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INDIAN  
ENDODONTIC  
SOCIETY



# IES TIMES

Official Newsletter of Indian Endodontic Society



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## Editor's Message

### The Emerging Role of Biomarkers in Endodontics

Endodontics, which deals with diagnosing and treating dental pulp and surrounding tissue diseases, has traditionally relied on clinical signs, radiographs, and histology. However, advancements in molecular biology are shifting the field towards the use of biomarkers—measurable indicators of biological conditions. Biomarkers can revolutionize endodontics by providing precise, objective data for diagnosis, treatment planning, and outcome prediction, moving beyond the limitations of traditional methods.

Biomarkers offer a more sensitive and specific way to detect conditions like pulpitis and periapical disease at a molecular level, often before they are visible on radiographs. For instance, elevated levels of inflammatory cytokines and matrix metalloproteinases can indicate the severity of inflammation and tissue destruction, respectively. Additionally, biomarkers related to bone remodelling can help predict the healing potential after root canal therapy, allowing for more personalized treatment approaches.

Despite their promise, incorporating biomarkers into routine practice presents challenges, such as the need for standardized biomarkers, rapid testing methods, and a deeper understanding of the underlying biology. However, as research progresses, biomarkers are expected to become essential tools in endodontics, leading to more accurate diagnoses and improved patient outcomes. The future of endodontics looks promising, with biomarkers poised to play a pivotal role.

### Dr Vineeta Nikhil

MDS, FICD

Editor IES Times





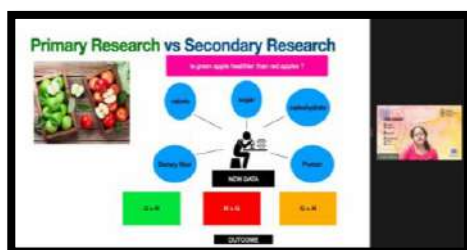
## Chronicles of Success

### Experts' Insights through IES CARES:

The Indian Endodontic Society is delighted to announce the successful conduction of programs in IES CARES (Clinical, Academic & Research in Endodontics Online Series). This series is dedicated to providing educators, students, and professionals with invaluable insights from leading experts across various fields. Each session is designed to inspire and equip our audience with the knowledge and tools needed to excel in today's dynamic educational landscape as we explore innovative ideas, best practices, and cutting-edge research, all aimed at fostering a brighter future for endodontics."

#### IES CARES – 9

On 12th April 2024, Dr. Lora Mishra, Professor in the Department of Conservative Dentistry and Endodontics and Deputy Director of the Cochrane India Affiliate Centre at the Institute of Dental Sciences, Siksha 'O' Anusandhan Bhubaneswar, delivered a compelling lecture titled **"Unveiling the Power of Cochrane: A Pillar in Evidence-Based Decision Making."** The session was met with an overwhelmingly positive response, significantly enhancing the knowledge and skills of our members. Dr. Mishra provided valuable insights into the transformative impact of Cochrane on oral healthcare decision-making, underscoring its critical role in shaping clinical guidelines and improving patient outcomes globally.





## IES CARES - 10

On 16th May 2024, the esteemed Dr. Rui Pereira da Costa, Assistant Professor in the Department of Endodontics at the University of Lisbon, Portugal, delivered an engaging presentation titled **“Removal of Separated Instruments: From Impossible to Predictable.”** This presentation provided a clinical overview of different methods for managing the technically challenging cases of separated instruments in clinical endodontics, further contributing to the professional growth of our attendees.





## IES CARES – 11

The Indian Endodontic Society successfully hosted an engaging IES CARES event on 25th July 2024. The lecture titled "Electronic Working Length: Clinical Protocol and Troubleshooting" was delivered by Dr. Ajay Logani, Head of Department and Professor, Department of Conservative Dentistry and Endodontics at AIIMS, New Delhi. Dr. Logani's presentation was both informative and captivating, shedding light on the complexities of working length determination in endodontics. Attendees found the session highly beneficial as it addressed common errors in this critical aspect of endodontic practice while providing practical insights into the optimal use of apex locators. The session was praised for its clarity, depth of knowledge, and real-world applicability, making it an invaluable resource for clinicians aiming to refine their skills and improve patient outcomes.







## IES CARES – 12

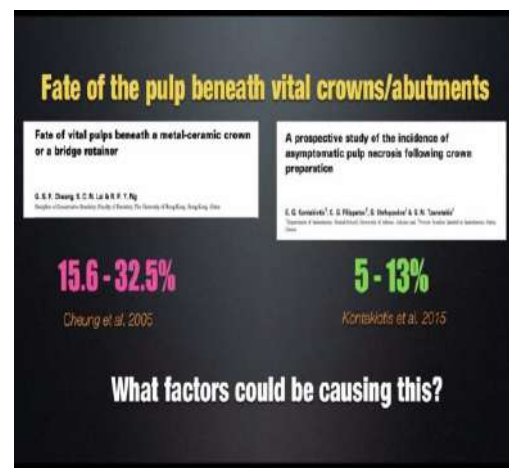
The Indian Endodontic Society successfully conducted the 12th program in the IES CARES (Clinical, Academic & Research in Endodontics Online Series). Renowned speaker Dr. Prasanna Neelakantan, Associate Professor and Director of Research at the University of the Pacific Arthur A. Dugoni School of Dentistry, delivered an insightful lecture titled "**Pulpal Responses to Irritants**" on **23rd August 2024**. The session explored the pulp's reactions to various irritants, providing crucial knowledge for therapeutic decision-making. His thoughtful analysis and application of research to real-world scenarios captivated attendees.

### Accessing the Programs

The IES CARES programs were complimentary for all IES members. Non-members could also benefit from this high-quality content by paying a nominal fee of INR 250. For those who were unable to attend the live lectures, the sessions are available for viewing through our online repository.

Watch Now: To access the lectures, please visit our online repository at: [IES CARES Repository] (<https://ies.vidocto.com/home/home>)

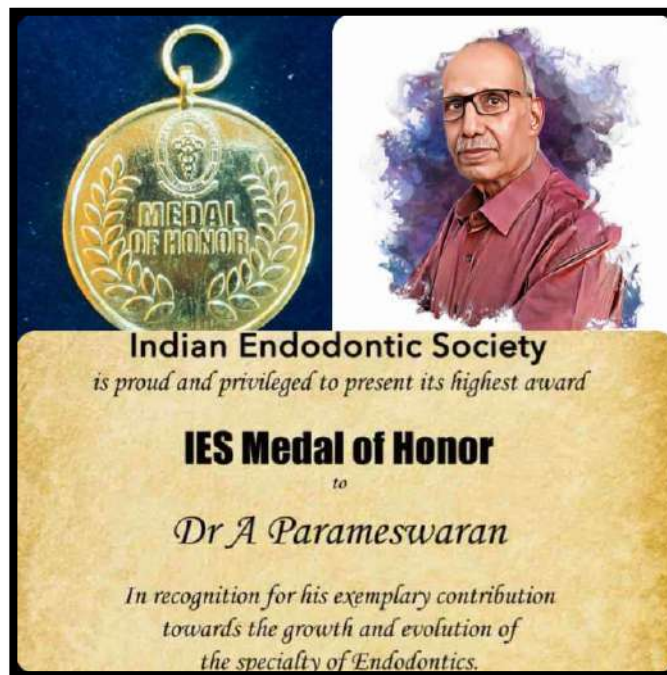
Join us in our commitment to advancing the field of Endodontics through continuous learning and professional development.





## Guru Purnima Celebration:

The Indian Endodontic Society celebrated Guru Purnima, a day dedicated to honouring and appreciating the invaluable role teachers play in shaping our lives. We are immensely proud and delighted to announce that the *IES Medal of Honour 2024* will be awarded to *Dr. A. Parameswaran*, fondly known by many as the "Teacher of Teachers". Dr. Parameswaran has made significant contributions to fostering a spirit of research and publications in the field of endodontics in India. This prestigious award will be presented to him during the IES National Congress in Chennai in October 2024.







## Tête-à-tête with maestro



### **James L. Gutmann**

DDS, Cert Endo, PhD, FACD, FICD, FADI,

FAAHD, FDSRCSEd, Dip ABE, IBE.

Professor Emeritus, Texas A&M University College of Dentistry

Honorary Professor, Wuhan School of Stomatology, Wuhan, China

Adjunct Professor, Saveetha College of Dental Medicine, Chennai, India

Dr J.L. Gutmann is a distinguished endodontist with a significant impact on the field through his clinical expertise, academic contributions, and extensive research. Renowned for his work in endodontic treatment and dental education, he has authored numerous publications and is respected globally for his advancements in root canal therapy and dental pathology. Let's delve deeper into the professional achievements and personal journey of this remarkable figure.



**Q. What inspired you to specialize in endodontics, and who were your mentors or role models during your early career?**

The initial impetus and inspiration to pursue endodontics came from two individuals - a female Latvian Professor and Department Chairperson, Dr. Tamara Riteris and a practicing endodontist, Dr. Eugene Gloudemann, a prince of a gentleman. They recognized by academic and clinical skills in my dental studies and guided me into the endodontic world. I graduated from Marquette University School of Dentistry #10 in my class of 110. From there I went on to specialize in endodontics.

Once there, I had another female Professor from Lithuania, Dr. Nijole Remeikis (at the University of Illinois - Chicago - UIC) along with multiple practicing endodontists who guided me during my specialty education. Interestingly, it was a Pediatric Dentist and Professor who guided me in my inquisitiveness and research pursuits, especially in learning how to read the literature critically - Dr. Maury Massler at UIC. Finally, I was mentored into full-time education from full-time practice by Dr. Daniel Green, which leads to the next question.

**Q. You have been associated with institutions like the Baltimore College of Dental Surgery, Baylor College of Dentistry, and Marquette University School of Dentistry. Can you share more about your academic journey?**

Actually it was Dr. Green who recruited me to teach full-time at the Medical College of Virginia, Virginia Commonwealth University (MCV-VCU) in 1975. I had spent 2 years in the US Army as an endodontist and 15 months in full-time practice when Dr. Green sat me down and persuaded me to go into academics. After 9 months as an Assistant Professor at MCV-VCU I was offered the Chairperson position at the Baltimore College of Dental Surgery...I was just 30 years old. Seven years later in 1982, on a whim, I applied for the positions of Professor, Chair and Graduate Program Director at the Baylor College of Dentistry (which was to become Texas A&M University College of Dentistry in the mid 1990s). I opted to retire from Texas A&M in 2002 and went into full-time practice and also served as a consultant to Tulsa Dental Specialties (to become Dentsply Sirona). I retired from full-time practice in 2013 following two shoulder surgeries and served as a consultant until 2020. In that year I took the position of Professor, Chair and Postgraduate Program Director at Nova Southeast University College of Dental Medicine until late 2021.



**Q. Your book 'Problem Solving in Endodontics' has become essential reading for all endodontists. What inspired you to compile this book?**

This started as a group of lectures given in the late 1970s and early 1980s. A publishing company representative heard my presentations and asked me to write a text. This was the first time a book like this had been written in dentistry (endodontics)...and many have since copied this approach. At the time of initiation, I chose authors from the East Coast, West Coast, with me living in the Middle of the USA...we all had somewhat different approaches but that was the value and essence of our accomplishment...a compilation of concepts to cover all bases. The text has been published in 5 editions and 9 languages. The focus was to encourage a thoughtful approach to provision of quality endodontic care.

**Q. How has the field of endodontics evolved since you began practicing, and what do you consider the most ground-breaking advancements?**

Ground-breaking achievements - not in any special order: NiTi instruments, enhanced obturation techniques, focus of bacterial control through irrigation and disinfection, better codification of diagnostic procedures, enhanced understanding of microbial populations and disease states, improvements in radiological assessments, and pain control, along with ability to provide rapid and efficient treatment procedures both nonsurgically and surgically. With every advancement there may also be negative issues that will vary from country to country.

