**RECENT ADVANCES IN ENDODONTICS**

The primary goal of non-surgical endodontic treatment is to eliminate apical periodontitis of endodontic origin and ensure the stability of results to prevent recurrence. Endodontics is undoubtedly an ever evolving and expanding branch of dentistry.1 Recent advances in the evolution of significantly more proficient and safe endodontic instruments reached gave important outcomes in the most recent years with the adoption of heat-treated NiTi alloys, which could enhance the instrument flexibility as well as resistance.2 In general, root canal/endodontic treatment is usually considered as one of the most challenging procedures in dental practice. However, recent technological advancements have resulted in a more predictable endodontic treatment with successful outcomes in challenging cases.

Artificial Intelligence in Endodontics:

The expression "artificial intelligence"(AI) was given by John McCarthy at a conference in the United States in the year 1956. Subdivisions of AI incorporate machine learning, neural net­works, and deep learning. Neural networks (NNs) utilize artificial neurons that resemble human NNs and mimic the human brain using a numerical model. NNs can recreate human cognitive abilities like critical thinking and human skills to reason, which incorporates both learning and decision making.3 NNs essentially consist of three layers: input layer (where data enters the framework), hidden layer (where information are handled), and the output layer (where the framework chooses what to do).4 The most utilized sorts of NNs are artificial neural networks (ANN), convolutional neural networks (CNN), and recurrent neural networks. Deep learning constitutes a part of NNs where the computer learns by itself as to how to deal with the information.5

AI can prove to be valuable in recognizing periapical lesions and root cracks/fractures, assessment of canal anatomy, anticipating the viability of stem cells, working length estimations, and foreseeing the outcome of endodontic retreatment.6 Setzer et al. in their study utilized deep learning to ascertain periapical lesions on cone-beam computed tomographic (CBCT) scans and successfully detected them in 93% of cases.7 AI has additionally demonstrated to be extremely productive in contrast with periapical radiographs in diagnosing vertical root fractures on CBCT scans.8

Guided Endodontics:

Endodontics can frequently prove to be an arduous task when instances of pulp canal obliteration (PCO) are experienced in clinical practice. PCO alludes to the accumulation of hard tissue inside the canal space and can happen because of injury, following orthodontic treatment, as a response towards pulpal injuries, dental caries, restorative treatment or abfractions and in teeth of older patients.9 As of late, the idea of guided endodontics (GE) has been accounted for, in which computer-planned guides are utilized for access cavity preparation to accomplish unsurprising and safe outcomes.10

There are various sorts of GE namely static GE (SGE) and dynamic GE (DGE). SGE is performed by procuring a CBCT scan of the patient's either arch (contingent upon where the tooth to be treated is present). The patient's arch of interest is registered simultaneously, which can be done with an intraoral scanner or by taking an impression to be scanned later. The two acquired pictures are superimposed with the help of a programming software, by which a guide can be planned that will take into account the tooth of interest (and a few contiguous teeth). A drill opening can be planned in this guide with a particular suitable dimensions and angulation to permit direct admittance to the calcified canal.11 DGE depends on the utilization of CBCT pictures with reference points that are located in the patient's mouth on side opposite to the side to be worked on (prior to taking CBCT). Trajectory of the drills into both the pulp chamber and root canal is synchronized with the assistance of a stereo camera linked to a dynamic navigation system. The operator will be able to monitor everything they do and make any necessary adjustments to the instruments' angulation.12

It may very well be reasoned that guided endodontics utilizing static or dynamic navigation gives off an impression of being a safe and insignificantly obtrusive strategy for recognizing calcified root canals.

Magnification in Endodontics:

Magnification is chiefly driven by innovation and technology and has now radically changed how endodontic practice is currently being performed.13 Numerous magnification tools have been developed over time to bridge the gap between the naked eye and the microscope. In fact, modern devices that appear to be more practical and convenient for use, such as loupes and dental operating microscopes, have largely replaced tools like an endoscope, magnifying glass, and intraoral camera (DOM). The main differences between the two devices have been depicted in figure 1.14



Figure – 1: Differences between loupes and DOM

The improved vision accompanied by light can simplify the following endodontic procedures:14

* Identifying small cracks and caries
* Preparation of conservative access cavities
* Recognizing doubtful root canal anatomy
* Handling calcified canals
* Verifying the cleanliness of the canal before obturating
* Identifying as well as eliminating pulp stones
* Dealing with perforations along with tooth resorption
* Recovering fractured files, posts and silver point
* Endodontic microsurgery: smaller osteotomies, magnified inspection of the resected surface, retropreparation, and retrofill.

Endodontic Imaging:

The cone beam registered tomography (CBCT) approach has brought about boundless acceptance of this innovation for three-dimensional picture handling. Computed tomography significantly improves demonstrative yield in specific circumstances where two-dimensional routine radiographic examinations have restrictions. With the smallest available voxel size and the smallest field of view, the shortest scan times should be used without sacrificing the signal-to-noise ratio.15

After a thorough clinical evaluation, the use of CBCT for specific diagnostic tasks in clinical endodontics is supported by the existing literature. A portion of the expected uses of CBCT incorporate diagnoses connected with the following: Preliminary analysis where vague signs and symptoms occur, dental anomalies and developmental disturbances, occurrence of anatomic varieties, calcified canals, fractured instruments, vertical root cracks/fractures, failure of earlier treatment, retreatments, select instances of injury, resorption external, and implants.16

Root Canal Disinfection:

Effective disinfection in endodontics is often challenging owing to the complexity of the root canal systems in addition to the dentin structure and composition. Antimicrobials would be less effective in root canal treatment if they were unable to eliminate biofilm bacteria in the intricate anatomy and uninstrumented areas of the canal. To get the most out of the antimicrobials, it is essential to improve the delivery of irrigant (irrigation dynamics) within the root canal system.15

Antimicrobial photodynamic therapy (APDT) refers to a two-step process that involves first applying a photosensitizer (PS) and then illuminating the sensitized tissue with light (step 2) to produce toxic photochemistry on the target cell and kill the bacteria.17 APDT is currently viewed as a potential addition to the current protocols for root canal disinfection rather than an alternative.18

Ozone treatment has one of a kind properties ranging from antimicrobial, immunostimulant, pain relieving, and antihypnotic to detoxicating, bioenergetic, and biosynthetic activities. Ozone has the potential to be used as an antimicrobial in endodontics. Ozone is viable when utilized in adequate quantity, time and conveyed precisely into root canals after traditional means of cleaning, shaping, and irrigation have been achieved. The antimicrobial adequacy was similar to 2.5% NaOCl when a root canal was disinfected with ozone water and sonification. Ozone was found to be effective against disease-causing pathogens like *Enterococcus faecalis, Candida albicans, Peptostreptococcus,* and *Pseudomonas aeruginosa*. Additionally, ozone eliminates the particular anaerobic odor caused by consistently tainted teeth.19

CONCLUSION:

Technology and materials science have advanced at an unprecedented rate in modern endodontics. Together, these advancements aim to advance the science and art of endodontic treatment.

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