REVIEW ARTICLE

NANO-TECHNOLOGY IN DENTISTRY: A REVIEW

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ABSTRACT:
Nano-technology has occupied a significant weight ever since the 20th century. The use of Nanotechnology in dentistry has yet to occur on a commercial basis but the term Nano-Dentistry has emerged. Latest developments have indicated an elevated review that Nano-technology executed in the field of medicine and dentistry will lead to remarkable prosperity in the diagnostic as well as pre and post treatment plans. The implementation of Nano-technology in the field is emerging in spite of hurdles which include unwise use of Nano-particles. The basic purpose of the article is to highlight the suggested applications in the field of dentistry in terms of Nano-products and evaluate their impact in future clinical and laboratory work.
Keywords: Nanotechnology; Nano-Dentistry; Oral Health

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INTRODUCTION:

Nano-technology, a terminology inherited from the Greek bibliography which means "dwarf "which relates to being a billionth.[1] In the year 1950, a physicist named Richard Feynman indicated the use of nano machine parts and technology. Later on, in the year of 1981, a physicist Eric Drexler coined the term "Nanotechnology" in his paper at the Proceeding of National Science Academy. He is now described as the Founding Father of Nanotechnology. Even though the concept was introduced by him, the termed was explained in detail by scientist named Robert Freitas in 2000. [2] This manifested the idea of the probable practicability of Nano-technology in the stream of dentistry in the form of improvements in the diagnostic and therapeutic proceedings and ultimately improving the quality of the patient care. This will replace the conventional dental treatment and improve scope beyond the imagination of human mind. An intensive study and research in the field of dental from the perspective of nano-technology will give a better understanding of the physical and functional aspects. The study will hence help to understand most of the conditions and pathologies at a molecular level, which can supplement for prevention and cure.

Rice University[3] has come up with three distinct approaches to address nano-technology.

A) **Wet Nano-technology:** This involves deep study of biological systems that commonly occurs in liquid environment.

B) **Dry Nano-technology:** Involves detailed study of the biological systems that commonly occurs in dry environment which involves study of carbon and silicon like structures.

C) **Computerized Nano-technology:** Involves detailed study of the biological systems using simulated models and computer softwares.

LIST OF VARIOUS NANO-PARTICLES AND THEIR END RESULTS

No.	Study	Description	Result
1	Shaw S.Y. et al [4]	4 metal cores	Programmed Cell Death
2	Zhou H.Y. et. al [5]	Carbon Nano-Tubes	Cyto-toxicity as well as immunity responses
3	Liu R. et.al [6]	Oxide Nano-particles	Cyto-toxicity

NUMEROUS APPLICATIONS OF NANO-TECHNOLOGY IN DENTISTRY

A) NANO-TECHNOLOGY IN DRUG DELIVERY: Drug delivery in the current trends could by oral or by parenteral routes. It could also be dermal or in the form of inhalation. The dermal applications could be in the form of cream or emulsion applied locally over the affected area. Nano-emulsions have recently emerged to be an effective drug. It consists of two non-miscible liquids together which are believed to be stable for a very huge period. Other properties involves being non- toxic as well non-irritant. They have a wide variety of application, especially in the field of cosmetics and dermatology. Some of the common examples where Nano-emulsions are incorporated are drugs like aspirin and methyl salicylate and caffeine and insulin among others. [7]

B) **NANO-TECHNOLOGY IN LOCAL ANAESTHESIA:** For the effective use of nano-technology as a local anaesthesia, it is usually applied to the patients gingival. After crossing the gingival sulcus, and subsequent dentin, the particles reach the dental pulp. The dentist can thus instruct the nano-robots to work and shut down the sensitivity. Once the procedure has been completed, the dentist can shut down the nano-robots and restore the sensitivity back. This technique reduces the stress and trauma of the use of needle and syringes as well helps control sensitivity of the patient more effectively.[8,9]

C) **NANO-TECHNOLOGY IN HYPERSENSITIVITY**: Dentin hypersensitivity has been reported to be the most common problem in general population. Nano-technology provides a solution for this pathological problem.[10] During gingival recession, the loss of cementum could lead to moderate-severe form of dentin hypersensitivity. The best treatment method is to occlude the dentinal tubules. This could be easily and effectively achieved with the help of nano-robots. It is believed that it would be provide a quick and permanent cure. The method includes application of nano-robots followed by their inoculation in enamel , dentin and pulp. After the establishment in the pulp, dentist can shut the sensitivity with the help of nano-robots. The technique can be used for anesthesia and anxiety management of the patient.[11]

D) **NANO-TECHNOLOGY IN ORTHODONTICS:** The major success of orthodontic treatment is based on the prevention of relapse of the corrected malocclusion. In large number of cases, the gingival supra-crestal fibers are responsible for the relapse. Nano-technology uses nano-robots with the help of which the periodontal fibers could be quickly adjusted. This helps in rapid results for procedures like tooth up-righting and tooth repositioning. Moreover studies have suggested that heavy bong strengths could be achieved by using of material like nano-composites & nano-ionomers.[12] Hosseinzadeh et al. came up with the analysis that the nano-composites have way more bond strength as compared to ceramic brackets.[13]

E) **NANO-TECHNOLOGY IN ORAL CANCER:** Most of the treatment options available for the treatment of oral cancer have been associated with the adverse side effects which target the normal body cell and tissues as well .However Nano-technology provides

an alternative to it by site-specific action with absence of any side effect at all.[14] Various Nano-materials for treatment options like brachytherapy are being used which includes BrachySil and is being remotely used in clinical trials. Specific Nano-vectors are being developed currently to prevent and cure the disease at an atomic level.[14]

F) NANO-TECHNOLOGY IN PROSTHODONTICS: A very unique addition silicone impression material is formed as a result of consolidation of Nano-fillers into the vinyl poly siloxanes. The physical property of flow and chemical property of adhesiveness is severely improved as a result of the addition of nano-fillers. Also the hydrophilic property is enhanced, results into a better pouring and improved precision of the model[15] Implants, which are now gaining popularity, come in direct contact with the tissues. The property of the implant material can be improved too using Nano-technology. In comparison with conventional implants, this will have better mechanical properties and hence superior results.[16]

CONCLUSION: Nanotechnology is still in the preliminary phase and its routine application in dental and clinical settings is yet a long way to go. There is no doubt about the fact that this recent advancements in the nano materials will not enhance the dental experience but come up with some advanced diagnostic aids and potentially absolute treatment and cure. In the years to come, nano-technology will prove to be the most effective alternative to current trends of dental procedures. However, this could be achieved only if the current barriers of the technology are over-comed by the proper sharing and understanding of the application of Nano-technology.

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