

EVALUATION OF MICROBIAL COUNT BETWEEN BAMBOO TOOTHBRUSH AND PLASTIC TOOTHBRUSH



Microbiology

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ABSTRACT

Aim: The purpose of this study was to evaluate and compare the microbial count between Plastic toothbrush and Bamboo toothbrush.

Materials and Methodology: 30 toothbrushes which were divided into 3 groups. Group A: Plastic tooth brush with nylon bristles, Group B: Bamboo toothbrush with nylon bristles, Group C-Bamboo toothbrush with Castor oil seed bristles were used. All the tooth brushes were tested at 3 different time intervals i.e., at base line, 1 week interval and 1 month interval for presence of micro organisms. Sample collection was done both from head and handle of the toothbrush. The samples were inoculated in Glucose broth for 24 hours which were then transferred to sterile agar plates. The microbial count was estimated from each sample.

Results: The microbial counts taken from both heads and handles of all three groups and analyzed at 0 days, 1 week and 1 month time interval and were compared, analysed and interpreted statistically analysed.

Conclusion: Bamboo toothbrush with castor seed oil bristles had more cleaning efficacy when compared to other groups.

KEYWORDS

Bamboo Toothbrush, Nylon Bristles, Plastic Toothbrush, Microbial Count.

INTRODUCTION:

In our daily life, oral hygiene has become a crucial factor[1]. The integral part in the general health of an individual is oral health which reflects overall well-being of an individual either directly or indirectly. By maintaining the oral hygiene the load of the microbes in the oral cavity can be reduced and the oral diseases can be controlled[2]. The principal oral hygiene aid is toothbrush which is used for accomplishing the goal of plaque control and prevent dental diseases[2].

Toothbrushes were introduced in China in 619-907 BC, which consisted of bamboo or bone for handles and hog hair for bristles. Toothbrushes serve as a reservoir of microorganism. They play a significant role in transmission of diseases[5]. According to American Dental Association(ADA), the toothbrushes are oral cleaning instruments designed primarily to promote cleanliness of teeth and oral cavity. Retention and survival of micro-organisms on toothbrush can be possible cause of re-contamination in the mouth[2].

Plastic toothbrush is made from a mix of rubber elements, crude oil and they degrade into smaller micro plastics which are not biodegradable. The Bamboo toothbrush was first invented by a Brisbane dentist in which the handle is made from natural cellulose fibre. When compared to the plastic toothbrushes, bamboo brushes are antibacterial and minimise the microbial count which can be transferred to the mouth.

Nylon was first used as a toothbrush bristles in 1938. Castor seed oil bristles were also used which were made from castor bean oil, castor oil has bactericidal, fungicidal properties and has good biocompatibility[13].

The objective of this study was to compare and evaluate the microbial count between plastic toothbrushes and bamboo toothbrushes.

MATERIALS AND METHODS:

MATERIALS AND METHODOLOGY

The present study was done at Mathrusya child home, Tirupati after obtaining informed consent. The materials used were toothbrushes,

nutrient agar plates, agar media, sterile scissors, inoculation loops, glucose broth, incubator, colony counter.

INCLUSIVE CRITERIA:

Children whose mean age of 12-13 years.

EXCLUSIVE CRITERIA:

- Age below 12 years.
- Having any systemic diseases, oral diseases, using any medications.
- Informed consent not obtained.

Thirty toothbrushes which were divided into three groups and each group including ten toothbrushes in it. Group A-Plastic toothbrush with nylon bristles, Group B-Bamboo toothbrush with nylon bristles, Group C-Bamboo toothbrush with castor oil seed bristles were included in the study. All the toothbrushes were tested at 3 different time intervals at 0 days, 1 week, 1 month.

Aseptic measures for the toothbrush bristles were maintained. The toothbrush were trimmed using sterile scissors and swab were and transferred to petri dish.

Serial dilution of these trimmed bristles was done by pipetting 0.5ml of the bacterial suspension into test tube and was diluted to ten fold.

These diluted samples of bristles and handle were transferred into petridishes with nutrient agar as growth medium. The petridishes were incubated for 24 hours at 37°C. The microbial colony count was done using digital colony counter. The same procedure was followed for all groups at 1 week and 1 month time interval.

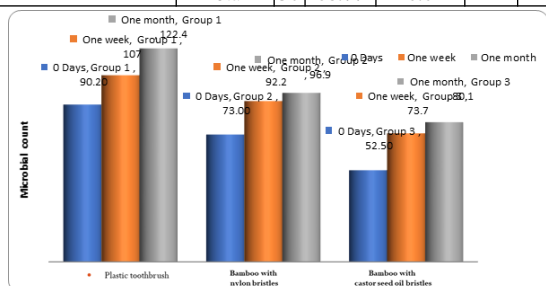
RESULTS:

There was a maximum number of total microbial count of 106.53 CFU/ml ($p \leq 0.05$) on plastic toothbrush with nylon bristles, followed by bamboo toothbrush with nylon bristle which is 87.37 CFU/ml ($p < 0.05$) and bamboo tooth brush with castor seed oil bristles is 68.77 CFU/ml ($p < 0.05$).

