Knowledge and awareness on the use of gold and silver nanoparticles in endodontics practice - A survey

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ABSTRACT
To make mindfulness and teach professionals about the impact of consolidating gold and silver NPs on the shear bond quality in endodontics. Silver and Gold nanoparticles have uncommon attributes that settle on them as fillers for dental caries filling. They could remain in nanoscale in the nearness of appropriate stabilizers which implies little collection or bunching and consistently dispersed particles. They have high synthetic dependability and make them simple to be integrated and controlled. Biocompatibility makes them nontoxic for organisms (Al-Hasnawy, 2020; González-Luna, 2016; Anitha and Ashwini, 2017). The nano-fillers can improve grip at the interface between the therapeutic material and the tooth structure through expanding the mechanical quality.

INTRODUCTION
Silver and Gold nanoparticles have uncommon qualities that settle on them as great decisions as fillers for dental caries filling. They could remain in nanoscale in the nearness of reasonable stabilizers which implies little collection or bunching and consistently appropriated particles. They have high substance security and make them simple to be integrated and controlled. Biocompatibility makes them nontoxic for organisms (Al-Hasnawy, 2020; González-Luna, 2016; Anitha and Ashwini, 2017).
of the cement layer and giving basic reinforcement. The nano-fillers are pressure retaining and have the job of a flexible layer between dental composite and enamel (Ashwini et al., 2017; Lakshmi, 2015).

Mechanical, electrical and attractive glue practices were relied upon to be changed. Entomb molecule powers, for example, van der Waals and electrostatic powers, just as attractive fascination, become more grounded (Corrêa, 2015; Sharma et al., 2019; Ezhilrasan, 2017). Effect of including gold NPs and silver NPs on lacquer surface vitality by expanding minor galvanic current inside the material likewise proposed.

The nearness of nanoparticles likewise improved the coefficient of warm extension and gave progressively dimensional security (Reidy, 2013; Kushwaha, 2018). Looking over the information and mindfulness on the utilization of gold and silver nanoparticles on endodontic practice among professionals will expand the utilization of gold and silver nanoparticles in the endodontic dentistry (Pulit-Prociak and Banach, 2016; Perumalsamy, 2018; Mehta, 2019).

Some considered the nearness of nanoparticles could avoid the small scale break and successfully increment the protection from the applied force (Samiei, 2016) to diminish the clinical disappointments because of less bond quality composite Ag-NPs and Au-NPs can be utilized as another option.

MATERIALS AND METHODS

This overview assesses the information and mindfulness on the utilization of gold and silver nanoparticles in endodontic practice. A complete number of 20 articles were chosen—period (or) term considered for reference articles 2000 to 2020. The information for this article was gathered from web crawlers like PUBMED, GOOGLE SCHOLAR, MESH, COCHRANE, SEMANTIC SCHOLAR. The inquiry terms are gold nanoparticles, silver nanoparticles, and endodontic filling. Articles identified with nanoparticles, articles identified with gold and silver Nps, articles identified with endodontic filling are incorporated. Articles not identified with gold and silver nanoparticles, Articles not identified with endodontic filling are rejected. A poll containing a lot of 11 inquiries was arranged and given to specialists. Reactions are gathered.

Data analysis

Data analysis was performed utilizing the SPSS application.

RESULTS AND DISCUSSION

Figure 1 represents gold and silver nanoparticles fillings, of those 157 responses-79% responded YES and 21% responded NO. Figure 2 indicates about high chemical stability and easy manipulation, of those 157 responses, 74.5% responded YES and 25.5% responded NO. Figure 3 inquires about non-toxicity for organisms, of those 157 responses, 66.2% responded YES and 33.8% responded NO. Figure 4 shows about the filling used in teeth, of those 157 responses, 82.8% responded YES and 17.2% responded NO. Figure 5 concerns improving adhesion interface between the tooth and restorative material, of those 157 responses 55.4% responded YES and 44.5% responded NO. Figure 6 represents coefficients of thermal expansion, of those 157 responses, 58.4% responded YES and 41.6% responded NO. Figure 7 highlights the increasing minor galvanic current, of those 157 responses 58.4% responded YES and 41.6% responded NO. Figure 8 is to know about the awareness created by this survey, of those 157 responses, 93% responded YES and 7% responded NO.
Figure 3: This chart is about non-toxicity for organisms, of those 157 responses, 66.2% responded YES and 33.8% responded NO.

Figure 4: This chart shows the filling used in the tooth, of those 157 responses, 82.8% responded YES and 17.2% responded NO.

Figure 5: This chart concerns improving adhesion interface between the tooth and restorative material, of those 157 responses 66.9% responded YES and 33.1% responded NO.

Figure 6: This chart concerns the coefficients of thermal expansion, of those 157 responses, 55.4% responded YES and 44.5% responded NO.

Figure 7: This chart highlights the increasing minor galvanic current, of those 157 responses 58.4% responded YES and 41.6% responded NO.

Figure 8: This chart is to know about the awareness created by this survey, of those 157 responses, 93% responded YES and 7% responded NO.

Figure 9: Stability of nanoparticles statistically significant. Out of 74.5% (117) students who are aware 57% were female and 43% were male.

