
**“EFFECT OF TWO DIFFERENT
MOUTHWASHES AGAINST COLONISATION OF
STREPTOCOCCUS MUTANS OVER METAL,
SELF-LIGATING AND CERAMIC BRACKETS:
A RANDOMIZED CONTROLLED TRIAL.”**

**By
REG. NO. II0221005**

Dissertation

*Submitted to
KAHER, Belagavi, Karnataka
In partial fulfilment of the requirements for the degree of*

**MASTERS OF DENTAL SURGERY
IN
ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS
(BRANCH – V)**

**DEPARTMENT OF
ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS
KLE VISHWANATH KATTI INSTITUTE OF DENTAL SCIENCES,
KAHER, BELAGAVI, KARNATAKA.**

2021 – 2024

ENDORSEMENT

KAHER, BELAGAVI

Endorsement by the Head of the Department and Principal/Head of the Institution

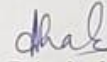
This is to certify that the dissertation entitled "EFFECT OF TWO DIFFERENT MOUTHWASHES AGAINST COLONISATION OF STREPTOCOCCUS MUTANS OVER METAL, SELF-LIGATING AND CERAMIC BRACKETS: A RANDOMIZED CONTROLLED TRIAL" is a bonafide research work done by
REG. NO. II0221005



Head of Department

Dr Rohan Hattarki M. D.S.
Professor & Head,
Department of Orthodontics and
Dentofacial Orthopaedics,
KLE Vishwanath Katti
Institute of Dental Sciences,
KAHER, Belagavi.

Date : 22.04.2024
Place: Belagavi



Principal

Dr Alka Kale M. D.S.
Principal,
KLE Vishwanath Katti
Institute of Dental Sciences,
KAHER, Belagavi.

Date : 22.04.2024
Place: Belagavi

PLAGIARISM CHECK REPORT

Scientific Correspondence and Review Committee



KLE VK Institute of Dental Sciences

A Constituent Unit of KLE Academy of Higher Education and Research
(Deemed-to-be-University u/s 3 of the UGC Act, 1956)

Nehru Nagar, Belagavi - 590 010, Karnataka State

Accredited 'A' Grade by NAAC (2nd Cycle)

Placed in Category 'A' by MHRD (GoI)

☎: 0831-2470362

FAX: 0831-2470640

Web: <http://www.kledental-bgm.edu.in>

E-mail: principal@kledental-bgm.edu.in

Date : 19/4/24

Serial No. : 189

PLAGIARISM CHECK REPORT

Name of the Applicant : REG. NO. II0221005

UG / PG / Ph.D / Staff: PG

Batch & Year : 2021 - 2024

Department : ORTHODONTICS & DENTOFACIAL ORTHOPAEDICS

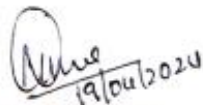
The soft copy of Research Work / Manuscript by entitled

“EFFECT OF TWO DIFFERENT MOUTHWASHES AGAINST COLONISATION OF STREPTOCOCCUS MUTANS OVER METAL, SELF-LIGATING AND CERAMIC BRACKETS : A RANDOMIZED CONTROLLED TRIAL.....”

under the guidance of has been submitted for

Anti-Plagiarism check to the Scientific Correspondence & Review Committee of KLE VK Institute of Dental Sciences using “Turn-it-in” software.

The scan has been carried out and the scanned output reveals a Similarity Index of 7.....%, which is **within** / **not within** the acceptable limits of 10% as per the UGC guidelines.


19/04/2024

Member Secretary

Scientific Correspondence and Review Committee
KLEVK Institute of Dental Sciences
KAHER-Belagavi



Chairman

Scientific Correspondence and Review Committee
KLEVK Institute of Dental Sciences
KAHER - Belagavi

UNDERTAKING

I, **REG. NO. II0221005** , Post-Graduate student in the subject of Orthodontics and Dentofacial Orthopaedics, have completed research work on the topic “**EFFECT OF TWO DIFFERENT MOUTHWASHES AGAINST COLONISATION OF STREPTOCOCCUS MUTANS OVER METAL, SELF-LIGATING AND CERAMIC BRACKETS: A RANDOMIZED CONTROLLED TRIAL**”, in the year 2024.

I have been given to understand that any research work I undertake for dissertation, oral presentation or publication during my study course shall be the property of the KLE Academy Of Higher Education and Research, (KAHER) KLE V. K. Institute of Dental Sciences, Belagavi. Hence, I hereby declare that the name of the Department, Institute, and University shall be mentioned in my publications. The authorship shall be according to the guidelines informed to me.

Signature of the Post-Graduate Student

UNDERTAKING

I, **REG. NO. II0221005**, hereby declare that the information and data mentioned in my thesis entitled **“EFFECT OF TWO DIFFERENT MOUTHWASHES AGAINST COLONISATION OF STREPTOCOCCUS MUTANS OVER METAL, SELF-LIGATING AND CERAMIC BRACKETS: A RANDOMIZED CONTROLLED TRIAL”** belongs to me and is original.

I am aware of the definition of plagiarism as detailed below:

- An act or instance of using or closely imitating the language and thoughts of another author without authorization and the representation of that author's work as one's own, as by not crediting the original author.
- A piece of writing or other work reflecting such unauthorized use or imitation.
- The deliberate or reckless representation of another's words, thoughts or ideas as one's own without attribution in connection with the submission of academic work, whether graded or otherwise.

I hereby declare that the thesis prepared by me is an original one and does not involve plagiarism anywhere. In case at a later stage, it is found that I have indulged in plagiarism, then I am solely responsible for the same and the Institution is at liberty to take any disciplinary action against me including cancellation of the dissertation or any other penalties imposed by the University.

