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Assessment of Antibacterial potential of different Toothpastes and Toothpowders against Mouth flora

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ABSTRACT

Dental care is one of the important aspects of human sanitation which unfortunately receives less attention in the small cities and towns that lead to the major dental complication results in the form of decay or cavity in the tooth due to that patient must undergo a clinical procedure that involves root canal to removal of the teeth. The study was carried out to access the antibacterial potential of the different toothpaste and tooth powders available in local market against the isolated mouth microflora from fifteen different samples(include tooth scraping and swabs) collected from various dental clinics and from people with different age group ranging from 5-35yrs.The six different isolates namely E. coli, B. subtilis, Streptococcal spp, S. aureus, Lactobacillus spp. and Pseudomonas spp. were frequently encountered from mouth flora, antimicrobial efficacy of different toothpaste including conventional, herbal and toothpowders were studied by agar well diffusion method, the data obtained from the complete investigation it had shown that toothpaste formulation having active ingredients such as fluoride, triclosan were more effective in controlling the oral microflora whereas herbal based products are equally effective as the other formulations but not superior to them, whereas the toothpowder formulations was less effective in controlling the oral flora.

Keywords : Oral flora, Antibacterial potential, Toothpaste, Toothpowders

Introduction:

Our day begins with the toothpaste. We aim to maintenance of good dental hygiene by use of toothpaste because dental care is one of the aspects of human sanitation, which unfortunately receives scanty attention. Most of the people use toothpaste without knowing their potential efficacy, bacteria form an important group of micro-organisms found in both healthy and diseased mouths. There have been more than 300 types of bacteria found in the mouth; it's a very serious matter to select the effective toothpaste or powder to prevent teeth from microbial attack preventing the principle dental diseases like dental plaque, dental caries, gingivitis and periodontitis. The purpose of oral hygiene using toothpaste is to reduce oral bacterial flora, mouth bacteria have been linked to plaque. Plaque is a complex biofilm found on the tooth surface that is a major cause of the development of dental caries (Benson *et al*., 2004). The accumulation and development of plaque depends upon the outcome of the interactions between the adhesiveness of plaque to the tooth surface and the physical shear forces which serve to dislodge and remove the plaque (Roberts *et al*., 2005). Dental problems are of three types, formation of dental plaques, dental caries and periodontal diseases. (Clarke, 1924).

Dental caries is a localized, transmissible infectious process that ends up in the destruction of hard dental tissue, *Streptococcus mutans* is the main opportunistic pathogen of dental caries. There are diverse types of mouth bacteria some are useful, others are humful: *Neisseria, Staphylococcus, S. pneumoniae, Porphyromonas gingivolis, Diptheroids, Fusobactaria, Haemophilus, Spirochetes, E. coli, Lactobacilli and Bacillus* (Yost *et al.,* 2005).

Toothpaste is classified as drugs not cosmetics, different brands of toothpastes and toothpowders contain effective antibacterial ingredient either which is a broad spectrum antibacterial agent and effectively reduce mouth bacteria and contribute to dental health. (Regos *et al.,* 1974). Triclosan, a low-toxicity, non-ionic phenolic derivative with a wide spectrum of antimicrobial activity has been successfully incorporated into toothpastes and mouthrinses, resulting in moderate but distinct positive effects on both dental biofilm and marginal inflammation or gingivitis, the antiseptic activity of triclosan is due to its ability to block the synthesis of fatty acids by inhibiting the enoyl-acyl carrier protein reductase enzyme. The active agents that are incorporated into treatment form include surfactants, antibacterial agent, baking soda, peroxide, metal salt, herbal and natural extracts, and chlorine dioxide (Williams and cummins, 2003).

Natural toothpastes are those without triclosan or fluoride. They usually contain natural ingredients such as special mineral salts like Sodium fluoride and sodium chloride, and plant extracts like lemon, eucalyptus, rosemary, chamomile, sage and myrrh. There are toothpastes and other remedies that help kill and prevent bacteria in people's mouths.

Materials and methods:

The fifteen different samples from various dental clinics and from people with different age group ranging from 5-35yrs. was collected and were further processed for the isolation and identification of an organism. The six different isolates namely *E. coli, B. subtilis, Streptococcal spp, S. aureus*, *Lactobacillus spp*. and *Pseudomonas spp*. were frequently encountered from mouth flora. The confirmation of isolates was done on the basis of cultural, conventional, biochemical characteristic and on enzyme study (Bergey´s, 2001).