**Q. Can you share some of the most significant milestones or achievements in your career?**

Possibly the most significant may include to name a few: American Association of Endodontists (AAE) Award, "Proficiency in Endodontics as a Dental Student", Marquette University, School of Dentistry "Staff Appreciation Award", presented by clerical and technical staff of the Dental Clinic, Marquette University, School of Dentistry; appointment as a Department Chair at age 30; my first publication for the my manuscript was returned from the editor with NO corrections; my involvement on all levels with the American Association of Endodontists from 1977 until 2002 that culminated in my Presidency in 2001-2002; Honorary PhD from the University of Athens in 1999; my Alumnus of the Year Award at Marquette University in 2000; Hayden-Harris Award from the Academy of the History of Dentistry in 2009; Royal College of Surgeons of Edinburgh - Honorary Fellow in Dental Surgery in 2017; Honorary Diplomate Status with the India Board of Endodontics; Editor of the Journal of the History of Dentistry; Alumni Achievement Award from the University of Illinois in 2023...and many, many more...which leads into the next question...





**Q. You have received several prestigious awards: the I B Bender Lifetime Educator Award, the Edgar D. Coolidge Award, and this year, the Ralph F. Sommer Award from the AAE. You are considered the doyen of endodontics. What keeps you so down-to-earth and humble?**

I have blessed to have achieved and awarded those three awards from the AAE...they just happened to have come in recognition of my passion and commitment to my profession, my specialty, the people I have worked with, the students whom I have mentored and the patients that I have served over the past 58+ years. My character and its attributes come from my parents and my strong religious beliefs for which I am forever grateful.

**Q. What are some of the biggest challenges you have faced in your practice and research, and how did you overcome them?**

Biggest challenges in practice were the diagnostic dilemmas and having committed and capable dental assistants. Yes, there were technical challenges, but these could be overcome. Tooth anatomy was always a challenge, but that was just part of doing a wide range of endodontic procedures and not just root canal treatment. In fact to practice as a true endodontist, one has to be a diagnostic sleuth, a creative thinker when faced with unforeseen circumstances, have the ability to perform a wide range of surgical and restorative procedures and all this while engendering patient confidence, allaying apprehension and reassuring the patient that you can save a tooth and relieve pain...and the at times having the wisdom to know which teeth can be saved and which cannot. Always challenging is the situation when you have to admit that your decision-making and treatment execution failed.

Research is a completely different animal, as one has to devise ways to answer questions that will impact on ultimate choices in patient treatment. Good research requires think-tanking, introspection, stepping back from a problem, reassessing and starting over when failure is present. It requires genuine honesty of purpose...and choosing directions that have not been previously chosen...all with a well-thought-out purpose in mind. Research for the sake of research is usually dead ended...as there has to be a plan. Much, too much of today's endodontic research lacks vision and direction as to the purpose that it should serve.



**Q. In your opinion, what are the future trends in endodontics, and what advancements do you foresee in the next decade?**

More and more young people will aspire to become endodontists for various reasons...two of the most important would be to save teeth and manage patient's pain. Unfortunately, in my country the motivating factor may be monetary.

Practices will focus on just doing root canal procedures...academics lacks educators and clinicians who are well versed in providing the full range of endodontic procedures, many of which require a different mindset in diagnosis, treatment planning and execution.<sup>1</sup> I really think it is important to recognize the full range of procedures that lie within the scope of endodontics...and to distinguish those who can perform all procedures from those that claim to be endodontists and can only provide root canal procedures.

Advances will include enhanced irrigation and disinfection protocols...newer biologically-driven obturation materials...possibly robotics in the delivery of surgical procedures<sup>2</sup>...more accurate and precise diagnostic tools for the determination of pulpal and periapical disease...replacement of metallic implants with the use of tooth buds to regrow new teeth...greater use of intentional replantation to preserve teeth.

**Q. What continuous professional development activities do you engage in to stay current with advancements in endodontics?**

I am the Editor of the Journal of the History of Endodontics and I spend a great deal of time editing manuscripts, not only historical manuscripts but those sent to me from a wide range of international and national journals. Daily I peruse the literature from global sources identifying publications that may have an impact on endodontic thought and practice...I cover all specialties. I usually attend webinars and seminars given online by various organizations...and I read a lot...and also write many articles for publication. Keeping the pulse on endodontics and associated disciplines is essential even at my age. I am presently working with postgraduate and predoctoral students, along with faculty, from the local dental college and in international settings on research endeavours.



**Q. You have long been associated with the IES, serving as a mentor and guide to the society. What advice would you give to its members to elevate the society to greater heights?**

Firstly, there is tremendous wealth of talent within the IES...those that have achieved must adopt mentorship roles for the young aspiring endodontists. Secondly, get involved in committee work; pursue academic teaching positions; seek possibilities for collaborative research or at least some meaningful publications that will impact on the society. Thirdly, use the resources such as influential patients for whom you have provided endodontic care to spread the news about the specialty and its impact on the quality of life in the retention of teeth and elimination of pain. Fourthly, develop teaching materials that can be delivered at national and maybe international meetings. Be passionate about your contributions to our specialty.

**Q. Can you tell us a little about your family and friends back home?**

I have two adult children (one daughter and one son) and one granddaughter, who is a recent college graduate...all live in North Texas. I am proud of their achievements in life. Here in South Florida where I live, I have many good friends, of which many are former students and international colleagues.

**Q. How have you managed to balance your professional responsibilities with personal life, and what advice do you have for maintaining this balance?**

To be honest, for years I failed to achieve the proper balance between professional activities and my personal life. In reality, at times my professional life became my mistress. In doing so, challenges were abundant and occasional failure in one or the other was evident. However, I am a self-motivator and have rectified the ship in my latter years. Within the Zodiac I am a Libran, and my balance is maintained by extensive reading in areas not related to dentistry and my religious faith and beliefs. I also tend to favour a green thumb as I enjoy growing plants here in Florida, from plumerias to orchids to cactus...I cook, I bake, I clean and I am pretty handy with challenges in maintaining a household, all of which helps to maintain balance.



I would encourage all young endodontists to focus their lives in multiple area and do not let the narrowness of the root canal cause you to narrow the development of your skills, ambitions, and desires as a person. Family is a priority always and enjoy the treasures of an intimate relationship along with parents, grandparents, and children. You can always do another root canal procedure...but your family should take priority.

**Q. You are affectionately regarded as a father figure by many endodontists. What message do you have for all the budding endodontists?**

Develop an extensive knowledge base, both historically and contemporaneously; periodically assess your performance (helps at times just to look in mirror and be honest with yourself); develop a passion for what you are doing; do not let an occasional failure get the best of you; be humble in all you do and in all your interactions. There is no room for arrogance in endodontics. Do not be afraid to question the self-appointed gurus, of which there are many. Be yourself in all phases of your life and be thankful for all the blessing you have received.

1. Gutmann JL. Revisiting the scope of contemporary endodontics. Dent Today 2015;34:12, 13-14.
2. Niño IA, Cebrián Carretero JL. Robotic surgery: A pending subject in oral and maxillofacial surgery. Journal of Dental Sciences, <https://doi.org/10.1016/j.ids.2024.01.006>









## From Vision to Venture



### **Dr. B. Subhash Chandra Shetty**

B.D.S., M.D.S.

Founder and Chairman,  
Confident Dental Equipments Pvt Ltd

Dr. B. Subhash Chandra Shetty began his career as a dedicated dentist, committed to providing top-notch dental care to his patients. With a keen understanding of the challenges faced by dental professionals and a passion for innovation, he transitioned into entrepreneurship, founding Confident Dental Equipments Pvt Ltd. Today, as the Chairman of the company, Dr. B. Subhash Chandra Shetty leads a team dedicated to designing and manufacturing state-of-the-art dental equipment, helping to elevate the standards of dental care worldwide. His vision and expertise continue to drive the company towards excellence in the dental industry. Let's know more about the professional and personal life of this legend.





**Q.** You pursued a career in dentistry when it wasn't a very popular profession. What attracted you to this field?

"I became a dentist by chance; I never planned on pursuing this profession. My interest was in engineering, but my parents strongly encouraged me to become a doctor and gain recognition, given that I come from a village where engineering had limited opportunities. They wanted me to serve the public. During that time, admissions for medical and dental schools were based on the same marks. When I wasn't selected for medical school, dentistry was the next option available. Reluctantly, I accepted the dental school seat and began my journey in dentistry."

**Q.** What changes have you witnessed in dentistry from the time you graduated to now?

"It is challenging to convey the importance of procedures like fillings, scaling, extractions, and denture making that we learned during dental school. A significant portion of the curriculum focused on prosthetics for denture making, which many dentists don't practice after graduating. In essence, we were taught many things that have little relevance in real-life practice, and unfortunately, this continues. Lab work should not be the dentist's responsibility. In our country, we fail to produce good technicians or competent dentists because the curriculum for dentists and technicians is mixed. It's high time for a change. Clinicians should be trained to become excellent, confident, and capable of providing the best clinical treatments. We must also produce skilled technicians proficient in all aspects of lab work. Currently, we often rely on foreign technicians for high-tech training, which needs to change."

**Q.** Do you prefer your role as an Endodontist or as an entrepreneur?

"I am a postgraduate, and although I was a good clinician during my MDS, I transitioned into entrepreneurship immediately after graduation. Consequently, I have little to share as an endodontist. I was a part-time practitioner and performed some endodontic treatments, but I wasn't deeply involved. I had no time to enjoy being an endodontist because my focus was entirely on developing dental equipment and becoming an industrialist, which required complete dedication and hard work."



**Q.** As a role model for many, what advice do you have for Indian dental postgraduates regarding entrepreneurship and its opportunities in India and abroad?

"That's a very difficult question. Anything is possible in this world, which is full of opportunities. However, thinking there's a lot of money in entrepreneurship is a misconception. As a postgraduate, it's challenging to delve deeply into any subject due to a lack of opportunities—you have to create them and conduct research. Unfortunately, dentists have not contributed much to the development of instruments, equipment, or materials. If you look through a catalogue of German instruments, you'll notice many are named after doctors who developed and researched them.

When reviewing specifications made by any government or institution, it's disheartening to see their limited understanding of the necessary tools for good clinical practice. Esteemed institutions instead of conducting research and contributing to dentistry, boast about importing equipment. It's unfortunate and ridiculous that they might be benefiting from these imports. Government institutions, envisioned to contribute to the country's manufacturing sector by designing and developing equipment in collaboration with industry, are instead promoting imported equipment. This should be an area where young dentists can innovate and manufacture as start-ups, making the dental community proud.

I don't know when Indian researchers and great institutions will align with the 'Make in India' vision and contribute to the Prime Minister's initiative. It's not just about industrialists; institutional support is crucial, especially from high-calibre dentists. I'm deeply disappointed to see these institutions promoting imported equipment.

Even the Supreme Court's full bench judgment on this matter shows a consensus on the issue. We manufacture Indian equipment that matches the best in the world in terms of clinical excellence. This situation reflects the control of traders in the department. I hope that, in the future, attitudes will change, and there will be recognition of our industrial skills."

**Q.** If you weren't an oral health professional, what other career might you have chosen?

We were all born in a village, I belong to an agricultural family, those days we did not make decisions of our own, and neither of our parents were so intelligent to guide us for a specific career. We don't even know what a career is, we want to become something by which we become popular in our place, we never knew things beyond this.



**Q.** What are some of the biggest challenges you have faced in establishing yourself as an entrepreneur?

There is nothing like the biggest challenge, every day is a challenge in industry, there is nothing like relaxing, we have to continuously do the work with total commitment and concentration to reach the next level. We have to improve our own records, our own product. Stagnation means the end of industry. In everyday life we have to see new things. You have to be competitive with the globe, earlier days we were happy with the equipment which is discarded abroad can be brought to India. Today with the global economy we have to rub shoulders with the most advanced country of the world, we have to produce equipment on par with global standards because everyone is exposed to modern technology and the modern world. We have to balance and make the best. Everyone wants to impart the best of treatment to their patients even in Tier II and III cities with the economic progress. Everyone is demanding they are exposed to facilities available globally so our responsibility is to offer the best equipment, though in turn they can offer the best of treatment to their patients. I am 75 years plus still I work 10 hours a day. It is not for earning but it is definitely my passion to the dental industry. I feel it is an achievement but whether I have been able to develop equipment required for this country and I still remain the uncontested leader in the manufacturing sector in this country and even up to neighbouring countries.