Place:

Date:

Signature of Student

BIOSTATISTICS CLEARANCE CERTIFICATE



KLE V.K. Institute of Dental Sciences

(A Constituent unit of KLE Academy of Higher Education & Research Deemed-to-be-University u/s 3 of the UGC Act, 1956)

Nehru Nagar, Belagavi-590 010 INDIA

Accredited 'A*' grade by NAAC (3rd Cycle) & Placed in Category 'A' by MHRD (GoI)

☎: 0831-2470362

FAX: 0831-2470640

Web: <http://www.kledental-bgm.edu.in>

E-mail: principal@kledental-bgm.edu.in



Biostatistics Clearance Certificate

This is to certify that the Biostatistics aspects of the Dissertation/ Research work of REG. NO. II0221005 **postgraduate student**, under the guidance of

Department of Orthodontics and Dentofacial Orthopaedics, entitled **“EFFECT OF TWO DIFFERENT MOUTHWASHES AGAINST COLONISATION OF STREPTOCOCCUS MUTANS OVER METAL, SELF-LIGATING AND CERAMIC BRACKETS: A RANDOMIZED CONTROLLED TRIAL”** under the guidance has been done under my guidance and considered satisfactory

Dr. Asawari Shidhore

Name & Signature of Biostatistician

Place: Belagavi

Date: 19-04-2024

ABSTRACT

Introduction:

The number of people seeking orthodontic treatment has increased significantly during the last 20 years. During orthodontic treatment, the patient's oral hygiene can impact the effectiveness and timeliness of the therapy. One typical adverse effect of orthodontic treatment is enamel demineralization, often known as white spot lesions surrounding orthodontic appliances. Because permanent appliances have inherent morphologic abnormalities, they create an excellent environment for colonization of microbes. The main microorganism that initiates dental caries is *Streptococcus mutans*.

Thus, it becomes a dire need to maintain the oral hygiene of the patient. The methods to maintain include mechanical and chemical methods. The study aims to assess how two mouthwashes affected the colonization of *Streptococcus mutans* on ceramic, self-ligating, and metal brackets.

Materials and methods:

Metal, self-ligating and ceramic bracket systems were taken and two mouthwashes, fluoride and chlorhexidine containing mouthwashes were taken. Based on the bracket system and mouthwash prescribed, 6 groups were created. There were 14 patients in each of the group. Samples were obtained at T1, T2 and T3 and CFU was counted before and after the use of mouthwash. The values were compared between the groups and sub-groups through statistical tests.

Results:

The results obtained showed that:

- The colonization of *S mutans* at baseline is most in the Ceramic brackets and least in self-ligating brackets.
- The *S mutans* colonization is reduced with both the Chlorhexidine and Fluoride mouthwash at the end of one and three months.
- The effectiveness of Fluoride mouthwash was better statistically in the Ceramic bracket group.

Conclusion:

The use of mouthwash is beneficial in patients undergoing orthodontic therapy. Fluoride mouthwash can be preferred in Ceramic brackets. This is due to the statistically significant reduction in colonization with Fluoride mouthwash.

Keywords: Brackets, Orthodontic treatment, Mouthwash, Chlorhexidine, Fluoride, Ceramic, Metal, Self ligating, *Streptococcus mutans*.

CONTENTS

SL NO.	PARTICULARS	PAGE NO.
1.	INTRODUCTION	1-5
2.	AIM AND OBJECTIVES	6
3.	REVIEW OF LITERATURE	7-11
4.	METHODOLOGY	12-22
5.	RESULTS	23-45
6.	DISCUSSION	46-50
7.	LIMITATIONS OF THE STUDY	51
8.	SCOPE OF THE STUDY	52
9.	CONCLUSION	53
10.	SUMMARY	54-55
11.	BIBLIOGRAPHY	56-62
12.	ANNEXURES	63-69

LIST OF FIGURES

Figure No.	Particulars	Page No.
1.	Dryer to dry the culture plates	18
2.	Inoculating Loop to streak the culture plate	19
3.	Streaking of the culture plate	19
4.	Incubator	20
5.	S mutants on the culture plate	21

LIST OF TABLES

TABLE NO.	PARTICULARS	PAGE NO.
1.	Descriptive statistics of colonisation of S.mutans over different types of brackets in Group 1 mouthwash at different time intervals	23
2.	Descriptive statistics of colonisation of S.mutans over different types of brackets in Group 2 mouthwash at different time intervals	24
3.	Intergroup comparison of colonisation of S.mutans over different types of brackets between 2 groups (2 mouthwashes) at different time intervals	25
4.	Intragroup comparison of colonisation of S.mutans over different types of brackets between different time intervals in Group 1 mouthwash	27
5.	Intragroup comparison of colonisation of S.mutans over different types of brackets between different time intervals in Group 2 mouthwash	28
6.	Pairwise multiple post hoc intragroup comparison of colonisation of S.mutans over different types of brackets between different time intervals in Group 2 mouthwash	29

7.	Intragroup comparison of colonisation of S.mutans between different types of brackets at different time intervals in Group 1 mouthwash	30
8.	Pairwise multiple post hoc intragroup comparison of colonisation of S.mutans between different types of brackets at different time intervals in Group 1 mouthwash	31
9.	Intragroup comparison of colonisation of S.mutans between different types of brackets at different time intervals in Group 2 mouthwash	32
10.	Pairwise multiple post hoc intragroup comparison of colonisation of S.mutans between different types of brackets at different time intervals in Group 2 mouthwash	33
11.	Descriptive (mean) statistics of the difference (T3-T1) and % difference in different groups	34
12.	Intragroup comparison of the difference (T3-T1) and % difference in different groups	35
13.	Intergroup comparison of the difference (T3-T1) and % difference in different groups	36
14.	Studies that show and do not show differences in the effectiveness of Fluoride and Chlorhexidine mouthwash in orthodontic patients.	47

LIST OF GRAPHS

GRAPH NO.	PARTICULARS	PAGE NO.
1.	Mean values of S.mutans colonisation over different types of brackets in Group 1 mouthwash at different time intervals	37
2.	Mean values of S.mutans colonisation over different types of brackets in Group 2 mouthwash at different time intervals	38
3.	Mean values of S.mutans colonisation over Metal brackets in Group 1 and Group 2 mouthwash at different time intervals	39
4.	Mean values of S.mutans colonisation over Self ligating brackets in Group 1 and Group 2 mouthwash at different time intervals	40
5.	Mean values of S.mutans colonisation over ceramic brackets in Group 1 and Group 2 mouthwash at different time intervals	41
6.	Mean values of S.mutans colonisation over different types of brackets in Group 1 and Group 2 mouthwash at different time intervals	42
7.	Mean values of difference between T3 and T1 over different types of brackets in group 1 and group 2 mouthwash.	44
8.	Mean percentage difference between T3-T1 in different types of bracket in group 1 and group 2 mouthwash	45

LIST OF ANNEXURES

ANNEXURE NO.	PARTICULARS	PAGE NO.
I	Ethical clearance	63
II	Consent form	64-66
III	Patient Information Sheet	67-69

INTRODUCTION

The mouth is an individual's first organ in communication with the outside world; it facilitates nutrition, speech-based social interaction, and cognitive growth. In addition to providing aesthetic value and influencing interpersonal interactions, it is a remarkable aspect of the individualization of humans.^[1] The face also represents a vital element of personal charm and self-esteem development. It is also believed that facial appearance may interfere with various social relations since facial deformities with negative social and psychological reflexes act on patients' self-confidence, perception of beauty, external relations, and even identification with professional success. Thus, it is rightly said, "Use your smile to change this world, but don't let this world change your smile."