Four different toothpastes including conventional, herbal and two toothpowders were isolated to study the antibacterial efficacy of them against the oral mouth flora. The survey was aimed at knowing the brands of toothpaste that are mostly used and are randomly purchased from the market. The antimicrobial efficacy of different concentrations i.e. 2%, 4%, 6%, 8%, and 10% of the toothpastes and toothpowders was determined by modified agar well diffusion method (Popoola *et al*., 2007, Barry *et al*., 1991).

Table 1. Active ingredients in various toothpastes with their role.

Ingredients	Oral condition, disease or health property claimed to be benefitted by products
Fluoride	Antibacterial, make tooth more resistant to the formation of dental caries, promotes remineralization of tooth enamel.
Triclosan	Antibacterial and antifungal.
Peroxide	Antimicrobial, bactericidal.
Baking soda	Abrasive (Antimicrobial agents).
Sodium bicarbonate	Tooth whitening.
Garlic	Antiviral, Antibacterial.
Ginger	Prevents and relieves nausea, antibacterial, anti-inflammatory.
Spearmint, peppermint	Flavors and freshness.
Clove	Antibacterial, analgesic.
Detergents and surfactants.	Carry away debris, dissolve plaque and have significant antibacterial properties.
Phosphates & polymers	Prevent the bacterial enzyme activity (antibacterial)
Silica	Abrasives and antibacterial agents.
Chlorides and nitrates	Strong antimicrobial.
Vitamins	Makes stronger teeth.

Results:

Table 2. Isolates obtained from the patients.

Sample ID.	Gender	Age grp.	Address	Isolates
A	M	35	Akola	Pseudomonas
B	F	22	Akola	S. aureus, E.coli
C	F	22	Akola	S. aureus, Pseudomonas
D	F	21	Akola	E.coli
E	F	40	Babhulgaon	E.coli
F	M	16	Digrus	S.aureus
G	F	5	Babhulgaon	B.subtilis,S. aureus
H	M	11	Babhulgaon	Lactobacillus
I	M	10	Babhulgaon	Pseudomonas
J	F	8	Babhulgaon	B.subtilis, E.coli
L	F	9	Babhulgaon	S. aureus
M	M	10	Babhulgaon	Pseudomonas
N	M	10	Babhulgaon	Streptococcus
O	F	9	Babhulgaon	S. aureus
P	M	11	Babhulgaon	S. aureus, E.coli

Table 3: Diameter of zone of inhibition by well agar diffusion method for T1 toothpaste.

Name of organism	Diameter of zone of inhibition				
	Dilution of toothpaste (%)				
	2%	4%	6%	8%	10%
Lactobacillus spp.	10mm	11mm	14mm	24mm	26mm
Bacillus subtilis.	8mm	10mm	14mm	14mm	17mm
Streptococcus spp.	12mm	14mm	20mm	29mm	32mm
Staphylococcus aureus.	10mm	12mm	18mm	22mm	30mm
Escherichia coli.	12mm	16mm	18mm	21mm	27mm
Pseudomonas spp.	9mm	12mm	13mm	14mm	14mm

Table 4: Diameter of zone of inhibition by well agar diffusion method for T2 toothpaste.

Name of organism	Diameter of zone of inhibition				
	Dilution of toothpaste (%)				
	2%	4%	6%	8%	10%
Lactobacillus spp.	11.5mm	13mm	15mm	20mm	26mm
Bacillus subtilis.	10.2mm	14mm	16.1mm	18mm	25mm
Streptococcus spp.	8mm	10mm	14mm	15mm	18mm
Staphylococcus aureus.	12.3mm	15mm	19.1mm	24mm	25mm
Escherichia coli.	10mm	12.5mm	16.5mm	18mm	23.1mm
Pseudomonas spp.	11mm	11mm	13mm	13mm	15mm

Table 5: Diameter of zone of inhibition by well agar diffusion method for T3 toothpaste.

Name of organism	Diameter of zone of inhibition				
	Dilution of toothpaste (%)				
	2%	4%	6%	8%	10%
Lactobacillus spp.	07mm	10 mm	14 mm	16mm	18 mm
Bacillus subtilis.	10mm	13mm	14mm	18 mm	22mm
Streptococcus spp.	12mm	13.5mm	14mm	18 mm	20.2mm
Staphylococcus aureus.	10.5mm	13.2mm	14.6mm	18mm	21.1mm
Escherichi coli.	7mm	8 mm	10mm	12 mm	14 mm
Pseudomonas spp.	6mm	9 mm	10 mm	12mm	14mm

Table 6: Diameter of zone of inhibition by well agar diffusion method for T4 toothpaste.

