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DENTAL HEALTH CARE-CHANGING SCENARIO FROM 1980S, ANCIENT KNOWLEDGE TO 2020S, NANODENTISTRY

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ABSTRACT

Before the onset of synthetic era man has natural tendency to seek for more economical and easily available biological resources for preventive primary health care and other body ailments. Almost all civilization has a history of using medicinal herbs to cure diseases. Ancient literature of Ayurveda and Unani medicines is studded with information, benefits and knowledge in ample about herbal drugs. In the developing country like India mostly people are ignorant towards dental health care. The visit to dental doctors is rare and natural products available at home are most preferred healing practice. Unhealthy food habits and prevalent soft and hard drinks are served which in turn has worsened the scenario in upcoming generations. Moreover the adulterated food and polluted water is further a major concern need to be considered. The trees like Neem and Acacia sticks are still in use as toothbrush and most of the population cannot afford costly medicaments and gels available. Plenty of plant derived products need authentication to treat oral health problem and have been investigated against oral bacteria. The phytochemical have crucial role in inhibiting the growth of oral bacteria and act by reducing the symptoms of oral diseases, their adhesions on tooth surfaces and finally avoiding dental plaque formation. The literature survey and the ancient knowledge of using different plant parts by tribal people in gum pain and as toothbrush have inspired us to explore the potential of leaf, stem and root extracts of medicinal plants as alternative cariogenic agents.

Keywords: Cariogenic, Antimicrobial, Odontalgic, Medicament, Pathogenesis, *S. mutans*

INTRODUCTION

Antibacterial agents serve the purpose of acting against specific conditions of oral diseases especially sub and supra gingival biofilm formation which in turn are major issues in dental health care. With the advancement in technology and awareness in society there is a concern for oral health issues in modern civilization especially dental caries and periodontal diseases. Plenty of synthetic drugs and chemicals are available in markets that have been prescribed as effective supplements in the prevention of oral health diseases but most of them are associated with side effects. Some chemicals and synthetic drugs have pronounced side effects like brown staining of teeth and tongue, toxicity of connective tissue, impairment of taste buds, soreness and drying of the oral cavity, allergenicity and oral desquamation in children **[1]**. The antibiotics available like penicillin and erythromycin might have been prescribed in most cases of oral health issues but possess inherent adverse effects [**2]**. Early treatment of dental caries is less painful and can prevent further infection. Dental caries in turn leads to bad breath and foul tastes and on further spread to surrounding tissues they cause edentulous mouth **[3]**. In the present scenario of pandemic prevalent from past March 2019, most of the people might not be following corona protocols or etiquettes but 75% population solely relying on carrying masks as primary prevention from the corona. Even the type of masks that is available became a controversial issue to consider which type is more resistant or susceptible for corona particles to pass through. In winter it was feasible to carry a mask but in approaching summer it totally becomes helpless to carry when the situation is not feasible. It may lead to dental hygiene related pathogenesis. One of the possible outputs in my concern is to maintain dental hygiene by eating or chewing or keeping some medicinal herb in the mouth to combat to some extent pathogenesis of disease related to teeth's. Plants especially medicinal herbs, shrubs, trees and even weed plant leaf, root; stem and berries have been reported in dental hygiene as therapeutic agents from time immemorial **[4]**. Wu and his coworkers in 2001 described that these chewing sticks or other plant parts work in a collaborative way by cleaning mechanically and in leaching out of oral microbiota **[5]**. Donatan and Costertor in 2002 supported the theory by further adding that stress conditions like low ph, high osmolarity, extreme shortage or excess of nutrients along with consumption of antibiotics results in oral adaptation of *Streptococcus mutans* synthesized biofilm formation **[6-8]**. Dental caries is a microbial infection that causes destruction of calcified tissues by localized dissolution of teeth **[9-11]**.