**Q.** Tell us something about your family and your hobbies.

"My family is quite close-knit. I have three children. My eldest son, Dr. Saphal Shetty, is a Prosthodontist who also specialized in implantology at New York University. He is an excellent clinician and a good speaker. His wife, a BDS graduate, assists him. They run one of the most sophisticated dental hospitals in the country, equipped with 24 dental chairs and modern equipment, and they also have an academy.

My second son, Mr. Rakshith, is a biomedical engineer and the COO of Confident Dental Equipments Pvt. Ltd., working alongside me.



My daughter, Mrs. Moksha Shetty, is a graduate married to Dr. Ashish Shetty, an endodontist and former Professor and Vice Principal. He also specialized in Cosmetic Dentistry in the USA. He is the COO of Confident Dental Laboratory, which plans to establish 110 sophisticated milling centres across the country, offering top-notch laboratory facilities nationwide, from Kashmir to Kanyakumari.

Today, digital dentistry is a rapidly growing field. With the advent of intraoral scanners, dental professionals can scan teeth after preparing crowns and bridges or orthodontic work. The scanned images are sent to the lab for further processing, making the entire procedure fast and highly accurate, ultimately providing the public with the best prostheses.

In my old age, my hobbies include working and spending time with my grandchildren. I take them on tours both abroad and within India every year. We enjoy holidays, traveling once a year internationally and once a year to different places within India. When I'm abroad, I particularly enjoy fishing."

**Q.** How do you balance your work and family responsibilities?

I don't balance, I do my work, I have no responsibility for my family, all of them are fully competent and they are intelligent. They all have been established so I have no responsibility. I feel happy they are working hard and my son and son-in-law are highly ethical practitioners, excellent workers. I am proud of them. My 2<sup>nd</sup> son who is COO, who looks after all the dealers and all the branches.









## Demystifying the Myth



### Dr. Kundabala Mala

M.D.S.

Professor

Department of Conservative dentistry and Endodontics,  
Manipal College of Dental Sciences, Mangalore

### Reaching hearts through root canal therapy

There is a myth in social media since some time misleading our dental patients that root canal treatment (RCT) causes cardiovascular diseases (CVD). What is the source of this myth? Is it the implant lobby, trying to sell their products in the market at the cost of root canal therapy? Is it the cardiologists, who have found a correlation between RCT and cardiac disease? Or is it the lazy endodontist, trying to make a fast buck? Today, social media plays a major role in not only creating awareness but also confusion by airing misinformation about medical and dental treatment to our patients.<sup>2</sup> It is high time that endodontists raised their voices to clear any misconceptions about RCT and to save our patients from falling prey to these faulty promotions. We have to create awareness and provide evidence that appropriate endodontic therapy is a saviour of teeth and does not cause cardiac disease such as endocarditis.





There is no literature evidence from Cardiologists or Cardiac Surgeons establishing RCT as a causative factor for cardiac diseases. Using a nationwide population-based database Po-Yen Lin *et.al.* investigated the association between unfinished RCTs and the risk of cardiovascular disease (CVD). Taking all the potential confounding factors such as age, sex, number of RCTs, annual scaling frequency following RCT, periodontal disease and systemic diseases, they found that there was an association of participants with unfinished RCTs with a higher risk of future CVD hospitalization. They suggested the necessity of additional studies to further evaluate a causal relationship between unfinished RCT and subsequent CVD events.<sup>3</sup>

CVDs affecting the heart and blood vessels can be caused by a combination of stress, metabolic, behavioural, socio-economic and environmental risk factors. These include high blood pressure, unhealthy diet, high cholesterol, diabetes, air pollution, obesity, kidney disease, physical inactivity and harmful use of alcohol and tobacco.<sup>4</sup> There is no scientific evidence implicating well-done and completed root canal therapy in the causation of CVDs

Endodontic therapies are performed to avoid extraction and save teeth by eradicating dental infection, even in grossly destroyed teeth. By performing root canal therapy/surgical endodontic procedures and then restoring the tooth's proper form and function, the stomatognathic system is maintained in good physiologic condition. Loss of one tooth can cause disturbances in occlusion and destroy the balance of healthy dentition. No good implant can replace the natural tooth morphologically as well as functionally.

Netflix brought out a documentary film "Root Cause" on January 1<sup>st</sup>, 2019, containing substantial misinformation that is not supported by scientific evidence. American Dental Association (ADA), American Association of Endodontists (AAE) and American Association of Dental Research (AADR) soon opposed the film by saying, "the film can harm the viewing public by spreading misinformation about safe medical treatments like root canals". Dr. Gibbs said, "This is a really well-produced film designed to scare people into seeking out some fringe medical and dental therapies," Many oral care professionals insisted Netflix, Amazon and other companies to remove the film from social platforms.

Dr. John Liljestrand, a doctoral candidate at the university of Helsinki, stated, “cardiovascular diseases in patients with hypertension, dyslipidaemia and diabetes, are intensified by oral inflammation around the roots of their teeth”. Root canals contain bacteria *Porphyromonas endodontalis* that has been linked to cardio-vascular diseases. According to him, these bacteria are able to invade smooth muscle cells and vascular walls of heart. He concluded that further studies are required to explore the relationship between endodontic lesions (root canal lesions) and heart disease. He added by asking whether performing root canal treatment can minimise or mitigate cardiovascular risk.<sup>6</sup>

An observational study conducted by Caplan DJ, *et.al.* to explore particular associations between endodontic infections and cardiovascular disease concluded that substantial associations are difficult to identify because of the obvious risk of bias and challenges regarding validity and reliability of data reported in those investigations.<sup>7</sup> It was hypothesized that there was a modest association between RCT and CVD in patients who were found to have an increased incidence of coronary/ valvular heart disease following self-reported RCT.<sup>8</sup> Evidence based report from a systematic review by Aloutaibi *et.al.* concluded that there is weak evidence regarding the association between cardiovascular diseases and chronic endodontic infections. Further longitudinal clinical studies are required to determine the association between cardiovascular diseases and endodontic infections.<sup>9</sup>

In 1909, the “Focal infection theory” was described by Rosenow as a localised or generalised infection caused by bacteria travelling through the blood stream from a distant focus of infection. It was more of a past century belief than the fact, which can be proved now. There is no solid scientific evidence to consider an infected canal as a focus of infection to distant body sites.<sup>10</sup> During those days, there was not much of research done like current evidence based practice or modern microbiologic techniques such as molecular methods or Confocal Laser Scanning Microscopy, to support the theory. According to Jose´ F. Siqueira Jr and Isabela N. Rocas, no clinical decision-making is to be based on the ‘focal infection theory’ In case of systemically compromised patients, endodontic bacteria as part of the total oral infectious burden or through bacteraemia have the potential to cause systemic infection. Therefore, the infective potential of the total oral infectious burden must not be ignored. There is no clear evidence to consider endodontic bacteria in isolation have an effect on the rest of the body. Hence, in case of medically compromised patients having systemic diseases it is better to identify specific pathogen or molecular patterns related to treatment outcome.



This may probably be the best way to establish tests to serve as a more accurate surrogate outcome. This is an important area of research that has the potential to create evidence and shape the future of the clinical discipline of endodontics.<sup>11</sup>

It is well understood that root canal treatment prevents the bacterial infection migrating from the periapical region and causing significant issues in the heart or elsewhere in the body. Hence, Cardiac Surgeons and Cardiologists want endodontists to perform root canal therapy for infected teeth before they take up the patients for cardiac surgery or for placing a stent. In fact, if root canal therapy is not done on infected teeth, bacteria may enter the bloodstream and travel to the area where they can colonize such as certain cardiovascular structures or prostheses and create life-threatening problems such as endocarditis.

However, current scientific knowledge and research do not support a direct etiological link between root canal therapy and cardiac disease. More clinical studies are to require to create evidence to establish this myth of root canal treatment causes cardiovascular diseases and label it a fact. Maintaining good oral hygiene by regular oral and dental check-ups, treating infectious dental conditions by root canal therapy or periodontal therapy when necessary is very important for overall wellbeing of our patients. Thus, we can reach the hearts of all our patients through good root canal therapy.

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## Up to the minute



### Dr. R. Anithakumari

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### "Sinus Surprises: The Hidden Endodontic Link"

The connection between dental infections and sinus disease is well-documented in both dental and medical literature. The intimate proximity between the roots of the maxillary teeth and that of the sinus floor have been extensively studied, with maxillary 2<sup>nd</sup> molars showing the closest proximity. This close contact has its own implications that needs to be studied.



Despite this extensive recognition and high reported prevalence, periapical infections manifesting in the maxillary sinus often go unnoticed. Dentists, otolaryngologists, and radiologists frequently misdiagnose these infections as sinogenic sinusitis. Recognizing Maxillary Sinusitis of Endodontic Origin (MSEO) is crucial. Failing to identify and properly manage the underlying endodontic issue can lead to persistent sinus disease, ineffective medical treatments, and potentially serious or life-threatening craniofacial infections<sup>1</sup>.

Bauer first referred to it as maxillary sinusitis of dental origin (MSDO) in 1943<sup>2</sup>. Around 25% of chronic maxillary sinusitis cases can be linked to dental issues<sup>3</sup>. But in spite of fairly increased incidence in relation to odontogenic infections of the maxillary teeth, especially the canines, pre molars and molar teeth, Melen et al. similarly found that 56 of 99 (55%) cases of odontogenic maxillary sinusitis were overlooked during routine dental examinations and radiographic evaluations<sup>4</sup>.

This condition can present with varied symptoms, clinical progression, and radiographic presentations. Patients frequently present with a history of dental pain, tooth mobility, or gingival abscess on the affected side of the maxillary sinus. Clinical oral examination may reveal carious lesions, pain upon tooth percussion, or gingival erythema and edema.

Depending on the pathogenicity of the dental infection, anatomical factors, the extent of mucosal edema, and the patency of the sinus ostium, periradicular inflammation may extend beyond the antral floor, potentially leading to partial or complete obstruction of the maxillary sinus. This can result in symptoms and radiographic findings similar to those of sinogenic sinusitis. The condition may further ascend to involve the nasal cavity, ethmoid, and frontal sinuses. In rare and severe cases, it can progress through the maxillary sinus to cause orbital cellulitis, vision loss, meningitis, subdural empyema, brain abscess, and life-threatening cavernous sinus thrombosis. Additionally, a foul odor, unilateral facial pressure, and the presence of pus at the middle meatus, along with regional mucosal hyperemia and swelling observed via endoscopy. A recent consensus has proposed a diagnostic criteria based on clinical symptoms and radiographic evidence and classifies MSEO as that presenting Definite, Potential and Questionable Evidence<sup>5</sup>.





Effective management of MSEO, like any infection of endodontic origin, centers on eliminating the source of the infection and preventing its recurrence. This involves a multidisciplinary treatment approach provided by the cooperation of rhinologists and dentists. The ideal sequence for administering nasal and dental treatments for MSEO has yet to be established. It relies on individual conditions of patients.

Many studies suggest that dental treatment to eliminate the source of infection should be performed prior to nasal treatment.<sup>6</sup> According to guidelines set forth in the AAE Guidance on the Use of Systemic Antibiotics in Endodontics should not replace endodontic treatment or the removal of the infected root canal system.<sup>7</sup> However, non-surgical approaches are the primary means of managing acute symptoms of MSEO. Rhinological non-surgical treatments, including antibiotics, corticosteroids, and irrigation, aim to alleviate symptoms by enhancing sinus drainage.