(Figure 10) Bar graph representing the view of the adhesive property of nanoparticles. The X-axis represents the gender and Y-axis represents the No.of. Students who responded YES and NO. Chi-square test, the P-value was 0.036 (>0.05) hence statistically significant. Out of 67% (105) students who are aware 60% were female and 40% were male.

(Figure 11) Bar graph representing view on galvanic current produced by nanoparticles. The X-axis rep-
Different nanoparticles are nanopores, nanotubes, quantum spots, nano shells, lipo somes, nano rods, fullerens, nano spheres, nano wires, nanobelts, nanorings, and nanocapsules (Figure 1) (Luckie et al., 2018; Lakshmi et al., 2017; Ezhilarasan, 2018). A few examinations have indicated that silver, in its nanoparticulated structure, has an inhibitory impact against numerous microscopic organisms and parasites, including S. mutans, C. Albicans, P. aeruginosa, E. faecalis, and S. aureus, among others, which could diminish the event of optional caries, parasitic disease, flops on endodontic treatment, and dental embed misfortunes (Figure 2) (Khan et al., 2012; Pagonis et al., 2010; García-Contreras, 2011). Despite the fact that AgNP is a promising antimicrobial to be utilized in dentistry.

AgNP has additionally been ending up being biocompatible with mammalian cells, proposing that its application on dental materials doesn't speak to a danger to human wellbeing (Figure 3) (Shrestha and Kishen, 2016; Ezhilarasan et al., 2018; Gheena and Ezhilarasan, 2019). Studies are expected to research the Ag particle discharge and long haul properties of the new AgNP-containing dental materials (Figure 4) (Takamiya et al., 2016; Menon et al., 2018; Rajeshkumar and Kumar, 2018). We likewise urge scientists to examine and explain the ideal methods of silver joining just as the conceivable negative impact of its expansion in dental materials, particularly with respect to shading changes and mechanical properties (Figure 5) (Bhushan and Maini, 2019; Karthiga et al., 2018).

Gold is known to create an antibacterial impact by following up on various (Figure 6) (Priyadarsini et al., 2018). They executed planktonic microbes fundamentally better-contrasted targets beginning from cooperation and the sulphhydryl gatherings of proteins and DNA, adjust the hydrogen holding/respiratory chain, loosen up DNA, and meddle with cell divider blend/cell division (Figure 7) (Neel et al., 2015; Rajeshkumar et al., 2018). Au-NPs are known to additionally destabilize the bacterial layer and increment porousness, prompting spillage of cell constituents. (Braz et al., 2012; Song and Ge, 2019). Au-NPs with noteworthy antibacterial movement could be utilized for root. Trench purification. Nonetheless, the drawn-out collaboration time required by Au-NPs for compelling bacterial killing should be considered (Figure 8) (Mantri and Mantri, 2013; A S Senthil Kumar Janahan, 2020).
CONCLUSION

Through this examination, we have talked about the familiarity with the utilization of gold and silver nanoparticles on endodontic practice. It makes specialists mindful of the benefits of gold and silver nanoparticles, utilize the points of interest and causes them to give greater quality treatment. Some considered the nearness of nanoparticles could redirect the miniaturized scale split and adequately increment the protection from the applied power. To diminish the clinical disappointments because of less bond quality composite, Ag-Nps and Au-Nps can be utilized as another option. The outcome may contrast in the greater populace.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

REFERENCES

A S Senthil Kumar Janahan 2020. A deep learning approach for predicting the active phytochemical constituent’s presence in Premna Latifolia Leaf Extracts Data set. International Journal of Advanced Science and Technology, 29(05):1075–1080.

Al-Hasnawy, H. H. 2020. The Therapeutic Potential of Silver Nano Particles. International Journal of Psychosocial Rehabilitation, 24(5):4217–4224.

Anitha, R., Ashwini, S. 2017. Antihyperglycemic activity of Caralluma fimbriata: An In vitro approach. Pharmacognosy Magazine, 13(Suppl 3):499–504.

Ashwini, S., Ezhilarasan, D., Anitha, R. 2017. Cytotoxic Effect of Caralluma fimbriata Against Human Colon Cancer Cells. Pharmacognosy Journal, 9(2):204–207.

Bhushan, J., Maini, C. 2019. Nanoparticles: A promising novel adjunct for dentistry. Indian Journal of Dental Sciences, 11(3):167–173.

Braz, A. K. S., et al. 2012. In situ gold nanoparticles formation: contrast agent for dental, optical coherence tomography. Journal of biomedical optics, 17(6):66003–66003.

Corrêa, J. M. 2015. Silver nanoparticles in dental biomaterials. International Journal of biomaterials, (8):485275–485275.

Ezhilarasan, D. 2017. Acacia catechu ethanolic bark extract induces apoptosis in human oral squamous carcinoma cells. Journal of Advanced Pharmaceutical Technology & Research, 8(4):143–149.

Ezhilarasan, D. 2018. Oxidative stress is a bane in chronic liver diseases: Clinical and experimental perspective, Arab Journal of gastroenterology: the official publication of the Pan-Arab Association of Gastroenterology, 19(2):56–64.