Consuming soft and hot drinks along with fast food and sweetness altogether make the pathogenesis more worsened with time. The condition leads to heart disease, high blood pressure, diabetes and multiple sclerosis with the passage of time **[12]**. The information on natural products and their application has been transferred verbally from one generation to the next. There is still no authenticated data to look upon for these simple remedies due to lack of communication and restrictions to particular regions or religions. The side effect and financial burden have shifted the interest of almost 40% population to herbal products and the situation will be changed further far beyond the emerged 21st century **[13]**. Literature cited a large number of medicinal plants from Asia **[14]**, Africa **[15]** to have different plant parts utility in oral hygiene. They reported the importance of the chewing stick from medicinal plants to be more efficient than modern time bristles/ brushes. The process increases salivation and thus helps in the killing of oral pathogens. The major concern is on avoiding dental hygiene, a biofilm formation starts at the beginning which is solely credited by oral pathogen *Strepococcus mutans,* a streptococcus by nature which in turn initiates dental caries **[16, 17]**. It is described that in general procedure polyphenols present as the bioactive substances in plants bind to proteins and nucleic acids via reversible interaction. Methanolic extracts of plants are mainly reported as methanol being less polar help in the extraction of maximum phenolic compounds by releasing them from cell wall-bound polyphenols. Most of the bioactive components get extracted using methanol as a solvent system as compared to other solvents being more potent as revealed in literature [**18]**. Although the mode of action and bioactive components involved behind has not been investigated in most of the cases and very few articles discussed the mechanism of dental pathogenesis **[19]**. Medicinal plants offer alternative solutions to these antibiotics preferred or prescribed in oral health care. The adverse effects like hypersensitivity, staining and infection to surrounding tissues can be combated using natural and economical resources available as therapeutic agents. Oral bacteria can also be controlled using medicinal plant extracts as a literature survey clearly depicts their importance in folklore medicines to maintain oral hygiene [**20**, **21]**. Polyphenols are considered as good donors of hydrogen which helps in hydrogen bonding which enables strong binding to nucleic acids and proteins. Indian ancient literature is flooded with medicinal plants which possess utmost potential against cariogenic pathogens as antimicrobial agents and mostly chewing sticks from the stem of

trees, roots of weeds and leaves of small herbs have been reported to have potential as alternative agents against dental pathogens [**22]**. The use of plants as sticks of Acacia and Azadirakhta is a very common practice till today and their use as toothbrushes has been well documented [**22]**. Most of the literatures on the antimicrobial activity of plants and their phytochemicals have major concerns regarding antibacterial activity against planktonic bacteria in comparison to biofilm-forming bacteria which are considered resistant strains [**23**]. In India, ancient knowledge needs to be exploited and explored as medicinal plants contribute a large fraction for medicines. Pharmaceutical, food industry, agriculture and cosmetics, all sectors have documented the cost effective/ economical herbal products with no side effects. The plant kingdom is a rich bio-reserve of phytochemicals and secondary metabolites most of which are already exploited for medicinal and other drug development processes [**24, 25**]. Sohaibani and Murugan described the chewing sticks from meswak (*Salvadora persica*) to be used as a cleaning and antibacterial agent **[26]**. These irreversible reactions of synthetic drugs and chemicals have urged the need to prefer natural herbal products and other medicinal plants available in the vicinity at lower cost and with lesser side effects [**27**]. *Streptococcus mutans* is considered the main causative agent in dental plague formation and pathogenesis of dental caries. It produces acids that dissolve tooth structure in presence of sucrose, fructose and glucose like carbohydrates [**28**]. While plague is nothing but a sticky substance that by mixing with saliva, acids and food debris form a film on teeth surfaces by adhering to them. This in turn initiates pathogenesis or tooth decay, if not cleared thoroughly in routine processes under dental hygiene [**29]**. The above said side effects propel the mass shifting towards herbal natural products and medicinal plants thereof which can serve as potent medicaments for different teeth caries. They need to be used synergistically along with conventional medicines; however the safety concerns needs to be explained first.