Over the past 20 years, there has been a significant increase in the number of individuals seeking orthodontic treatment.^[2] This has increased the scope of orthodontics and widened the upper age limit for orthodontic intervention. It has been proved that orthodontic treatment, besides improving dental esthetics, also significantly impacts the psychosocial aspect of the patient's life.^[3] The reason for this is the growing awareness of the people about the necessity for good oral hygiene which results in the patient reaching adulthood with a greater number of teeth in the mouth. It also happens to the increase in the esthetic requirement from society. by the increased access to information for the public about orthodontic treatment, and by the technological advancements in the field of orthodontics.^[4]

The success of orthodontic treatment depends, in part, upon the oral hygiene status of the patient and his active cooperation in the treatment. ^[6]

Oral hygiene is an important factor controlled by the patient during orthodontic treatment, which can affect the quality and timing of the therapy. Previous research has demonstrated a rapid decline in oral hygiene compliance subsequent to the initial bonding of orthodontic appliances. The presence of an orthodontic appliance tends to favor the accumulation of plaque and impedes proper hygiene procedures, contributing to its buildup.^[5]

With the recent increase in adults seeking orthodontic treatment, there has been a corresponding increase in demand for appliances that are more aesthetic and more comfortable than conventional fixed appliances ^[1] Though the demand for aesthetic appliances is increasing, conventional fixed mechanotherapy is currently being used extensively.

The efficiency of orthodontic treatment begins with the proper positioning of the brackets on the tooth surface. However, they also play a significant role in enamel demineralization because they are present throughout orthodontic treatment. They are also an excellent area for plaque retention and act as a nidus for the growth of several microorganisms. The initial affinity of bacteria to solid surfaces is mostly due to electrostatic and hydrophobic interactions. It has also been shown that the physicochemical properties of the bacteria and those of the solid surface contribute as mediators during the process of adherence to hard surfaces. The composition, as well as the rate of saliva secretion, may also affect bacterial adherence.

It is well known that the adherence of oral bacteria to enamel tooth surfaces and orthodontic materials has a harmful effect on teeth and periodontal tissues. Orthodontic appliances also reduce the effect of brushing on plaque and salivary flow. Increased levels of *S. mutans* and lactobacilli are detected in the oral cavity after the

bonding of orthodontic attachments.^[7] The incidence of enamel demineralization and periodontal disease after fixed orthodontic treatment can involve up to 50% of patients. The incidence of such white spot lesions around orthodontic brackets has been demonstrated within 1 month of treatment.

Enamel demineralization, or white spot lesions around orthodontic appliances, is a common side effect of orthodontic treatment. The oral environment with fixed appliances provides ideal conditions for the colonization of microorganisms as a result of their inherent morphologic irregularities. The resultant increase in plaque accumulation and retention areas places the patient at a higher risk for enamel demineralization adjacent to the appliance and exacerbates the effects of pre-existing incipient carious lesions.

Areas of contact between, the bracket and tooth or bracket and wire provide a unique environment that impedes proper access to tooth surfaces for cleaning.

Among the various oral bacteria, *S. mutans* acts as an important etiologic agent in dental caries and periodontal diseases.

Streptococcus mutans is a type of Gram-positive bacterium described by Clark in 1924. *Streptococcus* bacteria are initially replaced on the surface of the tooth and prepare the environment for acidic conditions, also allowing for the presence of other microorganisms. *S. mutans* metabolizes sucrose to lactic acid and provides the basis for dental caries. While *S. mutans* does not act alone in the development of dental caries, studies from several laboratories have convincingly demonstrated that *S. mutans* can alter the local environment by forming an EPS-rich and low pH milieu, thereby creating a favorable niche for other acidogenic and aciduric species to thrive.^[14]

S. mutans can persist in an environment including mucosal surfaces exposed to salivary flow, by forming a colony or free-living in saliva and proliferating; but other bacteria must attach to the mucosal surface. *S. mutans* can be colonized in the mouth before tooth eruption and transiently infect, but continuous colonization in the mouth depends on the presence of teeth. ^[15]

It has been suggested that therapies that interfere with the colonization of *S. mutans* can have a fundamental effect on reducing the incidence of caries in humans. ^[15]

Mechanical tooth-cleaning is very important for patients with fixed orthodontic appliances. Malocclusions and fixed orthodontic appliances cause difficulties in brushing and increase the accumulation of microbial plaque. ^[16] This, in turn, facilitates the formation of dental caries and induces periodontal problems, with deterioration of the ecologic balance of the oral flora^[8,9]

Furthermore, metallic brackets have been found to make specific changes in the oral environment, such as a decrease in pH and affinity of bacteria to a metallic surface because of electrostatic reactions. ^[10]

The bacteria initially adhere to surfaces of solids mostly by electrostatic and hydrophobic interactions. The attraction of *S. mutans* is directly related to the free energy of the surface. Eliades et al in their study demonstrated enhanced retention of plaque in stainless steel owing to the highest critical surface tension^[11]. There are certain changes induced by metal orthodontic brackets in the oral environment which include a pH decrease, enhanced accumulation of plaque, and elevated *S. mutans* colonization. Nevertheless, the results of present studies aiming to find a difference in

the affinity and adhesion of brackets on different bracket materials namely metal, ceramic, and plastic, are not conclusive.^[12,13]

There are different aids to reduce microbial adhesion and plaque retention which include toothbrushes, dentifrices, mouthwashes, interdental aids, and dental flosses. The use of mouthwashes is believed to decrease the growth of such microorganisms. Chlorhexidine is an ideal broad-spectrum antimicrobial. It has a positive effect against the growth of Gram-positive bacteria, Gram-negative bacteria, and fungi. It may be used by orthodontic patients to reduce plaque accumulation and pathogenic microorganisms.