Dental treatment with no rhinological surgical treatment is suggested, if the disease burden imparted by sinusitis (based on symptoms, endoscopy or CT) is low after rhinological non-surgical treatment. This needs to immediately be followed by appropriate endodontic therapy in order to preserve the tooth, which involves

1. Absolute isolation of the tooth/teeth under rubber dam isolation.
2. A combination of techniques of electronic apex locator and verification of the same with radiographs since roots in contact with the maxillary sinus have different levels of impedance than roots not in contact with the sinus. This might result in inaccurate determination of the Working Length.<sup>8</sup>
3. Complete debridement of the root canal system by employing top notch irrigation with machine activated devices for chemical cleaning in conjunction with appropriate endodontic instruments that the current technology can provide, followed by use of adequate intracanal dressing in order to significantly improve disinfection after chemomechanical procedures. The main action in this case needs to be confinement of all procedures within the canal space treating teeth with close proximity to the maxillary sinus may induce the extension of bacteria, endodontic tools, intracanal solutions, and root canal fillings into the sinus treating teeth with close proximity to the maxillary sinus may induce the extension of bacteria, endodontic tools, intracanal solutions, and root canal fillings into the sinus. This can be accompanied by microbial contamination, injury to the periapical tissues, and pain, reducing the success rate of root canal therapy.<sup>9</sup>



4. This is to be followed by complete 3 dimensional obturation of the canal space and appropriate post endodontic restoration for long term success of the treated tooth.

OMS (Odontogenic Maxillary Sinusitis) patients could be treated with the success rate of 99% (254/257) by ESS (Endoscopic Sinus Surgery) combining with dental treatment.<sup>10</sup> The prognosis of OMS depends on the precise underlying diagnosis of the etiology and

corresponding individualized treatment. However, in the most challenging cases, the extraction of the tooth may be necessary.

In conclusion, addressing the relationship between dental infections and maxillary sinus disease requires a precise and integrated approach. The complexity of diagnosing Maxillary Sinusitis of Endodontic Origin highlights the need for a collaborative effort between dental and rhinological specialists.

Here is a case report of a patient of maxillary sinus infection associated with symptomatic apical abscess. When a routine root canal treatment from twelve years ago resurfaces as a complex facial pain, the interplay between dental and sinus health takes center stage. A 43-year-old male was referred to endodontic practice by general dental practitioner for endodontic retreatment of 24 tooth. Tooth underwent RCT 12 years ago. The patient reported nonspecific recurrent pain in the left facial area for 3 months; there was no history of laryngological treatment nor other general health diseases expect for controlled diabetes mellitus. Extraoral examination revealed tenderness to percussion in the left maxillary sinus area. In an intraoral examination, tooth 24 gave a slightly positive reaction to percussion test. Intraoral periapical preoperative radiograph revealed periapical lesion. All canals were underfilled with poor condensation of obturating material. Because the presence of maxillary sinusitis was suspected, standard radiological diagnostics was supplemented with preoperative CBCT and CT PNS. It revealed thickening of the mucosal lining of maxillary and ethmoidal sinuses along with breach of the floor of maxillary sinus. Symptomatic apical abscess and MSEO were diagnosed and tooth 24.



Fig. 1: Pre-op IOPA radiograph of 24 with PA lesion.



Fig. 2: Sagittal section CBCT Scan showing thickening of the mucosal lining of maxillary sinus along with breach of the floor of maxillary sinus by the periapical lesion.



Fig. 3: Coronal section CT Scan PNS (PLAIN) showing thickening of the mucosal lining of maxillary and ethmoidal sinuses.





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### **Antibacterial Nanoparticles in Endodontics: Advancing Precision and Efficacy**

Endodontics, a specialized branch in dentistry focusing on the treatment of dental pulp and periapical tissues, has undergone remarkable evolution with the advent of antibacterial nanoparticles. These nanomaterials represent a paradigm shift in endodontic therapeutics, promising to revolutionize treatment outcomes by enhancing antibacterial efficacy, reducing treatment failures, and ultimately improving patient prognoses. This writing delves into the foundational science, practical applications, challenges, and future prospects of antibacterial nanoparticles in endodontics.

## Introduction to Antibacterial Nanoparticles

Traditional approaches in endodontic therapy emphasize meticulous mechanical debridement and chemical disinfection of root canal systems to eradicate microbial pathogens and prevent re-infection. However, these methods often fall short in eliminating bacteria entrenched within complex anatomical structures and resilient biofilms. Antibacterial nanoparticles, owing to their diminutive scale and potent antimicrobial properties, offer a novel avenue by which precise targeting of bacterial pathogens can be achieved with unprecedented efficacy.

## Mechanisms of Action

Antibacterial nanoparticles exert their antimicrobial effects through multifaceted mechanisms:

1. **Physical Disruption of Bacterial Cells:**
  - **Membrane Penetration:** Nanoparticles infiltrate bacterial cell walls, inducing structural damage and compromising membrane integrity, thereby leading to cellular leakage and eventual cell death.
  - **Biofilm Penetration:** These nanoparticles penetrate the extracellular polymeric matrix of biofilms, a feat often challenging for conventional antimicrobials, effectively eradicating bacterial reservoirs.
2. **Generation of Reactive Oxygen Species (ROS):**
  - **ROS Production:** Certain nanoparticles, particularly those with photocatalytic properties like titanium dioxide (TiO<sub>2</sub>) and zinc oxide (ZnO), produce ROS upon exposure to specific wavelengths of light. These highly reactive species, including hydroxyl radicals (•OH) and superoxide anions (O<sub>2</sub>•<sup>-</sup>), inflict oxidative damage on bacterial membranes, proteins, and nucleic acids, culminating in microbial eradication.
3. **Release of Antimicrobial Ions:**
  - **Ion Release:** Metallic nanoparticles such as silver (Ag), copper (Cu), and zinc oxide (ZnO) release ions (Ag<sup>+</sup>, Cu<sup>2+</sup>, Zn<sup>2+</sup>) in aqueous environments. These ions disrupt bacterial cell membranes, inhibit vital enzymatic functions, and contribute to bacterial cell death.



4. **Direct Interaction with Bacterial Components:**

- Nanoparticles interact directly with bacterial cell walls, proteins, and genetic material, leading to structural alterations and functional impairment crucial for bacterial survival.

5. **Synergistic Effects:**

- By harnessing multiple mechanisms concurrently, nanoparticles exert synergistic antimicrobial effects that reduce the likelihood of bacterial resistance development, a significant concern in conventional antimicrobial therapies.

### **Types of Antibacterial Nanoparticles**

A variety of nanoparticle types are under investigation for their application in endodontics:

- **Silver Nanoparticles (AgNPs):** Known for their potent antimicrobial properties, AgNPs release silver ions and induce oxidative stress in bacterial cells.
- **Copper Nanoparticles (CuNPs):** Emit copper ions and ROS, demonstrating robust antimicrobial efficacy against a broad spectrum of bacterial pathogens.
- **Zinc Oxide Nanoparticles (ZnO NPs):** Exhibiting photocatalytic activity, ZnO NPs generate ROS under UV light, effectively disrupting bacterial membranes and cellular components.
- **Titanium Dioxide Nanoparticles (TiO<sub>2</sub> NPs):** Photocatalytic in nature, TiO<sub>2</sub> NPs produce ROS upon UV exposure, offering substantial antimicrobial activity against bacterial populations.
- **Gold Nanoparticles (AuNPs):** Functionalized with specific ligands, AuNPs facilitate targeted delivery of antimicrobial agents to bacterial cells, enhancing treatment precision.
- **Chitosan Nanoparticles:** Derived from chitin, chitosan nanoparticles exhibit membrane-disrupting properties and can also generate ROS, contributing to their antimicrobial efficacy.

## Applications in Endodontics

Antibacterial nanoparticles are pivotal in various facets of endodontic therapy:

1. **Root Canal Disinfection:** Augment traditional disinfection protocols by penetrating inaccessible areas and effectively eliminating bacterial biofilms, thereby reducing treatment failures and enhancing clinical outcomes.
2. **Nanoparticle-Modified Root Canal Sealers:** Incorporate nanoparticles into root canal sealers to confer enduring antibacterial properties, thereby preventing re-infection and promoting periapical healing.
3. **Regenerative Endodontics:** Facilitate tissue regeneration within root canals by creating a sterile environment using nanoparticle-infused scaffolds, fostering optimal conditions for tissue repair and tooth preservation.

## Advantages of Antibacterial Nanoparticles

- **Enhanced Antimicrobial Efficacy:** Surpass conventional antimicrobials in efficacy, particularly against resistant bacterial strains and biofilms.
- **Reduced Cytotoxicity:** Mitigate adverse effects associated with conventional disinfectants, ensuring safety and minimizing damage to periapical tissues.
- **Sustained Antimicrobial Activity:** Gradual release of antimicrobial agents from nanoparticles ensures prolonged protection against bacterial colonization and re-infection, essential for long-term treatment success.
- **Versatility:** Compatible with a range of endodontic materials and applications, nanoparticles offer versatility in enhancing treatment efficacy across various clinical scenarios.

## Challenges and Considerations

Despite their potential, antibacterial nanoparticles encounter significant challenges:

- **Biocompatibility and Safety:** Ensure nanoparticles are biocompatible and biodegradable to mitigate potential long-term health risks associated with their use.



- **Stability and Aggregation:** Prevent nanoparticle aggregation in biological fluids to maintain efficacy under physiological conditions.
- **Antimicrobial Resistance:** Develop strategies to mitigate bacterial resistance to nanoparticle-based therapies, focusing on innovative formulations and combinatorial approaches.
- **Standardization and Quality Control:** Establish stringent protocols for nanoparticle characterization and manufacturing to ensure consistent performance and clinical efficacy.
- **Delivery and Targeting:** Optimize nanoparticle delivery systems to enhance penetration through biofilms and precise targeting of bacterial pathogens while minimizing off-target effects.
- **Interaction with Biological Systems:** Investigate nanoparticle interactions within biological environments to optimize efficacy and safety profiles.
- **Cost and Scalability:** Address economic barriers associated with nanoparticle synthesis and production scalability to facilitate widespread clinical adoption.

### Future Directions

Future research initiatives should prioritize refining nanoparticle formulations, elucidating their intricate biological interactions, and conducting robust clinical trials to validate safety and efficacy across diverse patient populations. Furthermore, navigating regulatory frameworks and environmental considerations will be crucial for advancing nanoparticle-based therapies into mainstream clinical practice.

### Conclusion

Antibacterial nanoparticles herald a transformative era in endodontic care, promising unparalleled precision, efficacy, and safety in combating bacterial infections associated with root canal treatments. By overcoming current challenges and leveraging their distinctive attributes, nanoparticles have the potential to establish new benchmarks in dental medicine, fostering superior patient outcomes and steering the field toward more effective and sustainable treatment modalities.