1. Defined Dental Caries and Effects

There are nearly about 700 different types of bacteria inhabiting in oral mouth of a person. High level of sugars, bacterial adherence and starch are main causative agents of tooth decay. Eating starch rich foods results in sticky plaque which turns into calculus or tartar. Cavities' arise due to acid production due to bacterial mediated action on sugars. This in turn dissolves the teeth structure making holes and cavities. So it is also called dietobacterial disease. The acid generated cause phosphate and calcium deficiency in enamels causing

demineralization. Fluorides needs to be topically present on teeth surface as most of the toothpaste does have it which maintain a low level of fluoride in mouth. This in turn not only prevents teeth decay at initial stages of plague formation but also slowdown demineralization **[30]**. Dental caries inhabitate two different areas of teeth that are:

1.1. Occlusal caries: which develop on topmost part where food particles adhere on teeth. The bacteria get attached here and start initiation of sugar digestion into acids. Dimeneralization starts and cause a mole formation which is very first step for dental caries.

1.2. Interproximal Caries: is formed in between the teeth. Bacteria attach here and start degradation of sugars into acids and same as Occlusal cause dimeneralization and beginning of dental caries.Teeth are unable to counter this attack and dimeneralization further enhanced. Enamel starts breaking down and acid penetrates into the teeth, overall teeth get destroyed both from inside and outside. So we need to reduce sugar intake in diet on daily basis.

2. 1980s Ancient Knowledge Domain

The plant has been shown to be a safe and natural way to avoid mouth illnesses. *Streptococcus mutans* is primarily associated with enamel lesions formation and dental caries [**10**]. The medicament has side effects of vomiting, teeth staining and diarrhea. Moreover toxicity concerns divert common people to natural products and are in limelight including natural antifungal agents and plant extracts using different plant parts [**13**]. Five tropical plants, *B. frutescens, G. glabra, K. pandurala, P.angulala,* and *Q. infectoria,* had significant antibacterial action against *Streptococcus mutans* when extracted in methanol [**31]**. Park and his coworkers reported anticariogenic activity of *Callistemon citrinus* extracts against cariogenic pathogen *Streptococcus mutans*. Volatile oils called leptospermone from plant is active against herbicide cause unique bleaching symptoms or susceptible weed species **[32]**. The medicinal plant extracts in dentistry could provide a wide horizon for health care services in India beyond the 21st century **(Table 1)** [**33**].

Table 1: Major medicinal plant and parts used against cariogenic pathogens

S. No.	PLANT	S. No.	PLANT
1.	*Chenopodium botrys*	12.	*Acacia nilotica*
2.	*Spilanthus acmella*	13.	*Turmeric(Curcuma longa)*
3.	*Cocos nucifer*	14.	*Piper cubeba*
4.	*Moringa citrifolia*	15.	*Morus alba*
5.	*Azadhirakhta iindica*	16.	*Schinustere binthifolius Raddi*
6.	*Prosopsis spicigera*	17.	*B. frutescens*
7.	*Anacardium occidentale*	18.	*G. glabra*
8.	*Chenopodium ambrosioides*	19.	*K. pandurala*
9.	*Achyranthes asper*	20.	*P .angulala*
10.	*Punica granatum*	21.	*Q. infectoria*
11.	*Trachyspermum ammi*		