Fluoride also plays a significant role in the prevention of caries and in improving oral and dental health. One of the common ways of fluoride use is the use of a fluoride-containing mouthwash, the most important of which in use is 0.2% sodium fluoride mouthwash.

Due to a lack of in vivo studies with conclusive results on the effects of different mouthwashes on different bracket systems, this randomized controlled trial is done to assess the potential effects of the above two types of mouthwashes on the colony-forming units of *Streptococcus mutans*. This in turn is believed to aid the clinician in deciding appropriate treatment modifications and thus help in making it more efficient and effective.

AIMS AND OBJECTIVES

AIM:

- To evaluate the effect of two different mouthwashes on colonization of *Streptococcus mutans* over Metal, Self-ligating and Ceramic brackets.

OBJECTIVES:

- To assess the quantitative analysis of *Streptococcus. Mutans* over metal and ceramic brackets.
- To compare the colonization of *Streptococcus. Mutans* over metal and ceramic brackets at the baseline, end of one month, and three months using Chlorhexidine and Fluoride mouthwash.

REVIEW OF LITERATURE

Dadgar et al.¹⁵ – A randomized clinical trial consisting of a total of 38 patients. They were divided as 12, 13, and 12 patients in the fluoride, probiotic, and placebo group, respectively. The mouthwashes were prescribed two times a day for 2 weeks. The 4-pass technique was used to collect the plaque sample in all three groups in two stages: before intervention and 2 weeks post using the mouthwash. By counting the colonies developed on agar media, the quantification of bacteria contained in dental plaque was ascertained. Kruskal-Wallis and Wilcoxon tests were employed. It was summed up that:

- The efficacy of *L. plantarum* probiotic mouthwash in reducing *S. mutans* in dental plaque was found to be ineffective. However, fluoride mouthwash was found to be significantly effective against *S. mutans* and is therefore recommended.

Sari et al.¹⁶ – This study comprised twenty patients who were 13 to 18 years of age, undergoing fixed mechanotherapy. Four stage evaluation of saliva samples of *S. mutans* and lactobacillus levels were evaluated: commencement of the orthodontic treatment, at least 2 weeks post bracket bonding, and 1-week post usage of 0.2% chlorhexidine gluconate mouth rinse, and at the fourth week. The variations in *S. mutans* and lactobacilli count were analyzed via the Wilcoxon test. The findings showed that:

- A mouthwash containing 0.2% chlorhexidine gluconate reduced the amount of *S. mutans* but had no impact on lactobacilli.

Thaweboon et al.¹⁷ - This study aimed to evaluate the *S. mutans* adherence on 7 types of orthodontic brackets *in vitro* (Clarity, Spirit MB, Inspire Ice, 3M, Tomy,Ormco and W&H). The brackets smeared with saliva were placed in a plate with 96 wells with a flat bottom which held a suspension of *S. mutans* (108 CFU/ml). The plate was subsequently incubated for two hours at 37 °C, 10% CO₂, and 100 rpm. 99% methanol was used to fix the adhered bacterial cells, and 0.5% crystal violet was used to stain them. Optical density (OD) at 590 nm was utilized to determine the degree of adhesion. The Kolmogorov-Smirnov test, Levene test, one-way ANOVA, and Games-Howell post hoc test were applied to analyze the data. Thus:

- The type of bracket material has zero effect on the level of bacterial adherence. The level of microbial adherence was significantly influenced by the bracket shape and size.

Jothika et al.³² - Each participant in this single-blind, randomized control research used a single mouthwash regimen during testing. For the study, fifty-two adult patients who met the study's eligibility requirements were chosen at random and placed into four groups: group 1 received 10 ml of distilled water, group 2 received 10 ml of mouthwash containing 0.2% chlorhexidine, group 3 received 10 ml of mouthwash containing 500 ppm F/400 ml sodium fluoride, and group 4 received 10 ml of probiotic mouthwash. In the maxillary quadrant, plaque samples were taken from the facial surface of premolars and molars. One examiner performed the sampling technique seven, fourteen, and thirty days after the mouthwash was used, respectively. After the microbiological analysis, statistical analysis with one-way analysis of variance (ANOVA) and post-hoc test were performed. Study results indicate that:

- Probiotic mouthwashes, sodium fluoride, and chlorhexidine have comparable and statistically significant antimicrobial effects on oral plaque streptococcus mutans susceptibility. Therefore, one of the useful routines for preserving dental cleanliness is using probiotic mouthwash.

Mummolo et al. ³³- In the study, which involved 90 orthodontic patients (56 men and 34 women), 30 subjects (aged 21.5±1.5 years) received treatment with removable clear aligners (CA), 30 cases (aged 23.3±1.6 years) received treatment with a fixed multibracket appliance (MB), and 30 patients (aged 18.2 ±1.5 years) received treatment with a removable positioner (RP). The levels of *S. mutans*, Lactobacilli, and PI in saliva were measured prior to the commencement of orthodontic treatment, as well as after three and six months. They came to the following conclusion:

- A high level of vulnerability to developing caries was identified by approximately 40 percent of MB patients and 20% following 3 months, indicating the need for additional strategies for plaque control and microbial colonization. After 6 months, only about 10% of CA patients and 13.3% of RP patients achieved microbial colonization, which may lead to an elevated chance of caries development.

Abraham et al. ³⁴- This study included 16 patients receiving orthodontic treatment with pre-adjusted edgewise appliances. *S. mutans* adherence to 0.016" and 0.016" × 0.022" NiTi and Cu-NiTi archwires was investigated using real-time polymerase chain reaction under as-received circumstances and after 4 weeks of intraoral use. Three-dimensional surface profilometry as well as dynamic contact angle analysis were used to investigate surface roughness and surface free energy, respectively. It turned out that:

- Cu-NiTi archwires had higher surface roughness, surface free energy, and adherence of *S mutans* than NiTi archwires. For all archwires under study, surface roughness and surface free energy enhanced following four weeks of intraoral exposure. The cycle threshold value of adhering bacteria and the characteristics of the surface showed a primarily negative connection.