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### **ARTIFICIAL INTELLIGENCE IN ENDODONTICS**

John McCarthy developed the field of "artificial intelligence (AI)", a subfield of applied computer science, in 1956. AI, often dubbed the "fourth industrial revolution," replicates human-like intelligence and decision-making using computer technology. (1)

The word "AI" is used when the computer imitates analytical functions, such as "learning and problem solving", that humans frequently associate with other human brains. AI techniques have demonstrated excellent capabilities and capacities in recognizing important data patterns, leading to extensive experimentation with them as clinical trial tools, specifically to assist in decision-making for prognosis and projection, as well as each phase of diagnosis and subsequent therapy. (2)



The core component of artificial intelligence technology is a neural network designed like that of human brains, which can also simulate human thought. Strongly interconnected neurons, known as artificial neural networks (ANNs), comprise this type of brain architecture, primarily functioning as a data processing system to address a particular issue. It is a rapidly evolving technology that allows robots to do formerly human-only jobs. Recently, it has started to be used in dentistry, which has resulted in exceptional achievements. (3,4)

Artificial neural networks (ANN) are a prevalent category of deep learning algorithms. They consist of interconnected neurons organized into layers, including an input layer, an output layer, and hidden layers in between. These hidden layers are crucial in processing information hierarchically from inputs to outputs. The pattern of neuron connections determines the architecture of a neural network, relying on adjustable connection strengths called weights. In medicine and dentistry, convolutional neural networks (CNNs) are a prevalent subclass of ANNs. They utilize a specialized architecture and the convolution operation to excel in processing digital signals such as images, sound, and videos. Their approach involves scanning small input data segments with a sliding window, allowing for comprehensive analysis across larger datasets. CNNs are particularly adept at image classification, making them the predominant choice for tasks related to image recognition. (5)

#### **How do artificial intelligence models work?**

AI operates in two phases: "training" in the first phase and "testing" in the second. The training data determines the parameters of the model set. Retrospectively, the model uses data from prior examples, such as patient data or data from data sets containing various examples. These parameters are then applied to the test sets. (6)

AI processes input, generates a "heatmap," and produces a prediction, such as identifying a "cat." The heatmap shows which input variables, like "pixels," influenced the prediction. This enables the distinction between safe and relevant prediction techniques, such as categorizing cat photos by focusing on the cat's ears and nose.(7)

AI in healthcare can be categorized into two main types.:

#### **Virtual robotics and Physical robotics:**

"Virtual Artificial Intelligence" applies mathematical algorithms to various healthcare-related tasks, such as electronic health record management, medication dosage calculations, imaging



analysis, appointment scheduling, and diagnosis. On the other hand, "Physical AI" involves robotic assistance in surgical procedures, telepresence applications, rehabilitation support, etc. (1)

Initially, developers designed AI systems using predefined rules to address specific purposes. However, "machine learning", a subset of AI, is now widely used in the medical field. Recently, "deep learning" has also gained popularity in the field of AI.(8)

**"Machine learning (ML)"** is a subset of AI where systems learn to perform tasks without explicit programming of rules. Instead, they learn from large datasets, identifying patterns through exposure to examples. Machine learning algorithms adjust their parameters through training to minimize errors and improve performance. This process is similar to teaching a child to recognize cats by showing them various pictures until they learn the distinguishing features, enabling them to identify cats in fresh images.

**"Deep learning (DL)"** is a machine learning subfield focused on capturing individual patterns and a structured hierarchy of interconnected patterns. By stacking and combining these patterns, a "deep" system emerges, which surpasses the capabilities of a "shallow" one. For example, when a child identifies a cat, it is not through a single instance of pattern recognition. Instead, the child starts by noticing fundamental elements like edges, which combine to create textured outlines and basic shapes such as eyes and ears. These components then build larger structures like heads and legs, leading to the identification of the whole cat. (9)

#### **CURRENT APPLICATION OF AI IN ENDODONTICS:**

AI has primarily been used in virtual capacities in endodontics, focusing on tasks such as diagnosing crown and root fractures, identifying periapical lesions, figuring out working lengths, and identifying morphological features. These applications highlight the virtual nature of AI's application in endodontics.

#### **Periapical lesion detection:**

Early detection is crucial for preventing the spread of the disease, maximizing complications, and improving treatment outcomes. Three-dimensional cone-beam computed tomographic (CBCT) imaging has become a more precise method of identifying periapical lesions, including their location and size.





However, CBCT imaging is less reliable when identifying apical periodontitis in teeth with root fillings. In particular, on panoramic and intraoral radiographs, deep learning algorithms have demonstrated encouraging results in matching or exceeding the diagnostic performance of radiologists and oral and maxillofacial surgeons in detecting periapical radiolucencies.

Researchers have explored AI to differentiate periapical cysts from granulomas using neural networks based on gene expression analysis, in addition to detecting lesions.. (1)

#### **Finding of Root Fractures:**

"Vertical root fractures (VRFs)" present a significant concern. Although they constitute a small percentage of crown/root fractures, they carry substantial implications, such as the potential need for root resection or tooth extraction. Traditional radiographs and cone-beam computed tomography (CBCT) imaging aid in VRF detection, although challenges persist due to diagnostic limitations, which may lead to unnecessary surgical interventions or extractions.

Machine learning demonstrated a higher positive predictive value when compared to observer interpretation and that micro-computed tomography was more accurate than CBCT in identifying fractured teeth.

#### **Working Length Determination:**

Saghiri et al. proposed artificial neural networks (ANNs) as a supplementary tool for locating the apical foramen on radiographs, potentially enhancing the accuracy of working length determination.

Hiraiwa et al. demonstrated that a deep learning system on panoramic radiographs accurately differentiated single or multiple roots in mandibular first molars' distal roots. (1)

#### **Morphology of Root and Root Canal System**

Compared to radiography, Cone beam computed tomography imaging is more accurate in determining the root and root canal geometries. However, it cannot be advised in standard clinical practice due to radiation problems. Lahoud et al. showed an automated, three-dimensional teeth segmentation using the CNN approach. In a rapid, accurate, and effective clinical reference evaluation of 433 cone-beam computed tomographic segmentations of teeth, the authors found that artificial intelligence performed precisely as well as a human operator while working much faster.



### **Predictions for retreatments:**

Campo et al. developed a case-based reasoning paradigm to forecast the result of nonsurgical root canal retreatment and weigh the advantages and disadvantages of doing so. The system utilized data encompassing performance, recall, and statistical probabilities to provide recommendations. While the system's strength lies in its potential to forecast retreatment outcomes accurately, its effectiveness relies heavily on the quality of the input data.

### **Prediction of the Viability of Stem Cells**

A study by Bindal et al. used the neuro-fuzzy inference method to assess stem cells extracted from tooth pulp in many regenerative treatments. This approach predicted the stem cells' survival following treatment with lipopolysaccharides of bacteria in a model clinical situation. The neuro-fuzzy inference system predicted cell survival after different regeneration procedures for cells vulnerable to microbial infection.

4oThe scientists tested the viability of the cells after administering lipopolysaccharide to pulp stem cells to elicit an inflammatory response. The scientists next evaluated the precision of the prediction provided by utilizing adaptive neuro fuzzy interferences to forecast these stem cells' survival following microbial invasion. (1)

### **LIMITATIONS AND CHALLENGES IN ARTIFICIAL INTELLIGENCE:**

#### **Data Acquisition:**

AI implementation in dentistry lags behind the medical field by several years, with challenges including insufficient data curation and sharing and limited data processing, measurement, and validation information. Ambiguities in sample size, reference data, and comparative tests hinder results' robustness, comparability, and generalizability. Standardizing data curation and reporting methodology is crucial to enhancing data quantity, quality, and readability.

#### **Computing Power:**

Updating medical and dental databases for AI applications necessitates continually enhancing processing power. The limitations of classical computers in data processing due to saturated computational power have emerged as a significant obstacle hindering the effectiveness of AI.



### **Ethical Considerations:**

The development of AI must prioritize the avoidance of harm to humans and the ethical treatment of machines themselves. Machine-led dentistry lacks the essential elements of clinical care, including clinical intuition, perceptual nuances, and empathy, which are crucial for delivering personalized health care and professionalism.

The unique human-to-human interaction dimension cannot be replicated simply in computer language. AI should be viewed as an augmentation tool to enhance dentists' capabilities and alleviate their burdens, allowing them to focus on tasks that require human expertise and improving professional interactions. (10)

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### **Raising Financial Savvy: The Importance of Financial Stability and Investment Awareness Among Dental Students".**

In today's rapidly evolving healthcare landscape, dental students face a unique set of challenges. Beyond mastering the complexities of dental medicine, they must also navigate the intricacies of financial management. Understanding the importance of financial education is essential for dental students to build a successful and sustainable career.

Financial literacy is the process of acquiring knowledge about financial products, understanding the concept of trade-off between risk and return, utilising the knowledge to make informed choices and appreciating the available professional knowledge. In today's healthcare environment healthcare professionals training programs are facing multiple challenges. Healthcare professionals earn high salaries after their graduation, after spending huge amount of money during their course. Ironically, the start of their career after the graduation begins with a debt either because they intend to set-up their own clinical practice or pursue higher education, both of which requires high amount of money Healthcare



professionals' complete education having received minimal unbiased financial planning guidance. Some of them rely on assistance from grants, scholarships, parental contributions, or part-time jobs to pay for the costs of tuition. They begin their career with high amount of investment, but being unaware about the strategies of investment may lead to a lot of money wastage. Therefore, it is necessary to provide them with complete unbiased financial education and empower them to make timely constructive financial decisions

### **Financial Literacy: A Critical Skill**

Financial literacy encompasses a range of skills and knowledge, including budgeting, managing student loans, understanding credit, and planning for retirement. For dental students, who often graduate with significant debt, these skills are not just beneficial—they are essential. By mastering financial principles early on, students can make informed decisions that will impact their financial health for years to come.

### **Managing Student Debt**

One of the most pressing financial concerns for dental students is managing student debt. With the average dental school graduate owing more than several lakhs, understanding loan repayment options, interest rates, and consolidation strategies is crucial. Financial education provides students with the tools they need to effectively manage their debt, avoid default, and maintain a good credit score.

### **Budgeting for the Future**

Creating and adhering to a budget is another vital component of financial education. Dental students must balance the costs of their education, living expenses, and personal spending. Learning to budget effectively ensures that they can cover their essential needs without accumulating unnecessary debt. Moreover, developing good budgeting habits during school can lead to long-term financial stability.



### **Investing in Your Career**

Financial education also empowers dental students to make strategic investments in their careers. This includes understanding the costs and benefits of further specialization, opening a private practice, or joining an established dental clinic. By evaluating the financial implications of each path, students can choose the option that aligns best with their professional and personal goals.

### **Preparing for Retirement**

It might seem premature to think about retirement while still in dental school, but early planning can make a significant difference. Financial education helps students understand the importance of saving and investing for the future, utilizing retirement accounts, and taking advantage of compound interest. Starting early can lead to a more comfortable and secure retirement.

### **Enhancing Patient Care**

Financial stability can indirectly enhance the quality of patient care. When dental professionals are not burdened by financial stress, they can focus more on their practice and their patients. Additionally, financially savvy dentists can better manage their practices, ensuring they have the resources to invest in advanced technologies and provide the best care possible.

### **Conclusion**

Incorporating financial education into the curriculum for dental students is not just a nice-to-have; it is a necessity. By equipping future dental professionals with the knowledge and skills to manage their finances effectively, we are setting them up for a more successful and fulfilling career. Financial education is an investment in their future—and the future of the dental profession.