Wood, bark, leaf and fruits were used to determine MIC assay against *Streptococcus mutans*. Ethanolic extracts were prepared and fruit extracts were found to be best in inhibiting *Streptococcus mutans* and hexane extracts were also effective. Leaf resulted in zone of 15.8 at 5mg/disc and fruit resulted in zone of 19.1 at same concentration. Fruit were better in inhibition followed by leaf in turn by wood extracts and that in turn better than bark. MIC of fruit extract was 31.2 µg/ml and hexane fraction results in 3.9ug/ml. Hexane was better solvent than ethanol and all other solvents used. At 50ug/ml of extract examined, the plants *G. glabra, K. pandurala* and *P. angulata* showed quick bactericidal activities against *Streptococcus mutans* within 2 minutes. Many medicinal plants, such as *Acacia, Albizzia, Bridalia grandis, Drosera paltata, Erthrina variegate* have been found to be effective against streptococcal bacterial strains such as *S. sobrinus, S. mutans, S. oralis*, and lactobacillus species according to [**34]**. Khan and his coworkers reported that plant *Trachyspermum ammi* (Ajowan caraway) poses a novel potential chemotherapeutic agent naphthalene derivative which acts by preventing biofilm formation and anti adherence activity against *Streptococcus mutans*. The bioactive component was isolated using silica gel chromatography and identified using FTIR, NMR. At 39.06mg/ml concentration the compound cause 50 percent reduction in bacterial adherence and at 78.13mg/ml prevents antibiofilm activity. The component also prevents ph reduction and reduces water insoluble glucan synthesis **[24]**. Lauryl sodium sulfate acts as a surfactant is mixed with these plant extracts results in antimicrobial action [**35**]**.** *Punica granatum* prevent plague formation which has been listed *in vitro* where plant powder inhibits the adherence of *S. sobrinus, S. mitis, S. mutans* and (*C. albicans*) to glass in presence of sucrose. Recently phytochemicals have been a part of the defense system to fight against oral pathogens [**36**]. Almost all civilization has exploited the medicinal plants for curing disease **(Table 4)**. Different plant parts like stem, seeds and essential oils along with leaves extracts have been mentioned in literature to cure teeth decay [**37]**. Essential oils have been extracted from natural products which have cariogenic potential against various microbial and fungal infections [**38**]. *Drosera peltata* (*Droseracea*) chloroform extracts from the aerial part of this plant have been reported to have significant activity against *S. sobrinus* and *S. mutans.* Plumbagin has been found as an active component involved in inhibiting these bacterial

strains. Eugenol commonly used as a pain reliever is extracted from *Syzygium aromaticum*. Neem leaf extract have been commercialized and sold as dental gels for primary oral health care. Benzoin extracted from *Styrax tonkinensis* is another oral disinfectant [**27**]. A compound flavones phytolexins has been extracted from *Sopphor aexigua* (*Leguminosae*) which have been found to be most active against cariogenic bacteria. Two active isoprenyl flavonones namely atrocarpin and artocarpesin were isolated from *Artocarpus heterophyllus*. *Camellia sinensis* has bacteriocidal effects on oral bacteria acting by inhibiting glucan production and amylases and avoiding bacterial adherence on tooth surfaces.

In addition, phytochemicals such as flavonoids, polyphenols, alkaloids, and terpenoids were discussed in relation to the healing of infectious dental disease. Researcher reported bacteriocidal effect of leaves of *Solanum nigrum* and *Phyllanthus niruri* on cariogenic pathogen. Alcoholic extracts were prepared using leaves from both plants. Mann Whitney test was used to test against *S. sanguis*, *S. salivarius*, *S. oralis, S. mutans* and *L. acidophilous* [**39]**. The leaves extract of *Phyllanthus niruri* were less effective compared to *Solanum nigrum* ranging zones from 9.6 to 11.6nm while *Solanum* resulted in zones in range of least 12.3 to 14.6nm. MIC value against *L. acidophilous* was 25mg/ml for *Solanum nigrum* and 50mg/ml for *Phyllanthus niruri*. MIC and MBC against *S. mutans* were 100 and 200mg/ml, while against *S. oralis* MIC and MBC were 50 and 100, while against *S. salivarius* it is 10 and 200mg/ml and in last against *S. sangusi* it is 100 and 200mg/ml. Plants have been used from time immemorial in dental caries. The usefulness of medicinal plant extracts in cariogenic action as a natural alternative to reduce oral infection disease owing to microbial growth is reported by [**27]**. Researcher tested leaf and fruit extracts from nineteen medicinal plants against four cariogenic bacteria. The extracts were tested against *L. acidophillus, L. casei*, *S. mutans*, and *S. aureus* using agar well diffusion with organic solvents like ethyl acetate, methanol, hexane and distilled water. Methanol, ethyl acetate extracts of leaves were found to inhibit cariogenic pathogens, but fruit extracts were found to be more potent than leaves extracts. *Coroupita guianensis* has a maximum zone of 19-25mm (Fruit). The zone size was much larger than the conventional antibiotic tested which gave a zone of 19mm against *L. casei* when using erythromycin. The MIC value found was 0.16 mg/ml. In phytochemical study, alkaloids were found to be a prominent component in all plant sections. Cardiac glycosides, steroids, terpenoids, and