Faltermeier et al.³⁵ - Three experimental adhesives categories were established for this study: unfilled urethane-dimethacrylate (UDMA) adhesive, UDMA adhesive and a filler-volume proportion of 35%, and UDMA adhesive that had a filler-volume fraction of 70%. Silicon dioxide was the filler that was used. Furthermore, two traditional orthodontic adhesives were tested: ConTec Duo (Dentaurum, Ispringen, Germany) and Transbond XT (3M Unitek, Monrovia, Calif.). Test specimens were added to *S mutans* solutions, which were then analyzed using an automated multi-detection reader and fluorescence dye. Additionally, scanning electron micrographs were created to assess the adherence of bacteria on substrates. It was found that:

- The findings show that there is no correlation between *S mutans* bacterial adherence and the filler-volume percentage of UDMA-based orthodontic adhesives.

Shukla C et al.³⁷ - Plaque samples from the buccal and labial portions of the anterior teeth as well as the four first molars of sixty randomly chosen patients were obtained for this investigation prior to the insertion of orthodontic appliances, and readings were recorded as T0. Plaque samples were taken from the same location again two and three months after the appliances (0.22 MBT preadjusted Gemini) were placed, and the measurements were recorded as T1 and T2, respectively. DM Strips (Orion Diagnostic, Espoo, Finland) were utilized to measure the *S. mutans* counts in these

patients. The Dentocult score for *S. mutans* showed significant variations over time at different intervals in the orthodontic patient, as determined by the Mann-Whitney U-test and the Kruskal-Wallis test ($P < 0.001$). It was determined that:

During orthodontic treatment, the colonization of *S. mutans* is enhanced by fixed mechanotherapy.

Ghorbani et al.³⁸- Twenty individuals (aged 18 to 35) were enrolled in this crossover trial which was conducted in four phases involving control and intervention groups. At the start of the investigation (phase 1), after the first prescription (phase 2), after the washout period (phase 3), and lastly after the second prescription (phase 4), the prevalence of *S. mutans* was determined in a specific volume of volunteer dental plaque by culturing in the bacteriology medium. A dentist performed saliva sampling and the plaque index during follow-up appointments. T-test was used to quantitatively assess the data. The findings indicated that:

- Magnolia Grandiflora 0.3% mouthwash tends to considerably reduce the amount of *S. mutans* in dental plaque. Thus, it is suggested to produce it in large quantities and distribute it to the oral health community. Nevertheless, more research with bigger sample sizes and different approaches is needed to validate the results of this investigation.

Gedam et al.⁴¹- A crossover study consisting of three groups with 51 children in total between 8 to 12 years of age were exposed to three mouth rinses, namely, probiotic, Chlorhexidine and Fluoride for two weeks and later a washout period for a period of four weeks. Pre and post mouth rinse MS counts were evaluated. They concluded that:

- The three mouthwashes were comparable against *Streptococcus mutans*.

MATERIALS AND METHODS

STUDY DESIGN

Randomized controlled trial

SOURCE OF DATA

- The samples were collected from Department of Orthodontics, KLE VK institute of Dental Sciences, Belagavi.
- The study was conducted at Microbiology laboratory, Jawaharlal Nehru Medical College, Belagavi

INCLUSION CRITERIA:

1. Patients undergoing treatment with the any of the three orthodontic systems mentioned.
2. Patients not using any kind of mouthwash prior to the treatment for at least 1 month
3. Patients with permanent dentition
4. No clinical sign of periodontitis.
5. No history of any systemic illness and no antibiotic administration at least 3 months prior to the study.

EXCLUSION CRITERIA:

1. Smoking
2. Pregnancy
3. Poor general health

SAMPLE SIZE ESTIMATION

The sample size (n) is derived by using the “comparing two means” formula:

$$n = \frac{(\sigma_1^2 + \sigma_2^2/\kappa) (Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2}$$

Where, σ_1 = standard deviation of Group 1,

σ_2 = standard deviation of Group 2

Δ = difference in group means (master article reference – Dadgar et al)

	Group 1	Group 2	Difference*
Mean	875770	505000	370770
Standard deviation	2001	680678	
Variance	4004000	4633230000	

κ = ratio = $n_2/n_1 = 1$

$Z_{1-\alpha/2}$ = two-sided Z value (eg. Z=1.96 for 95% confidence interval).

$Z_{1-\beta}$ = power of the study (80% power, critical value of 0.84)

Substituting the values in the above formula,

A minimum sample size of 27.7~28 patients per group; 14 in each subgroup is derived.

Considering 3 groups and 2 subgroups, the total sample size is 84 patients is derived.

Total sample size – 84

RANDOMIZATION

- Each of the 3 groups of subjects was randomly divided into two groups according to a random number table

PERMISSIONS OBTAINED

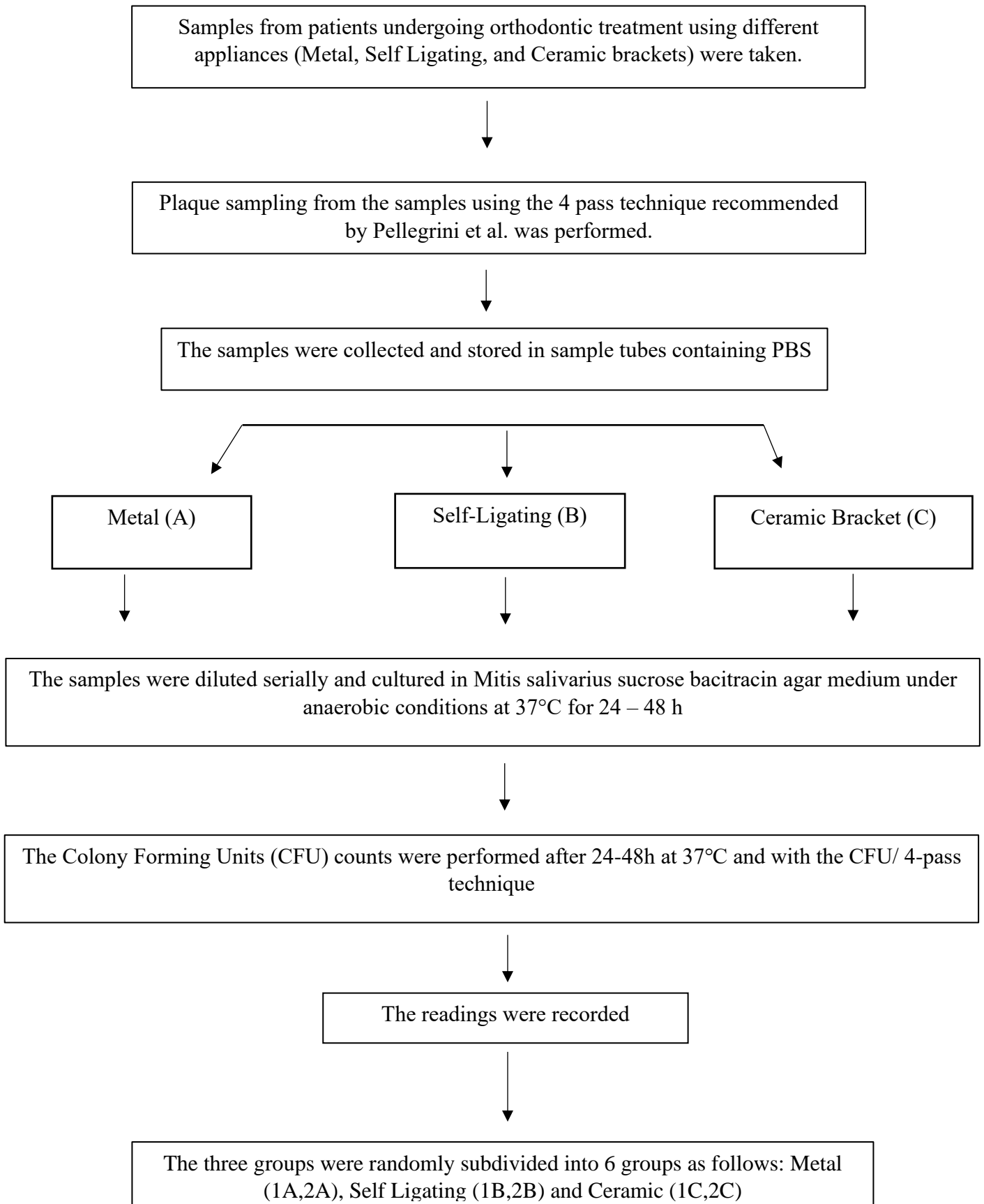
- Institutional ethical clearance.