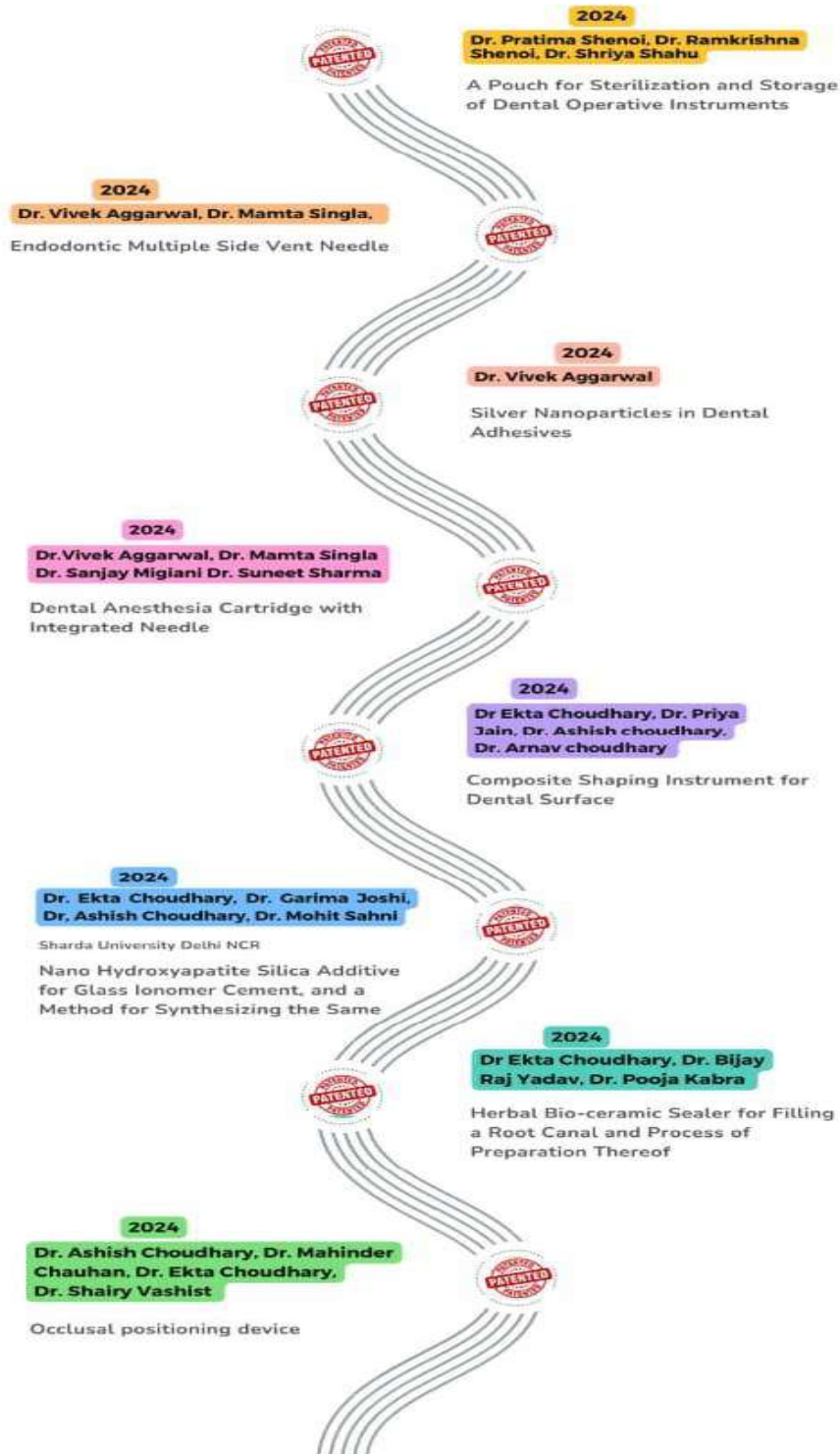


## Spotlight on Indigenous IP

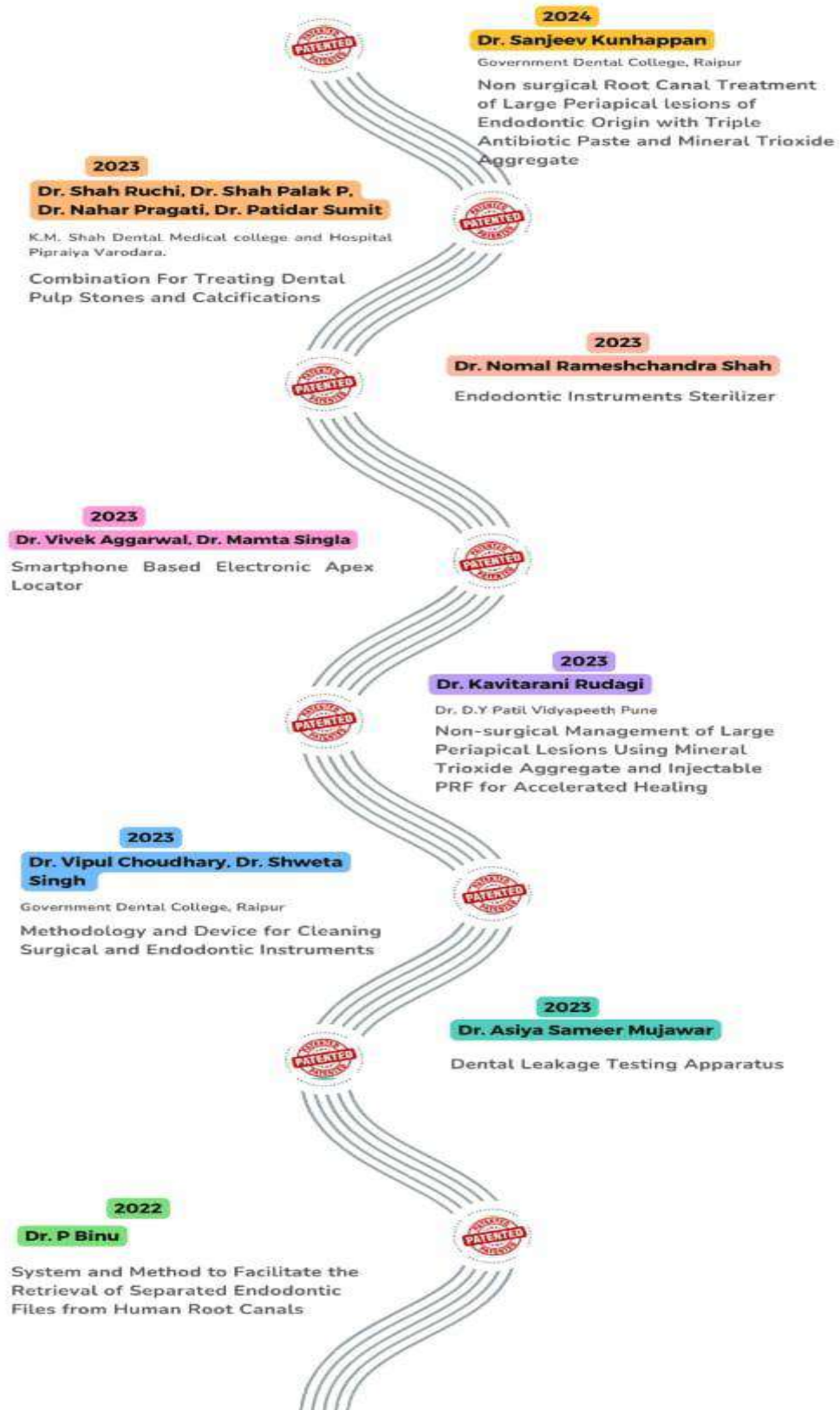
In our ongoing pursuit to highlight innovation and progress within the field of Endodontics, we are excited to introduce the new Patent Section in this issue of the Indian Endodontic Society (IES) Times. This section is dedicated to showcasing recently published patents that are highly relevant to clinical Endodontics, reflecting the creativity and commitment of our community.

We take pride in presenting these contributions, which exemplify the relentless efforts to advance our field through innovative ideas and solutions.

# Timeline



# Timeline







## Beyond the borders of the pulp chamber



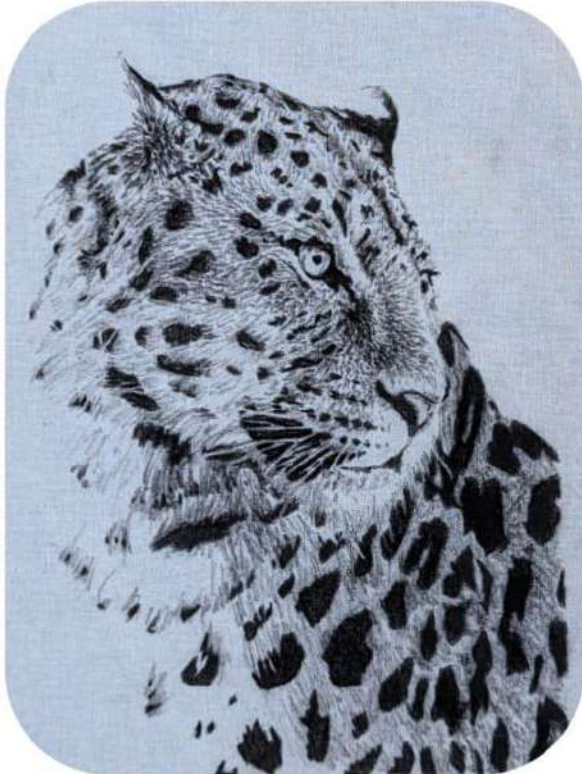
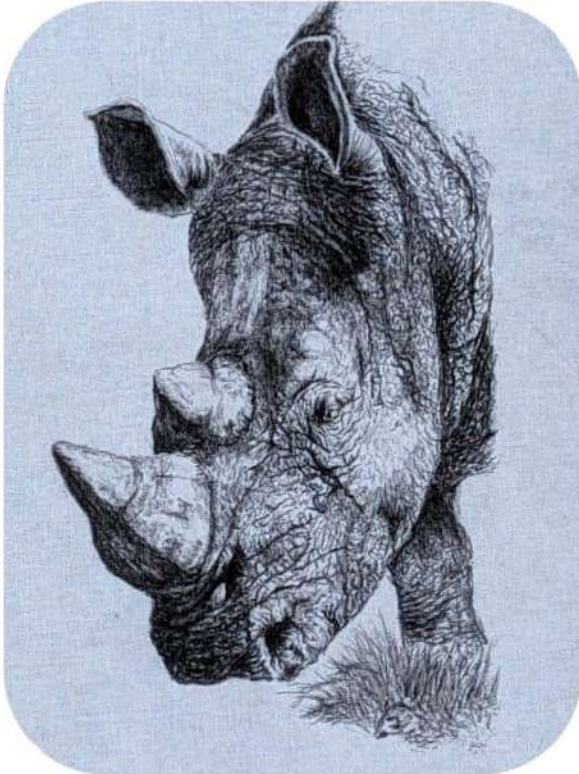
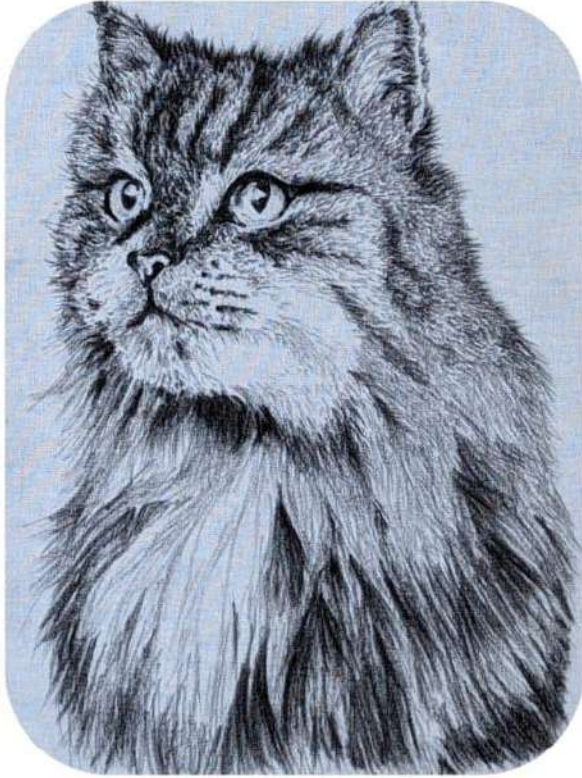
Dr Heitor De Souza

PG Student

Goa Dental College and Hospital, Goa

"While pursuing his studies in dentistry, Dr. Heitor De Souza has also nurtured a deep passion for drawing, particularly with charcoal and graphite. Take a moment to view and enjoy his creative works."









## Post graduate's ingenuity



### **Dr. Urja Mali**

PG Student

Ranjeet Deshmukh Dental College, Nagpur

### **3D Printing: Envision Efficiency and Precision in Endodontics**

Three-dimensional (3D) printing has brought significant advancements in the various fields of dental sciences, including endodontics. In the field of endodontics, 3D printing has positively impacted treatment planning, procedural accuracy, research and development, training of students and clinicians, and ultimately improving the quality of care provided to the patient. Its applications will continue to expand as technology advances and its applications in dentistry evolve.