Name of organism	Diameter of zone of inhibition				
	Dilution of toothpaste (%)				
	2%	4%	6%	8%	10%
Lactobacillus spp.	10mm	12mm	18mm	20mm	22 mm
Bacillus subtilis	16.2mm	18mm	20mm	22 mm	23mm
Streptococcus spp.	10mm	12.2 mm	13.6 mm	14.1mm	15 mm
Staphylococcus aureus	9 mm	10 mm	11 mm	12mm	14.2mm
Escherichia coli	10mm	12 mm	15 mm	17 mm	19.2mm
Pseudomonas spp.	10mm	12 mm	14mm	14.6mm	15 mm

Table 7: Diameter of zone of inhibition by well agar diffusion method for T5 toothpowder.

Name of organism	Diameter of zone of inhibition				
	Dilution of toothpaste (%)				
	2%	4%	6%	8%	10%
Lactobacillus spp.	8mm	10 mm	12 mm	12.6mm	13.2mm
Bacillus subtilis	9mm	12mm	14.2mm	14mm	15.1mm
Streptococcus spp.	8mm	9 mm	12.2 mm	14 mm	16mm
Staphylococcus aureus	9mm	12 mm	14mm	14.6mm	15.8mm
Escherichia coli	10mm	12 mm	12.6 mm	14.1mm	15 mm
Pseudomonas spp.	10mm	10mm	11 mm	13 mm	13.8mm

Table 8: Diameter of zone of inhibition by well agar diffusion method for T6 toothpowder.

Name of organism	Diameter of zone of inhibition				
	Dilution of toothpaste (%)				
	2%	4%	6%	8%	10%
Lactobacillus spp.	9.2mm		9.6mm	10.2mm	10.6mm	11 mm
Bacillus subtilis	7 mm		10mm	11 mm	11.8mm	12.2mm
Streptococcus spp.	6.4mm		7mm	7.8mm	8mm	8.9mm
Staphylococcus aureus	8 mm		9 mm	10.2mm	11.2mm	11.6mm
Escherichi coli	8mm		9 mm	10.2mm	11.3mm	12mm
Pseudomonas spp.	8mm		10 mm	10.3mm	11 mm	11.8mm

Discussion:

The mouth flora varies from person to person as per the diet; some people eat foods with more sugar than others. This would cause more bacterial growth and plaques in the oral flora than someone who eats healthier food (Williams and Cummins, 2003).

The fifteen different samples from various dental clinics and from people with different age group ranging from 5-35yrs. was collected and were further processed for the isolation and identification of an organism. The six different isolates namely *E. coli, B. subtilis, Streptococcal spp, S. aureus*, *Lactobacillus spp*. and *Pseudomonas spp.* were frequently encountered from mouth flora. The confirmation of isolates was done on the basis of cultural, conventional, biochemical characteristic and on enzyme study (Bergey´s, 2001).

Four different toothpastes including conventional, herbal and two toothpowders were isolated to study the antibacterial efficacy of them against the oral mouth flora. The data obtain from present study indicates that all the investigated dental care products exhibited wide variation in effectiveness against all the 6 test organism, a feature may be due to their antimicrobial active ingredients such as fluoride. Effectiveness was based on mean diameter of zone of inhibition produced by toothpastes and toothpowders by well agar diffusion method.

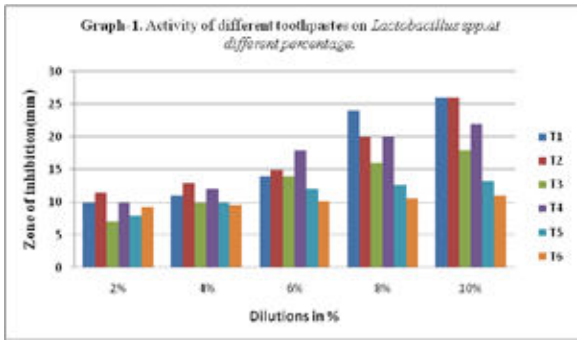
Toothpaste formulation No.1 was significant in controlling the *streptococci* infection from low concentration of 2% showing zone of inhibition 12mm and increase with concentration showing 32mm zone at 10% somewhat similar result was obtained in case of *S. aureus,* our results are in accordance with the result of Manupat *et al.,* 2010 they stated that some toothpaste shows better antibacterial activity against the flora and activity of toothpaste is because of active ingredients triclosan in it.