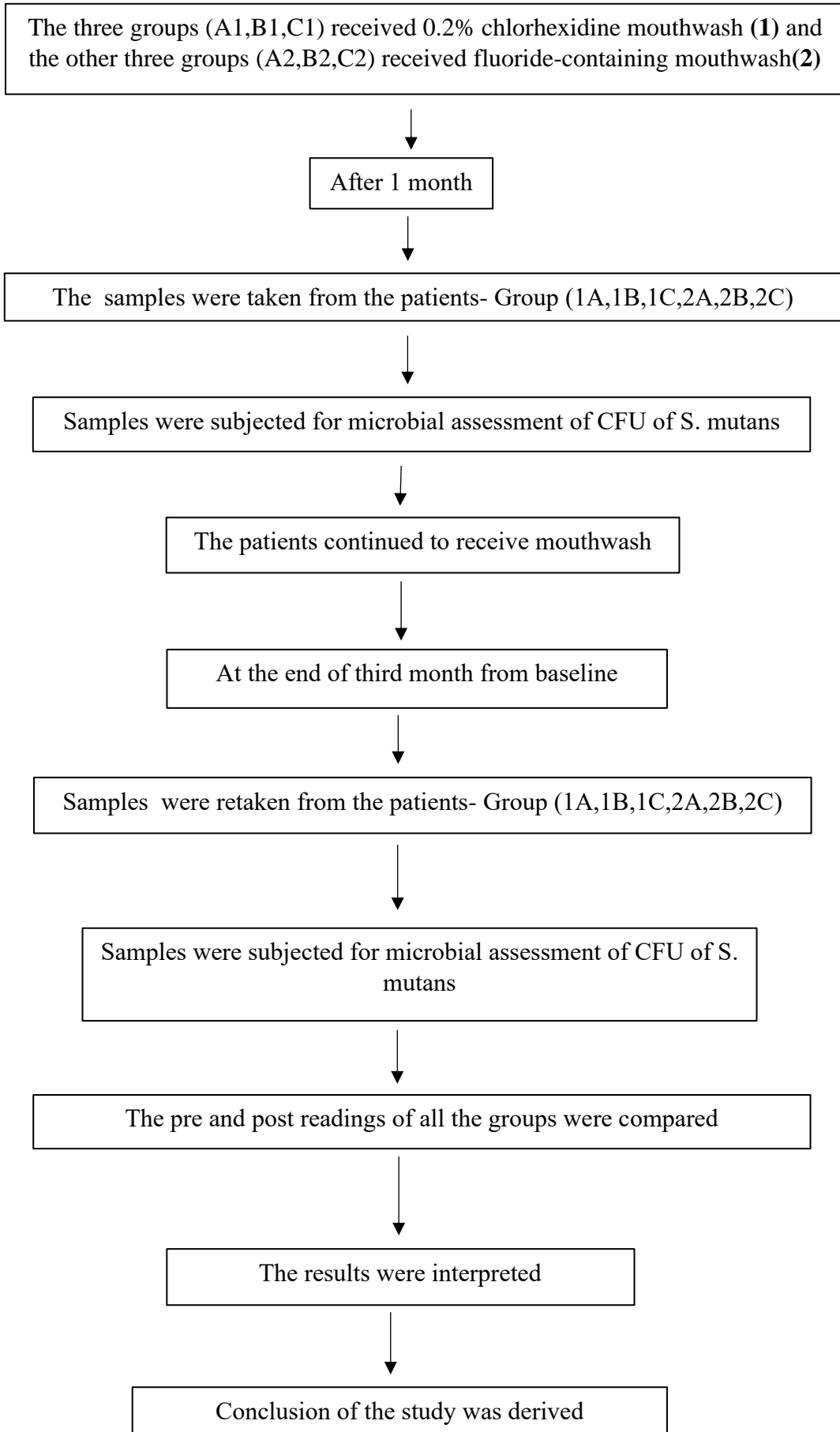
INSTRUMENTS AND MATERIALS

MATERIALS

1. Swab from Metal, Self-ligating, and Ceramic brackets
2. Sterile Curette
3. Petri dish
4. Mitis salivarius sucrose bacitracin agar medium at 37°C
5. 0.2% Chlorhexidine mouthwash
6. 0.04% Sodium Fluoride mouthwash
7. Collecting test tubes

METHODOLOGY





Mouthwash 1- 0.2% Chlorhexidine mouthwash (CHX)

Mouthwash 2- 0.04% Fluoride containing mouthwash (NaF)

Three groups of subjects into different orthodontic systems were taken up in the study which included Metal (**A**), Self-Ligating (**B**), and Ceramic brackets (**C**).