Ezhilarasan, D., Sokal, E., Najimi, M. 2018. Hepatic fibrosis: It is time to go with hepatic stellate cell-specific therapeutic targets. Hepatobiliary & Pancreatic Diseases International, 17(3):192–197.

García-Contreras, R. 2011. Perspectives for the use of silver nanoparticles in dental practice. International dental journal, 61(6):297–301.

Gheena, S., Ezhilarasan, D. 2019. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells. Human & Experimental Toxicology, 38(6):694–702.

González-Luna, P. I. 2016. Bactericide Effect of Silver Nanoparticles as a Final Irrigation Agent in Endodontics on Enterococcus faecalis: An Ex Vivo Study. Journal of nanomaterials.

Karthiga, P., Rajeshkumar, S., Annadurai, G. 2018. Mechanism of Larvicidal Activity of Antimicrobial Silver Nanoparticles Synthesized Using Garcinia mangostana Bark Extract. Journal of Cluster Science, 29(6):1233–1241.

Khan, S., et al. 2012. Gold nanoparticles enhance methylene blue-induced photodynamic therapy: a novel therapeutic approach to inhibit Candida albicans biofilm. International journal of nanomedicine, 7:3245–3257.

Kushwaha, V. 2018. Comparative evaluation of the antibacterial effect of nanoparticles and lasers against Endodontic Microbiota: An in vitro study. Journal of clinical and experimental dentistry, 10(12):1155–1160.

Lakshmi, T. 2015. Azadirachta indica: A herbal panacea in dentistry - An update. Pharmacognosy reviews, 9(17):41–44.

Lakshmi, T., et al. 2017. Acacia catechu Ethanolic Seed Extract Triggers Apoptosis of SCC-25 Cells. Pharmacognosy Magazine, 13(Supple 3):405–411.

Luckie, R. A. M., et al. 2018. Antibacterial Effect of Silver Nanoparticles Versus Chlorhexidine Against Streptococcus mutans and Lactobacillus casei. Silver Nanoparticles - Fabrication, Characterization and Applications.

Mantri, S. S., Mantri, S. P. 2013. The nano era in dentistry. Journal of Natural Science, Biology and Medicine, 4(1):39–44.

Mehta, M. 2019. Oligonucleotide therapy: An emerg-
ing focus area for drug delivery in chronic inflammatory respiratory diseases. *Chemico-biological interactions*, 308:206–215.

Menon, S., et al. 2018. Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism. *Colloids and surfaces. B, Biointerfaces*, 170:280–292.

Neel, A., Bozec, L., Perez, R. A., Kim, H.-W., Knowles, J. C. 2015. Nanotechnology in dentistry: prevention, diagnosis, and therapy. *International Journal of Nanomedicine*, 10(1):6371–6394.

Pagonis, T. C., et al. 2010. Nanoparticle-based endodontic antimicrobial photodynamic therapy. *Journal of endodontia*, 36(2):322–328.

Perumalsamy, H. 2018. In silico and in vitro analysis of coumarin derivative induced anticancer effects by undergoing intrinsic pathway-mediated apoptosis in human stomach cancer. *Phytomedicine: international journal of phytotherapy and phytopharmacology*, 46:119–130.

Priyadarsini, S., Mukherjee, S., Mishra, M. 2018. Nanoparticles used in dentistry: A review. *Journal of Oral Biology and Craniofacial Research*, 8(1):58–67.

Pulit-Prociak, J., Banach, M. 2016. Silver nanoparticles – a material of the future...? *Open Chemistry*, 14(1):76–91.

Rajeshkumar, S., Agarwal, H., Kumar, S. V., Lakshmi, T. 2018. *Brassica oleracea* Mediated Synthesis of Zinc Oxide Nanoparticles and its Antibacterial Activity against Pathogenic Bacteria. *Asian Journal of Chemistry*, 30(12):2711–2715.

Rajeshkumar, S., Kumar, S. V. 2018. Biosynthesis of zinc oxide nanoparticles using *Mangifera indica* leaves and evaluation of their antioxidant and cytotoxic properties in lung cancer (A549) cells. *Enzyme and microbial technology*, 117:91–95.

Reidy, B. 2013. Mechanisms of Silver Nanoparticle Release, Transformation and Toxicity: A Critical Review of Current Knowledge and Recommendations for Future Studies and Applications. *Health Impact of Nanotechnologies in Food Production*, 6(6):2295–2350.

Samiei, M. 2016. Nanoparticles for antimicrobial purposes in Endodontics: A systematic review of in vitro studies. *Materials science & engineering. C. Materials for biological applications*, 58:1269–1278.

Sharma, P., et al. 2019. Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. *Chemico-biological interactions*, 309:108720–108720.

Song, W., Ge, S. 2019. Application of Antimicrobial Nanoparticles in Dentistry. *Molecules*, 24(6):1033–1033.

Takamiya, A. S., et al. 2016. In Vitro and In Vivo Toxicity Evaluation of Colloidal Silver Nanoparticles Used in Endodontic Treatments. *Journal of Endodontics*, 42(6):953–960.