phenolic substances were found in methanolic plant extracts of *C. quianensis*. A group of researchers found the efficacy of probiotic experimental based mouthwash containing zamzam water having characteristics attributes of having higher amount of calcium and magnesium in comparison to ordinary water against *S. mutans* [**40]**. The water contains calcium, sodium, potassium, fluorine, magnesium, chlorine, bicarbonate, nitrate, sulfate and totally dissolved salts. As water is chief constitute of mouthwash so Zamzam (Holy water) water was tested for this efficacy against *S. mutans*. Moreover the water having no biological growth and vegetation found in ordinary water and compared them with Hexitol mouthwash containing chlorohexidine hydrochloride which have been considered as antiplague and antigingivitis and broad spectrum antimicrobial activity. Agar disc diffusion method depicts that Zamzam water showed a zone of 12.70mm after 24hr which increase in size after 72hr. Experimented mouthwash showed significant higher zones of inhibition (9.2) than standard hexitol (1.5). Agawi and his coworkers in 2020 reported Cannabigerol- a phytoactive minor phytocannabinoid extracted from *Canabis sativa* to be active against *Streptococcus mutans.* The researcher reported halt in proliferation of bacteria by altering membrane properties causing hyper-polarization which in turn decrease membrane fluidity and further decrease in metabolic activity of pathogen. The component also prevents drop in ph caused by bacteria [**41]**. Ancient history of curing oral disease is not well documented or say are passed on verbally from one generation to next and the need of hour is to document these herbal oral hygiene products available in plenty and to test clinically for societal health care.

3. 2020s, Nanoparticles as advance tool in dental health

Nanoparticles have conquered almost every sector including health, cosmetics, agriculture, food, space, feed and chemicals [**42]**. Owing to their enhanced biological activities and magnetic, optical and thermal conductivity in comparison to bulk size materials green route synthesis have been preferred by researchers over physical and chemical synthesis being restricted in scaling up and toxicity concerns respectively. The one step economical and eco-friendly synthesis along with easiness to scale up have attracted the scientific community to divert to living organism like bacteria, fungi, algae and plants which in turn are capable of reducing metal ions to stable nanoparticles without any side effects. People in India have documented the synthesis even a traditional Indian medicine (Bhasm) more than 200years before. The literature is flooded with green

synthesis nanoparticless using plant extract from different plant parts of different plant species. Even the agriculture and industrial waste has been reported to generate stable nanoparticles [**43]**. The plant secondary metabolites conjugate with nanoparticles and enhance the bioactivities and catalytic properties. These nanoparticles can be further exploited for purification of compounds and in turn to be utilized in food safety and drug delivery system. Green synthesis mainly involves redox reaction which in turn depends upon phytoconstituents/secondary metabolites such as terpenoids, alkaloids, poly-phenols, alcoholic compounds amino acids, glutathione, antioxidants polysaccharides, organic acids and quinines. Flavonoids have been well documented in literature as major molecule for green synthesis of nanoparticles. Most of FTIR analysis revealed the clues on bio-molecules involved in stabilizing and reduction of metals ions containing compounds with OH, COOH and NH_2 group of mono-terpenoids, sesquiterpenes and phytols. Terpenoids from *Andrographis paniculata* leaves have been used for green synthesis of zinc nanoparticles while chlorogenic acid has been observed as reluctant in synthesis of gold nanoparticles indicating OH functional group [**44]**. The nanoparticles used in cariogeny have been tabulated for easy observation **(Table 2)**.