### Applications of 3D printing in endodontics.

- **Guided Endodontics with Improved Treatment and its Planning:** 3D-printed models can provide better visualization of internal anatomy and canal complexities, leading to better and more effective treatment planning. 3D-printed endodontic guides can be created to carry information regarding the orientation and angle of the root apex, its arrangement in the adjacent osseous tissue, the thickness of the cortical bone, and the size of the periapical lesion [1]. It can reduce clinician-dependent factors affecting the prognosis of the treatment provided, as multiple procedure errors are possible to occur during endodontic therapy, especially in cases of pulp canal obliteration or calcific metamorphosis and complex or varied root canal configuration. The computerized planning technique and directed guide using cone beam volumetric tomography (CBCT) can result in simplified root canal treatment in complex cases reducing the risk of procedural errors and improving treatment outcomes.
- **Patient communication and record-keeping:** Patients can better comprehend their oral health and the suggested operations by using 3D-printed models to communicate treatment plans to them. This improves patient satisfaction and compliance with treatment recommendations. With increasing awareness among patients regarding treatment provided and unethical practice, record-keeping is becoming a standard operating procedure in routine clinical practice, and 3D-printed models can add value to it [2].
- **Education and research:** Natural teeth are still the standard practice in laboratory research and pre-clinical courses in dental institutes due to their advantages [3,4], like natural tissue hardness, morphology, color, texture, and radio density [1], but they have several drawbacks, like difficulty in handling, availability, collection, proper storage, and their disposal with bio-safety [5]. 3D-printed models for research and education regarding complex root canal procedures, anatomical variations, new techniques, and material usage can improve learning outcomes for clinical applications and research implementations.



**Conclusion** - In endodontics, 3D printing improves accuracy, adaptability, and patient outcomes; record-keeping by enabling precise diagnosis; customized treatment planning; and the production of dental equipment and devices that are unique to each patient. 3D printing can play a vital role in the field of dental research by providing lifelike models that provide effective results in clinical scenarios. Technology plays an increasingly important role in increasing the effectiveness and efficiency of endodontic procedures as they develop.

**References:**

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**DR. SAHITHA. N.R**

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Manipal

**Deep margin elevation with the Garrison's DME Kit**

Deep margin elevation (DME), or coronal margin relocation (CMR), is a minimally invasive restorative procedure that uses composite resin restoration to realign coronal sub-gingival margins for the placement of either an indirect restoration or direct restoration. It offers numerous advantages such as effective isolation with a rubber dam, improved moisture control, ease in taking impressions, facilitating proper bonding procedures, and minimizing tissue removal, thus avoiding unnecessary sacrifices. These days, clinicians often use



specialized matrix systems or modified normal matrix bands for performing DME. One notable system is the Garrison DME Kit, which includes a tensioning tool and reel matrix bands that can be tailored to fit specific tooth dimensions. These matrix bands are positioned and adjusted around the gingival area, ensuring a tight and precise fit along the gingival margin.

#### Instructions for use:

The tensioning instrument features a handle with a spherical component.



Pushing the sphere upward releases a notch, which engages with the reel matrix spool for insertion.



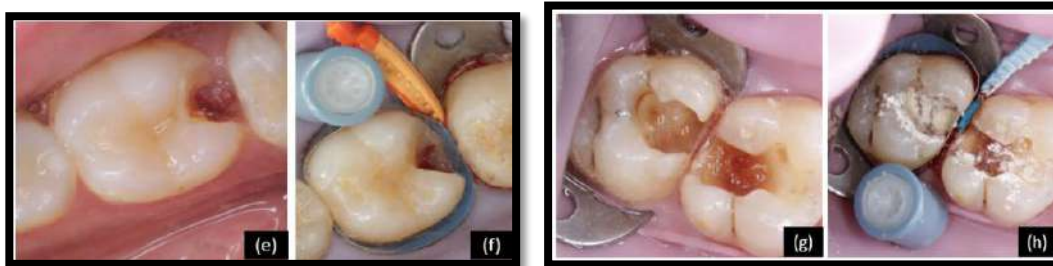
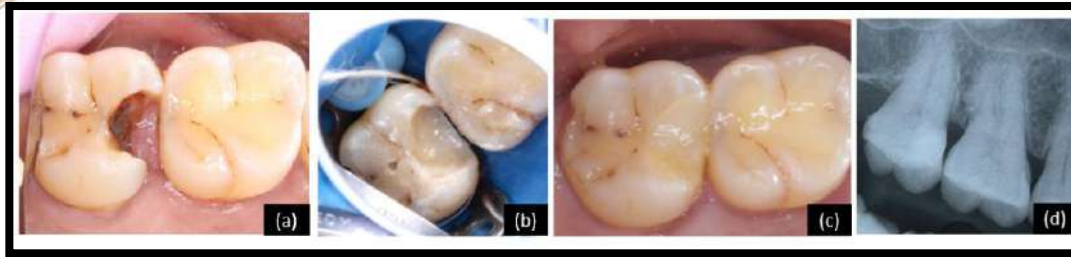
Once locked, the band is positioned along the tooth margins.



To secure it, rotate the sphere clockwise to conform to the tooth contours.



Another notable feature is that these reel matrices can be used in conjunction with other sectional matrix systems. Once the margin is lifted, there is no need to remove the band; instead, a second band can be placed over it to complete the restoration, as illustrated in the images below.



**(a-d)** is case 1, DME was performed followed by composite restoration on tooth 27. The radiograph demonstrates the tooth's contour has been appropriately shaped.

**(e, f)** is case 2, this image displays the occlusal view of the DME performed on tooth 36, demonstrating excellent adaptation to the tooth structure, effective isolation, and clear visibility of the margins.

**(g, h)** in case 3, it is evident that there is no hindrance from the rubber dam clamp, enabling straightforward placement of the matrix band and ease of restoration on the furthest distal tooth.



## Dr. Bhumika Vaswani

PG Student

Ranjeet Deshmukh Dental College, Nagpur

### **Vegan Dentistry: Combining Ethical Excellence with Your Smile**

In a world where ethical choices meet cutting-edge technology, Vegan Dentistry stands as a beacon of sustainable oral health practices. It upholds non-animal exploitation and sees substantial protection of nature and personal health.

Veganism is defined by The Vegan Society as

“ A lifestyle choice of having consumer products which are man-made and synthesized, without the exploitation or cruelty to humans, animals, or environment.” This approach extends not only to include non-animal alternative approaches but also safe ones, as there is no benefit derived from disease-causing or otherwise harmful technology. These products are proven to be effective in sensitivity and gingival health and are also free from any ingredients that were made by animals so there is less chance of allergic types reactions.





### **Vegan Toothpaste: It is a Favorable Choice for Your Teeth**

Vegan toothpaste does not contain chemicals such as parabens and SLS as commonly found in regular toothpaste products but only natural ingredients and hence is much safer on the gums as compared to the regular toothpastes. Most of these natural toothpastes contain ingredients that have natural whitening abilities and are very effective in removing plaque, and shows antimicrobial properties. For example, the use of baking soda provides the gentle abrasive action but necessary to eliminate surface discoloration and the antiseptic components of coconut oil help to avoid dangerous bacteria and reduce the volume of plaque. Antimicrobial and anti-inflammatory properties of the essential oils like tea tree, peppermint are good for the gums and breathe. These have a broad application in the cosmetic industry, and recently, they have been used in the formulation of vegan toothpaste.

### **Vegan Floss: Recycling and Reduction**

Popular and thin forms of plastic like dental floss, for example, contribute significantly to plastic pollution but are rarely discussed when calculating environmental impact. Vegan variety is provided by dental flosses, which are made from materials like bamboo and PLA maize fibers. Made from bamboo material, bamboo floss is highly effective, very sturdy, and fully biodegradable; if enhanced with activated charcoal to improve its cleaning capacity. For sensitive gums, it uses the PLA corn floss, which is said to be soft and does not cause abrasion on the teeth and gums when flossed.

### **Vegan Mouthwash**

Vegan mouthwash is sustainable because it uses plant-based ingredients rather than some common mouthwash that may contain ingredients with animal by-products. These are free from alcohol and other chemicals since mint or tea tree oil are anti-bacterial and natural and, therefore, have natural flares. Vegan mouthwashes also exhibit relevancy to sustainability since they come in environmentally sensitive packaging and are not violate of immoral standards.



### Future directives

Overall, the future of vegan dentistry is likely to be driven by advancements in materials science, consumer demand for ethical products, and a growing awareness of environmental sustainability. This trend shows how dentistry has the power to positively impact global environmental goals in addition to reflecting a shift towards more responsible purchasing.

### Conclusion

**“A Smile for Today, a Planet for Tomorrow:”**

Dental products that are vegan-defined change the modern dentistry as such products are morally, environmentally, and as shown in the current study, effectively substituting the traditional dental supplies. In this context, the presence of vegan ideas in dentistry on the International level makes the protection of teeth and gum more conscious and ecological. Hence, when opting for vegan dentistry, one can be certain that both healthy teeth and a healthy planet are in harmony and help to protect the future of Earth.

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Organic Vegan SuperFoods (2023) Natural & Vegan Floss, Lucky Teeth. Available at: <https://luckyteeth.com/collections/vegan-floss> (Accessed: 26 June 2024).





## Dr. Devashree Darak

PG Student

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### **“Reviving the dental vitality: A Case report on Miniature Pulpotomy.”**

A 32 year old, male, patient reported to the Department of Conservative Dentistry & Endodontics, with a chief complaint of pain on having cold food in lower left back region of the jaw since 1 week. Patient was apparently alright 1 week back when he experienced mild pain in lower left back region of the jaw on taking any cold food, which was gradual on onset and intermittent in nature, not associated with night pain and relieved after removal of stimulus. On clinical examination there was loss of enamel and dentin from mesiolingual and distolingual cusp w.r.t 36 and it was negative to percussion (Fig 1). On pulp sensibility test it showed early response on cold test and reading at 2 on EPT. Radiographic examination revealed, radiolucency involving enamel, dentine, and approaching mesial pulp horn w.r.t. 36. However, lamina dura was intact and no periapical changes were seen w.r.t 36 (Fig 1). Based on the pre operative evaluation, the diagnosis made was reversible pulpitis with normal apical tissue.

Procedure was initiated to perform vital pulp therapy under magnification(10x). After giving local anaesthesia 2 % lignocaine with 1:80,000 adrenaline and rubber dam isolation, caries excavation was performed using caries detecting dye and round bur in the presence of 1% NaOCl. During the removal, the mesial pulp horn was exposed (Fig 2). After exposure the pulp tissue was evaluated under magnification to see whether remaining pulp tissue is intact and free from inflammation. Upon examination it was found out that the pulp was inflamed and covered with infected dentin chips. It was removed using Hu-friedly spoon excavator (EXC#18) (Fig 3) and then the hemostasis and disinfection was achieved with 3% NaOCl solution for 5 minutes. The site of exposure was sealed with MTA (Fig 4) and then restored using fiber reinforced composite restoration (Fig 5). One year follow-up radiograph showed successful outcome (Fig 6).

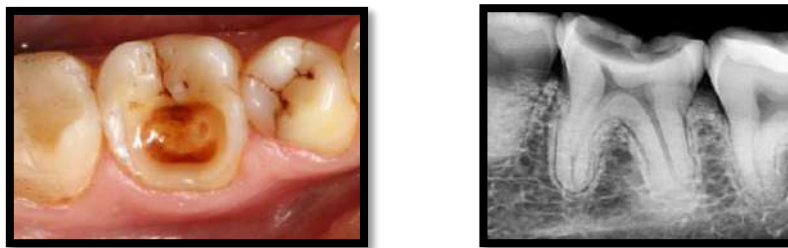


Fig. 1: Pre-operative clinical image of left mandibular first molar

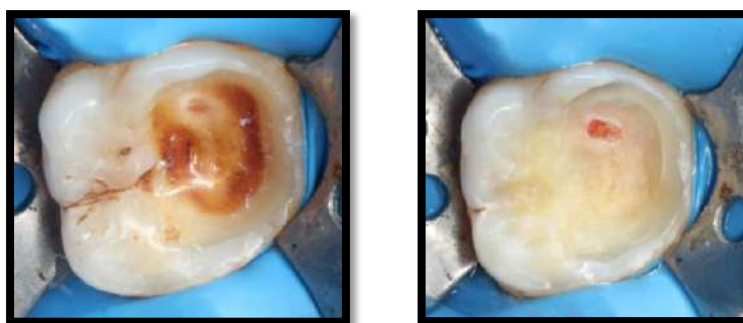


Fig 2: Rubber dam isolation was performed after disinfecting the dam with 2% chlorhexidine solution and caries excavation using round bur (BR-46) resulted in pulpal exposure with mesiobuccal pulp horn.