Each group (A,B,C) were randomly divided into two sub groups according to a random number table: Group 1 included 42 subjects who received 0.2% Chlorhexidine mouthwash; Group 2 included 42 subjects who received 0.04% Fluoride-containing mouthwash.

From all four randomized groups, plaque sampling were performed in three stages: The 1st day of study(T_0), one month after the intervention (T_1) and at the end of 3rd month (T_2). During the mouthwash period, the patients were asked to brush as usual and use the mouthwash twice a day after lunch and before bedtime.

The plaque sampling from six groups were taken using **the 4-pass technique recommended by Pellegrini et al.**

In this method, plaque was collected at baseline using a sterile curette on the labial surface of the existing premolar, adjacent to the bracket sides, in four directions of mesial, distal, occlusal, and gingival. The dental plaque was dissolved in 5 cc of PBS and stored in a refrigerator (4°C).

The samples were diluted serially and cultured in Mitis salivarius sucrose bacitracin agar medium at 37°C for 24–48 h



Fig.1.- Dryer to dry the culture plates



Fig.2.- Inoculating Loop to streak the culture plate

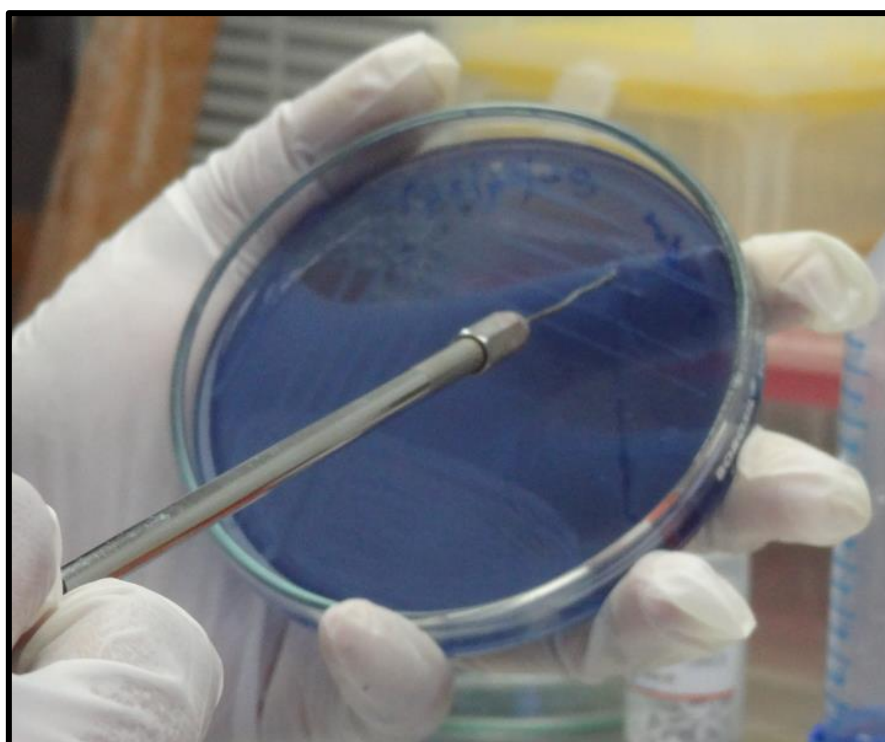


Fig.3.- Streaking of the culture plate



Fig.4.- Incubator

The number of bacteria in the dental plaque was counted based on the number of colonies grown on agar medium with the CFU/4-pass technique.

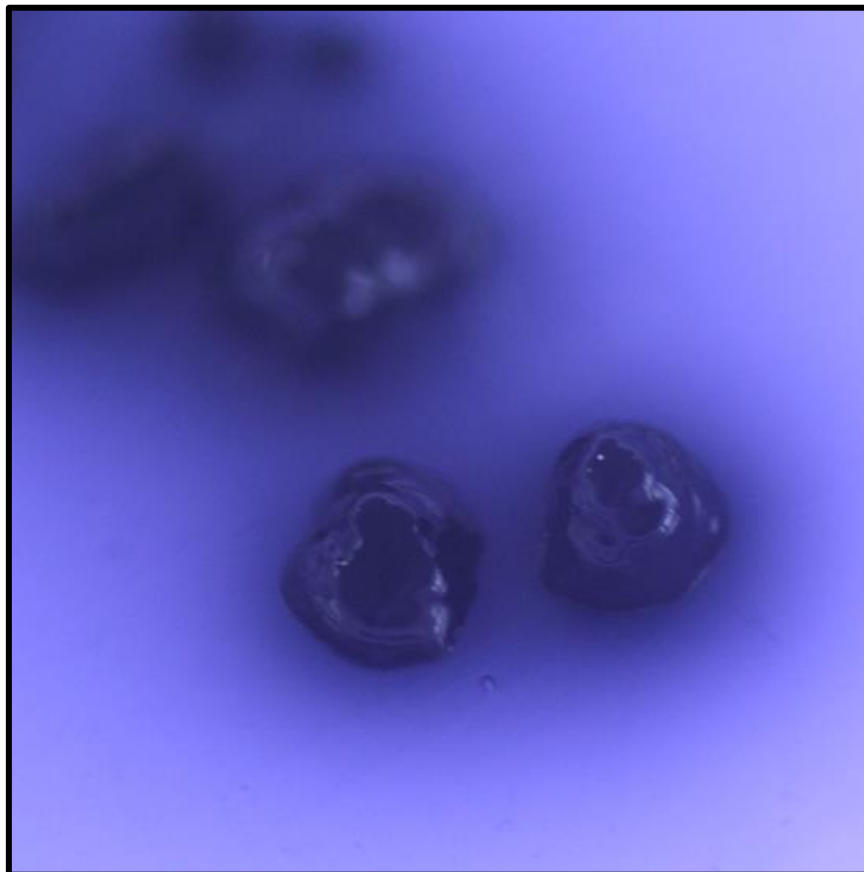


Fig.5.- S mutans on the culture plate

Group 1A	Plaque sampling from Metal using Chlorhexidine containing mouthwash
Group 1B	Plaque sampling from a Self-ligating bracket using Chlorhexidine containing mouthwash
Group 1C	Plaque sampling from Ceramic bracket using Chlorhexidine containing mouthwash
Group 2A	Plaque sampling from Metal using Fluoride containing mouthwash
Group 2B	Plaque sampling from a Self-ligating bracket using Fluoride containing mouthwash
Group 2C	Plaque sampling from Ceramic bracket using Fluoride containing mouthwash