Nanodentistry is an emerging field undergoing advancements in the branch of medicine and healthcare, one of the core areas being dentistry. Humankind for ages has suffered the ailments of the oral cavity ranging from dental caries, infection, gingivitis and many more, the use of Nanoparticles has emerged as a champion to tackle these issues. Oral cavity is a storehouse of various bacteria which can cause many painful and troubling conditions in humans. The plaque biofilm is the major cause of dental carries, peritonitis and other dental ailments which work by protecting pathogenic microorganisms from external drug agents and escaping the host defense mechanisms. To promote biointegration some nanobased design show exact similarity in mechanical and structural properties to native tissues. Dentition renaturalization, therapy for dentin hypersensitivity, complete orthodontic realignment, covalently bonding diamondized enamel, enhancing properties of root canal sealers, and continuous oral health maintenance using mechanical dentifrobots are major sectors dealing in evolution of new science called nanodentistry.

Table 2: Types of nano particles and their uses

Name Of The Nano-Particle	Usage	Advantages	Toxic Effects	Citations
Carbon Nanotubles	Teeth filling	Large surface area, Easy adherence on tooth surfaces, Dentin, Cementum.	Inflammatory induction, Fibrotic reactions owing to crossing membrane barriers.	[45], [46]
Graphene	Reduce biofilm formation, Imlantation and Tooth Coating applications.	Cost effectiveness, Fracture resistant, Low density form a uniform crystal lattice	Shape, Size, and Oxidative state of grapheme induce toxicity	[47],[48]
HydroxyApatite (Hap)	Retard auxiliary demineralization, Reduce dental hypersensitivity, Good cavity filler, , Enamel surfaces repairment	Easy integration into the dental tubules. Same composition as of bone and teeth, Biocompatible, Artificial Enamel coating on tooth surface, Reform periodontal shortcomings	Production of protein-particle complexes, Get killed by macrophages in tissues. Dispersed into lungs, spleen, and liver by blood. Toxicity concern, Inflammatory response, signaling pathway, and Oxidative stress	[49]
Zirconia	polishing agent Reduction in adherence on tooth surface,	Similar composition to bones and teeth, Low cytotoxicity, Sensible biocompatibility, High fracture resistance.	Short- and long-term risks like DNA damage in human T-cells Induce apoptosis, inhibition of cell proliferation in human mesothelioma and rodent fibroblast cell lines. Cellular oxidative stress causing cell mortality.	[50]
Silica	Tooth filling agent, Surface polishing, Reduce hypersensitivity.	Biocompatible, low toxic effect, Low density Significant adsorption ability Cost effective. Reduce roughness of teeth while polishing	Induce silicosis ,Lung cancer, Oxidative stress; Mediate apoptosis	[51]
Titanium	Dental implants	Surface modification, Less bacterial adhesion, Improved hardness	Toxic level can induce cancer in long terms on inhalation. Build up inside the brain by crossing blood-brain barrier in the region of cortex and hippocampus.	[52]
Silver	Dental implants Antimicrobial agent, , Dental prosthetics, Dental restorative material	Reduce bacterial colonization, Penetrate bacterial membrane owing to smaller size. Biocompatible, Low toxicity and Long-term antibacterial activity	Inhibition of Na-K-ATPase. LysosomalAcP activation, Actin disruption, oxidative stress production, Genotoxicity,	[53],[54]

In case of major surgery Genetic and Tissue Engineering are two emerging sciences which expanded the horizon for possibilities of growing whole new teeth *in vitro* and later can be embedded into sockets [**48**]. The painful operating dental procedures can be replaced using tooth renaturalization methods. The patient may get benefitted with replacement of the lost tooth with regeneration of the tissues. The tissue regeneration using tissue engineering can open new paradigm and relief patients who lost their teeth completely.