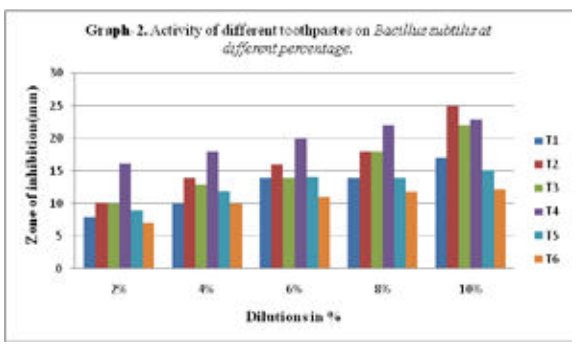
The result regarding the T2 formulation shows maximum zone of inhibition against all the test organism better results was shown 8% and 10% concentration rather than the lower concentration. Fluorides are abundantly used in many oral health products and helps in caries prevention (Grant, *et al*., 1979). Similarly, Jerkins, 1985 also stated that fluoride products such as toothpaste and mouthrinse formulations have shown to reduce caries between 30 to 70% compared with no fluoride therapy.

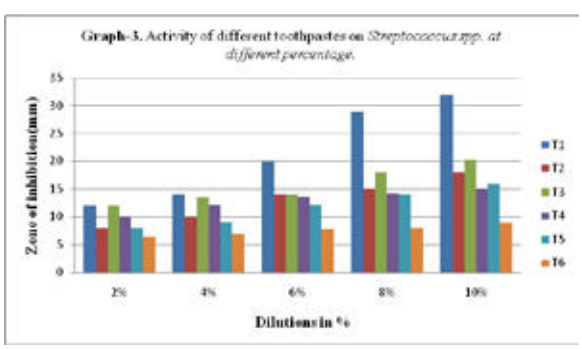
Formulation T3 and T4 are Herbal based products and exhibited least effectiveness as compared to other test formulations. This may be due to the ingredients present, the herbal formulation studied appeared to be equally effective as the fluoride formulations but not superior to them. The antimicrobial activity of the herbs may be due to the presence of secondary metabolites such as alkaloids, flavonoides, polyphenols and lectins. Using natural medicines to cure various diseases has become an increasing train. Hence herbal medicine had made significant contribution to modern medical practice (Almas *et. al*., 2001).

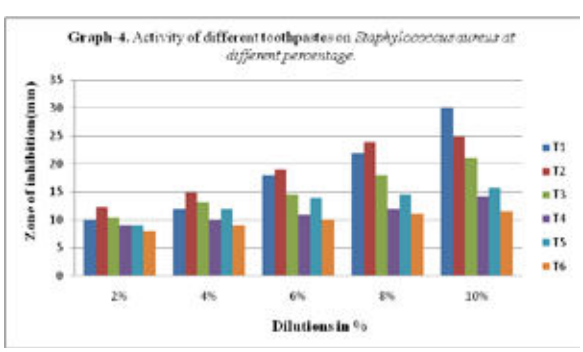
Formulation T5 and T6 are the toothpowders, at the lower concentration of 2% and 4% most of the isolates obtained showed less zone of inhibition whereas, at higher concentration at 10% not as such active results was shown by toothpowders used. Even at higher concentration not too much strong activity was shown.

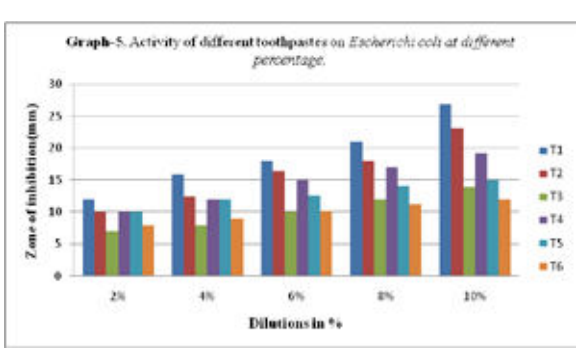
It had shown that toothpaste formulation having active ingredients such as fluoride, triclosan were more effective in controlling the oral microflora whereas herbal based products are equally effective as the other formulations but not superior to them, whereas the toothpowder formulations was less effective in controlling the oral flora.

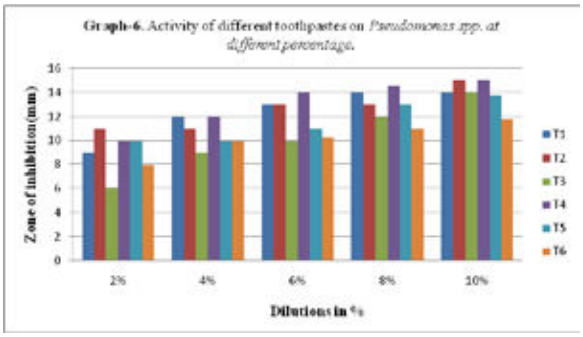












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