, particularly in vivo.

Stem cell and tissue engineering procedures are expected to provide a capability to regenerate large defects in periodontal tissues and alveolar bone, and ultimately replace the lost tooth itself. The tissues and organs targeted for such regenerative medicine strategies in dentistry include the salivary gland, tongue and craniofacial skeletal muscles, as well as the condylar cartilage of the temporomandibular joint.[6]

Tooth Regeneration

The regeneration of adult teeth will be possible in future with the help of tissue engineering and newer expansion in stem cell therapy. Regenerative procedures would be improved substitutes in place of dental implants.

Experimental studies on animal models have revealed that the tooth crown formation can be regenerated using tissue engineering techniques that combine stem cells and recyclable scaffolds. Epithelial mesenchymal exchanges are important in tooth development. The reciprocal exchange of signals between these two native germ layer tissues is considered in these exchanges, which results in the creation of distinct terminal phenotypes with their supporting cells.[6]

Bioinformatics

The informatics revolution will eventually revolutionize the way we practice dentistry. By merging scientific and clinical disciplines to encourage advancements in treatment, risk assessment, diagnosis, therapies, and oral health-care outcomes, this convergence will play a critical role in constructing a bridge of opportunity.

Bioinformatics has been an emerging field in the biomedical research and has been gaining attraction in dental field. This field

has produced a continuous stream of large and complex genetic data, which has changed the way clinical and basic researchers approach genomic research. Oral genomics, as it is known in dentistry, can help with the molecular understanding of the genes and proteins, as well as their interactions, pathways, and networks, that are involved in the genesis and progression of oral diseases and disorders.[7]

Discussion

Dental professionals will need a whole new set of abilities as a result of the digital revolution in dentistry. Who is performing what procedure in the dental workflow is changing in the dentistry profession. Even though the artistic aspect of the dental process remains, the instruments have changed, and the dental restoration is now a matter of digital handicraft skills. The distinction between labs and milling centres is beginning to fade now as the digital technology such as scanners, computer software, and milling machines have entered the labs.[8]

Clinicians employ digital equipment in their offices to design and mill prosthesis restorations (in simpler cases such as the production of temporary restorations or single crowns). This enables dentists to give dental restorations to patients without the assistance of a laboratory or milling centre. As a result, there will be more pressure on dental practitioners to work as a single unit, providing comprehensive in-office services. Consequently, dental education schools and programs will have to increase their focus on how to master digital equipment such as CAD/CAM technologies to educate students in clinical settings.[9]

Digital technology and an open digital workflow has led to an increased need for a wider range of dental materials on the market; fabrics, surfaces and colours as well as multi-layer materials. More research on the clinical behaviour, applications and biomechanical characterization of new dental materials is necessary for dental professionals to increase their knowledge and application techniques.[10] **(Fig. 2)**

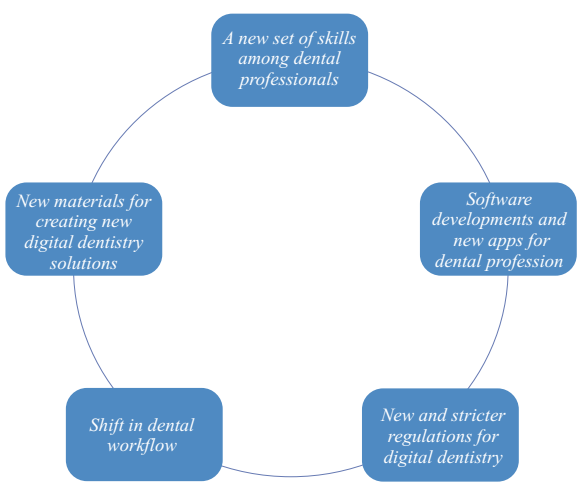

Figure2: Affects of Digital Technology

The norms and regulations for digital dentistry will evolve as technology advances. With time, the approval process for manufacturing dental components and using digital equipment will most likely become more stringent. This is a good thing since dental enterprises will have to provide validated goods and follow validated work processes, which will improve patient safety.[11]

Manufacturers and practitioners will need to prepare for inspections from authorities and notified bodies, who will approach the dental business in the future with a greater number of inspections.

Conclusion

The increasing resources devoted to education, research and technological development has led to significant advances in the field of Prosthodontics. A concentration on advancing high technology in prosthodontics and related areas is likely to continue in many areas. The way a Prosthodontic professional will respond to this macro perspective is not easy to foretell. Whatever happens, it should at least be hoped that these factors are reflected in the future development of education and research in prosthodontics even if available data and current trends do not convincingly point yet in this direction.

References

1. Sevimay M, Turhan F, Kiliçarslan MA, Eskitascioglu G. Three-dimensional finite element analysis of the effect of different bone quality on stress distribution in an implant-supported crown. J Prosthet Dent. 2005 Mar;93(3):227-34.
2. Kelly JR, Benetti P. Ceramic materials in dentistry: historical evolution and current practice. Aust Dent J. 2011 Jun;56 Suppl 1:84-96.
3. Gutmann JL. The maturation of science within dentistry: the impact of critical milestones and visionary leaders on contemporary achievements. JHist Dent. 2009 Winter;57(3):109-22.
4. Marras I, Papaleontiou L, Nikolaidis N, Lyroudia K, Pitas I. Virtual Dental Patients: A System for Virtual Drilling. In: Multimedia and Expo, 2006 IEEE International Conference on, 2006. p. 665-8.
5. Zhang Y, Lawn BR. Evaluating dental zirconia. Dent Mater. 2019 Jan;35(1):15-23.
6. Kolios G, Moodley Y. Introduction to stem cells and regenerative medicine. Respiration. 2013;85(1):3-10.
7. Wooller SK, Benstead-Hume G, Chen X, Ali Y, Pearl FMG. Bioinformatics in translational drug discovery. Biosci Rep. 2017 Jul 7;37(4):BSR20160180.
8. Jarad FD, Albadri SS, Mair LH. The use of objective digital matching to achieve an esthetic composite restoration. J Clin Dent. 2008;19(1):9-13.
9. Maestre-Ferrín L, Romero-Millán J, Peñarrocha-Oltra D, Peñarrocha-Diago M. Virtual articulator for the analysis of dental occlusion: an update. Med Oral Patol Oral Cir Bucal. 2012 Jan 1;17(1):e160-3.
10. Sevimay M, Usumez A, Eskitascioglu G. The influence of various occlusal materials on stresses transferred to implant-supported prostheses and supporting bone: a three-dimensional finite-element study. J Biomed Mater Res B Appl Biomater. 2005 Apr;73(1):140-7.
11. Buchanan LS. Endodontic treatment planning in the fourth dimension. Dent Today. 2010 Oct;29(10):104, 106, 108 passim.