The microbial growth is maximum on plastic toothbrush with nylon bristles at 1 month time interval 122.40 CFU/ml when compared bamboo toothbrush with nylon bristles 96.90 CFU/ml and bamboo toothbrush with castor seed oil bristles 80.10 CFU/ml at 1 month time period [Table 1, Graph 1].

Table 1: Intergroup comparison of microbial count on the bristles

		n	MEAN	Std. Deviation	f-value	p value
Group 1 (Plastic toothbrush with nylon bristles)	0 Days	10	90.20	8.43	6.5	0.05
	One week	10	107.00	12.86		
	One month	10	122.40	30.81		
	Total	30	106.53	23.39		
Group 2 (Bamboo toothbrush with nylon bristles)	0 Days	10	73.00	8.11	22.9	0.00
	One week	10	92.20	8.19		
	One month	10	96.90	8.75		
	Total	30	87.37	13.25		
Group 3 (Bamboo toothbrush with castor seed oil bristles)	0 Days	10	52.50	9.65	17.2	0.00
	One week	10	73.70	11.76		
	One month	10	80.10	11.46		
	Total	30	68.77	16.02		



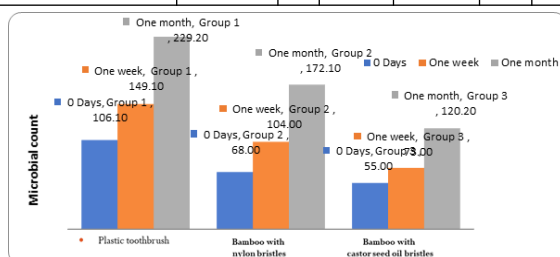
Graph 1: Intergroup comparison of all the bristles

The total microbial growth is maximum on the handle of plastic toothbrush with nylon bristles which is 161.47 CFU/ml ($p < 0.05$) followed by bamboo toothbrush with nylon bristles 114.70 CFU/ml and the growth of microorganisms on bamboo toothbrush with castor seed oil bristles is 82.73 CFU/ml.

After 1 month of use the results showed that there is more number of microbial growth on the handle of plastic toothbrush with nylon bristles 229.20 CFU/ml and least number of microbial growths is seen on the handle of bamboo toothbrush with castor oil seed bristles 120.20 CFU/ml [Table 2, Graph 2 represents].

Table 2: Intergroup comparison of microbial count on the handle of the toothbrush

		n	MEAN	Std. Deviation	f-value	p value
Group 1 (Plastic toothbrush)	0 Days	10	106.10	43.88	13.5	0.02
	One week	10	149.10	53.89		
	One month	10	229.20	61.52		
	Total	30	161.47	73.25		
Group 2 (Bamboo toothbrush with nylon bristles)	0 Days	10	68.00	24.40	21.2	0.00
	One week	10	104.00	39.00		
	One month	10	172.10	42.81		
	Total	30	114.70	56.15		
Group 3 (Bamboo toothbrush with castor seed oil bristles)	0 Days	10	55.00	20.00	14.1	0.00
	One week	10	73.00	23.12		
	One month	10	120.20	38.40		
	Total	30	82.73	39.11		



Graph 2: Intergroup comparison of microbial count on the handle of the toothbrush

DISCUSSION:

Toothbrush plays a major role in the retention or retrieval of microorganisms. These toothbrushes in every day use get contaminated by microorganisms, they transmit and inoculate these microorganisms through the abrasion of gingiva [6]. Oral cavity gets re-contaminated by adherence and survival of microorganisms on toothbrush [2].

The world's first synthetic fiber is nylon. Tooth brushes consisting of nylon bristles absorbs less water and dries faster than natural bristles to minimize bacterial growth [8]. But water from the bristles drain and accumulates at the bottom of the bristles, thus favouring more bacterial growth.

Castor oil is a vegetable oil from castor plant seeds which has good biocompatibility, bactericidal, fungicidal when combined with calcium carbonate [12,13].

The results showed that as the duration of use of the toothbrush increases from base line, 1 week, 1 month, the microbial count of bristles also increases respectively. Raiyani CM et al., 2015 pointed that toothbrush head had heavy contamination when used for 3 months period compared to 1 month used toothbrush. They are considered for transport of microorganisms their retention, growth and they may be the factor for reinfection [3].

Taghreed Almutairi et al., 2014 depicted that contaminated toothbrushes and their bristles during their everyday use plays a key role in the transmission and survival of microorganisms [6].

Nayak L et al., 2016 stated that bamboo toothbrushes have antimicrobial properties, sustainability and biodegradable [14], whereas plastic toothbrushes made of organic and inorganic materials had a positive result with the present study.

Bamboo toothbrushes showed the least amount of microbial growth. Among the bamboo toothbrushes, the one with castor seed oil bristles showed the least microbial growth. This could be due to the fact that the microbes from nylon bristles could drift down to the handle and contaminate the handle of the toothbrush.

CONCLUSION:

Toothbrushes can be a possible cause for contamination by microorganisms, and the use of these toothbrushes repeatedly over a period of time can increase the microbial load in the oral cavity. Toothbrush with castor seed oil bristles could be preferred over nylon bristles because of its less microbial growth and better biobased than nylon bristles.

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