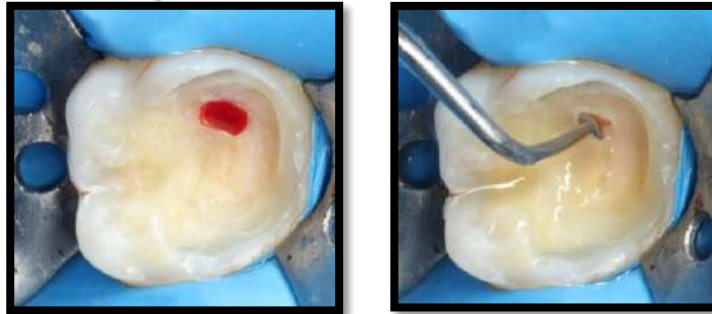


Fig 3: Removal of infected dentinal chips around the exposure site using Hu-friedly spoon excavator and 3% sodium hypochlorite solution. Fresh bleeding induced and hemostasis was achieved with 3% NaOCl.

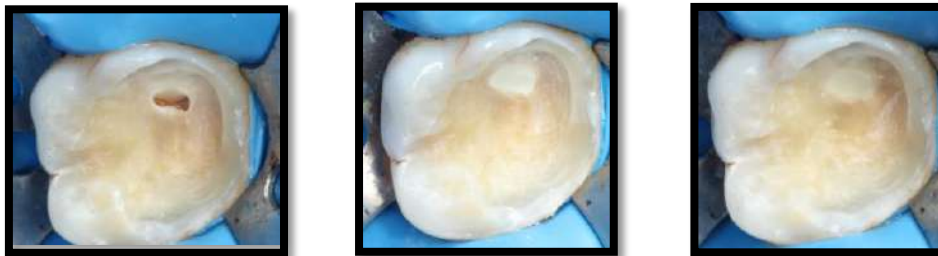


Fig 4. Hemostasis was achieved using 3 % NaOCl (3% NaOCl lavage for 5 mins). MTA (Mineral trioxide aggregate) was packed on the exposure site. Sealing of the MTA Using bonding agent and Flowable composite restoration before selective etching.





Fig 5. Selective etching was done using 37% phosphoric acid, water spray and air dried. Application of bonding agent. FRC and Flowable composite resin cement.

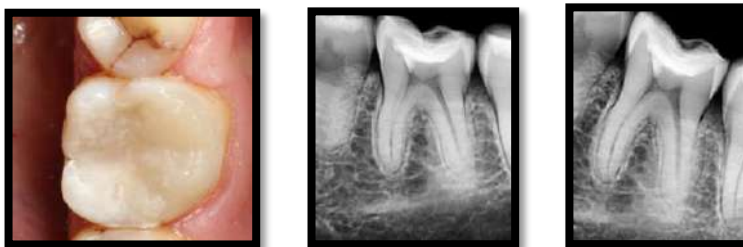
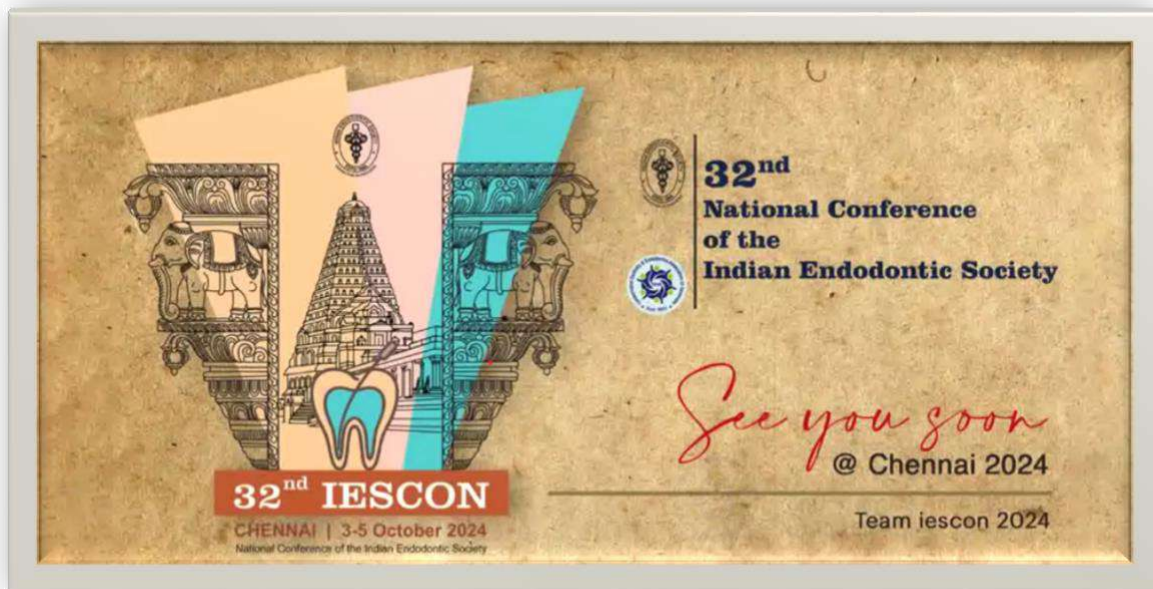


Fig 6: Composite restoration and immediate post operative radiograph after restoration. 1 year follow up radiograph



## What next?

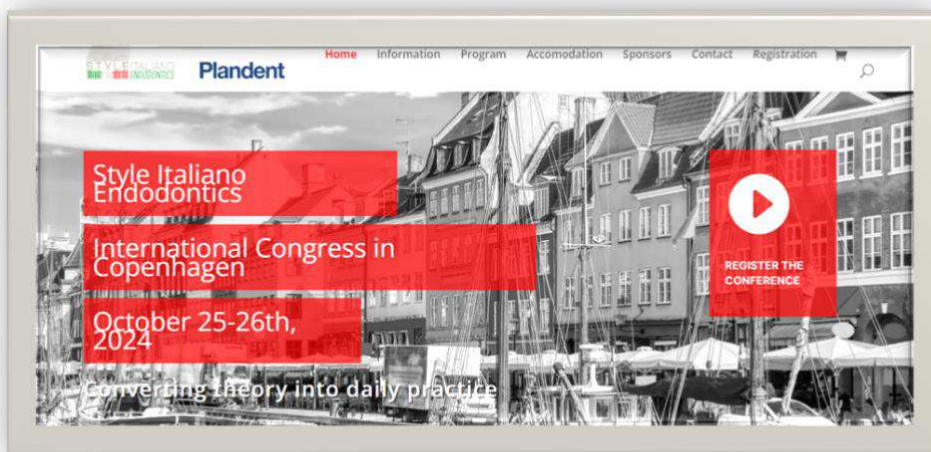


The 32nd National Conference of the Indian Endodontic Society is being held at Chennai Trade Centre, Chennai, Tamil Nadu, India from 3rd to 5th October 2024. Distinguished speakers worldwide will be delivering scientific lectures and interacting with the delegates. The conference focuses on refining our academic knowledge and improving technical skills, on a larger platform. For more details visit [www.iescon2024.com](http://www.iescon2024.com).





The biennial World Congress of the International Federation of Endodontic Associations (IFEA) will be organized in 2024 by The British Endodontic Society (BES) with Glasgow, Scotland, as the host city from the 11th– 14th September 2024.



This 2-day congress aims to give dental practitioners knowledge and tools to help them in their daily practice. The focal point of the congress is practical endodontics, and the lectures are highly clinical to give protocols to dentists in different aspects of endodontics. The motto of the SIE group is “feasible, teachable and repeatable”!





The Annual Meeting Planning Committee invites all members to submit a presentation to be considered for AAE25 in Boston.



The Biennial Congress of European Society of Endodontology is being held on For more details, log onto <https://esebiennialcongress.com/>

## The Debutante

### Biodentine XP (Septodont)



Biodentine bioceramic material has been widely used by clinicians globally for pulp capping, perforation repairs, repair of internal and external resorption defects, Root-end filling and apexification procedures. This patented ABS active biosilicate technology, is now introduced in all-in-one cartridges, which contain the powder and the liquid. The tip of the cartridge is bendable to place in the difficult to reach areas of the oral cavity. There is a choice of two volumes available: XP 200- designed for pulp capping, small restorations and endodontic indications and XP 500 – designed for deep caries, bulk filling and quadrant restorations. The cartridge needs to be placed in the XP mixer at a very high rotational speed of 6200 rpm for 30 seconds to obtain a homogenous mix. The cartridge is then loaded into the applicator gun and the mix is dispensed.

<https://www.septodontusa.com/product/dentin-restoration-biodentine-xp/>

## ZenSeal bioceramic sealer (Kerr)



The latest addition in bioceramic sealers is ZenSeal. It is biocompatible and can be used for single cone or lateral condensation technique. It is available in a 2g syringe and disposable tips. This leads to less wastage per application. Besides providing an excellent seal, another advantage is its high flowability of 23.5 mm, which allows the sealer to flow into accessory canals. <https://store.kerrdental.com/en-us/zenseal-kit.html>.

## C- Handle (Fanta)



The C- Handle is an attachment which can be used with manual files for ease in locating canals and establishing a glide path. It allows for easy visualization of the canal orifices. It has a frosted design for a better grip on the handle. There is a snap ring into which the file can be easily placed. It can be used with K files, spreaders and pluggers. <https://www.fanta-dental.com/Access/33.html>





## ENDO MIND BENDER

### WORD SEARCH

X O Q Y V X U J K N B W X W R J D J Q P  
U O Q S X B H V F O W R O J P C S W N U  
L L L H T E R M A C V M R O K W U X Y O  
T Y X C M I C R O D O N T I A C B X O B  
X F Y C A D C A M C P M B W H B L K Y S  
J M H H W O K F A T N F Q J F N U A V N  
W K K X O R N L P P E O R M P Q X U N P  
T K O D T R Z E R O G G Q H T I A B O J  
P B T I W X K C S O A L T C E X T I M A  
C U J O K F B P A W S I B K R O I O A M  
Q W V N I D E P W K V D P X L R O F R U  
C E J F U Q T V C R R E S T Z X N I T J  
X Q G S Z O H U G K Q P B B G Z J L E E  
T X W W T R E P H I N A T I O N S M N W  
V S O F O B Q O U Z O T W N I J W A S G  
Y M I X K L E E V M T H K W X S D F I I  
H C B O P E N Q R E A M E R R F B T T W  
R Y B N N R C R Q C J C C P G I S N E B  
U Y N M L C Y T O K I N E S O P M K F Z  
N A N O P A R T I C L E S P E E Z J X X

1. biofilm    2. reamer    3. subluxation    4. glidepath    5. cytokines    6. cadcam  
7. nanoparticles    8. martensite    9. microdontia    10. trephination



## Answer Key

X O Q Y V X U J K N B W X W R J D J Q P  
U O Q S X B H V F O W R O J P C S W N U  
L L L H T E R M A C V M R O K W U X Y O  
T Y X C M I C R O D O N T I A C B X O B  
X F Y C A D C A M C P M B W H B L K Y S  
J M H H W O K F A T N F Q J F N U A V N  
W K K X O R N L P P E O R M P Q X U N P  
T K O D T R Z E R O G G Q H T I A B O J  
P B T I W X K C S O A L T C E X T I M A  
C U J O K F B P A W S I B K R O I O A M  
Q W V N I D E P W K V D P X L R O F R U  
C E J F U Q T V C R R E S T Z X N I T J  
X Q G S Z O H U G K Q P B B G Z J L E E  
T X W W T R E P H I N A T I O N S M N W  
V S O F O B Q O U Z O T W N I J W A S G  
Y M I X K L E E V M T H K W X S D F I I  
H C B O P E N Q R E A M E R R F B T T W  
R Y B N N R C R Q C J C C P G I S N E B  
U Y N M L C Y T O K I N E S O P M K F Z  
N A N O P A R T I C L E S P E E Z J X X

1. biofilm
2. reamer
3. subluxation
4. glidepath
5. cytokines
6. cadcam
7. nanoparticles
8. martensite
9. microdontia
10. trephination



## EDITORIAL TEAM

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*- H.E. Luccock*



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