3.1. **Hypersensitivity cure** Exploiting nanotechnology to manufacture biological materials can selectively occlude the dentinal tubules and provide painless and permanent cure. These can allay the anxiety and associated pain within minutes of application.

3.2. Orthodontic nanorobots Periodontal ligaments and alveolar bone can be changed directly in periodontium using nanorbots within minutes to hours.

3.3. Dental durability and cosmetics The enamel layers can be replaced using biocompatible pure sapphires and diamonds

having hardness and strength almost 20-100 times more than natural enamel and ceramics leading to longevity of teeth.

3.4. Dentifrobots are nanorobots incorporated into dentifrices and mouthwashes that help to clean organic residues by moving throughout the gingival tissues at a speed of approximately 10 microns/second, continuously preventing the accumulation of calculus. They can also be deactivated when accidentally swallowed by the patient. Dentifrobots can selectively identify and destroy pathogenic bacterial species in plaque bio-films and prevent halitosis [**53**].

3.5. Dentin Hypersensitivity Reconstructive dental nanorobots are able to selectively and precisely block dentinal tubules, offering a quick and permanent cure. These nanorobots travel toward the dental pulp via the dentinal tubules [**54**]. Desensitizing toothpaste containing 15% hydroxyapatite nanoparticles has been found to be effective in reduction of dentin hypersensitivity clinically even after single application for a period of 4 weeks.

3.6. Nanorobotic Local Anesthetics Nanorobotic local anesthetics are composed of a colloidal solution of activated nanosized local anesthetic molecules. When applied to the gingival or the oral mucosa and signaled, the anesthetic travels via the epithelial and connective tissues of the gingiva to reach the pulp, thus providing selective anesthesia[**54**].

Lipsky and her coworkers in 2021 described the genuine factors like sex and gender difference or approach to oral hygiene stating men are more ignorant to oral hygiene and more prone to oral cancer, dental trauma and periodontal disease as compared to women who are more frequent in visiting dentist in case of even minor pains**[55].** Aloyuny and co-associates in 2021 reported that oral products available as such have many side effects like drying of lips, burning and painful erythematous swelling, intra- orally chapped, dry, painful swollen lips. The medicaments whether nano-based or herbal should have precautionary measures written on products. Certain components like sodium lauryl sulphate, menthol, eucalyptol, fluoride, and thymol peroxide, benzoic acids are major reason for oral mucosal inflammation irritation, pigmentation and in end allergic reactions **[56].** Nanoparticle based medicaments needs to address the toxicity concern and these symptoms which are reported using chemical oral solutions in comparison to herbal products have time tested efficacy still in 2020s.

CONCLUSION

The future solely depends upon scientific fields like pharmaceutical, medicine and nutrition. The remarkable altered

characteristics of bio-genically synthesized nanoparticles have the advantage of being utilized to control viral and bacterial diseases by controlling bodily infections. Nanomedicine have a strong impact being potential agents in disease diagnosis and treatment, developing surgical devices and other commercial health products. Our present review enlisted organic extracts and green route synthesized different nanoparticles having immense potential as a cariogenic alternative .Biogenic synthesis gives remarkable progression over chemical and physical methods being cost-effective, eco-accommodating and effectively scaled up for large-scale synthesis. Advantages of synthesis from plant extracts have various profits like the hygienic working environment, health and environment shielding, low wastage and highly stable products. Biosynthesized nanoparticles could be used in toothpaste, mouth wash and mouth fresheners to make it more effective. Antibacterial activity of clinical cotton bandages dipped in Nanoparticle solutions showed good antimicrobial activities which open the door for antimicrobial bandages, tissues and diapers for babies in future.

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