STATISTICAL ANALYSIS

- Study data obtained were entered to Microsoft Excel Software, which then was exported to Statistical Package for Social Sciences (SPSS) Version 25, IBM Statistics, USA.
- Descriptive Statistics were obtained.
- One-way ANOVA or Kruskal Wallis test followed by Post hoc tests (Bonferroni, Tukey's HSD) were performed to determine the within-group and inter-group comparisons.
- Paired t-test or Wilcoxon Sign Rank test were performed to determine the significant differences between pre and post usage of mouth rinse
- Level of significance were set at 5% ($p < 0.05$ = Statistically Significant)

RESULTS

- This study was done to evaluate and compare the effects of two mouthwash on the colonization of *S* mutans on Metal, Self-ligating and Ceramic brackets.
- A total of 84 samples were divided into 6 groups based on the type of mouthwash and bracket system.

Table 1 – Descriptive statistics of colonisation of *S. mutans* over different types of brackets in Group 1 mouthwash at different time intervals

Group 1 and Type of brackets	Time intervals	N	Mean	Std. Deviation
A (Metal)	T1	14	192.35	58.51707
	T2	14	166.78	46.78787
	T3	14	156.64	41.66645
B (Self-ligating)	T1	14	138.21	39.26474
	T2	14	124.00	35.17866
	T3	14	123.71	46.64337
C (Ceramic)	T1	14	322.71	119.01547
	T2	14	271.21	98.91735
	T3	14	240.57	106.02229

- Table 1 shows the descriptive mean and standard deviation of colonization of *S. mutans* over different types of brackets in Group 1 mouthwash and different time intervals.

Table 2 – Descriptive statistics of colonisation of *S. mutans* over different types of brackets in Group 2 mouthwash at different time intervals

Group 2 and Type of brackets	Time intervals	N	Mean	Std. Deviation
A (Metal)	T1	14	195.28	52.14098
	T2	14	162.42	61.01666
	T3	14	128.50	55.81804
B (Self-ligating)	T1	14	126.42	59.10058
	T2	14	110.92	51.97405
	T3	14	90.71	51.26917
C (Ceramic)	T1	14	253.21	81.08512
	T2	14	216.57	76.36624
	T3	14	192.28	61.84525

- Table 2 shows the descriptive mean and standard deviation of colonization of *S. mutans* over different brackets in Group mouthwash and different time intervals.

Table 3 –Intergroup comparison of colonisation of *S. mutans* over different types of brackets between 2 groups (2 mouthwashes) at different time intervals

Type of brackets	Time intervals	Comparison groups	N	Mean Rank	P value
A (Metal)	T1	Group 1	14	14.11	0.800
		Group 2	14	14.89	
	T2	Group 1	14	14.29	0.890
		Group 2	14	14.71	
	T3	Group 1	14	16.54	0.190
		Group 2	14	12.46	
B (Self-ligating)	T1	Group 1	14	15.00	0.748
		Group 2	14	14.00	
	T2	Group 1	14	15.25	0.629
		Group 2	14	13.75	
	T3	Group 1	14	16.93	0.118
		Group 2	14	12.07	
C (Ceramic)	T1	Group 1	14	17.57	0.801
		Group 2	14	11.43	
	T2	Group 1	14	17.14	0.009*
		Group 2	14	11.86	
	T3	Group 1	14	16.14	0.001*
		Group 2	14	12.86	

*p value <0.05 statistically significant, <0.01 highly significant

Table 3 shows the intergroup comparison of the colonization of *S. mutans* over different types of brackets between 2 groups (2 mouthwashes) at different time intervals. This was performed using Mann Whitney U test. This comparison showed statistically significant differences (p value <0.05) between the 2 groups only for ceramic brackets at T2 and T3 time intervals.

Table 4 –Intragroup comparison of colonisation of *S. mutans* over different types of brackets between different time intervals in Group 1 mouthwash

Comparison between time interval	Type of bracket	Time interval	Mean Rank	Chi-square value	p value
T1 vs T2 vs T3	A (Metal)	T1	25.96	2.990	0.224
		T2	20.32		
		T3	18.21		
	B (Self-ligating)	T1	26.93	4.969	0.083
		T2	16.64		
		T3	20.93		
	C (Ceramic)	T1	25.96	3.191	0.203
		T2	20.75		
		T3	17.79		

*p value <0.05 statistically significant, <0.01 highly significant

Table 4 shows intragroup comparison of colonisation of *S. mutans* over different types of brackets between different time intervals in Group 1 mouthwash. This was performed using Kruskal Wallis test. This comparison did not show statistically significant differences (p value >0.05) between the time intervals for any of the brackets in Group 1.

Table 5 –Intragroup comparison of colonisation of *S. mutans* over different types of brackets between different time intervals in Group 2 mouthwash

Comparison between time interval	Type of bracket	Time interval	Mean Rank	Chi-square value	p value
T1 vs T2 vs T3	A (Metal)	T1	29.11	11.523	0.003*
		T2	22.00		
		T3	13.39		
	B (Self-ligating)	T1	25.11	2.656	0.265
		T2	21.82		
		T3	17.57		
	C (Ceramic)	T1	29.39	10.771	0.005*
		T2	20.89		
		T3	14.21		

*p value <0.05 statistically significant, <0.01 highly significant

Table 5 shows intragroup comparison of colonisation of *S. mutans* over different types of brackets between different time intervals in Group 2 mouthwash. This was performed using Kruskal Wallis test. This comparison showed statistically significant differences (p value <0.01) between the time intervals for Metal and Ceramic brackets in Group 2.

Table 6 –Pairwise multiple post hoc intragroup comparison of colonisation of S. mutans over different types of brackets between different time intervals in Group 2 mouthwash

Comparison between time interval	Type of bracket	Time interval	Comparison	p value
T1 vs T2 vs T3	A (Metal)	T1	T2	0.041*
			T3	0.001*
		T2	T3	0.123
	C (Ceramic)	T1	T2	0.011*
			T3	0.000*
		T2	T3	0.183

*p value <0.05 statistically significant, <0.01 highly significant

Table 6 shows pairwise multiple post hoc intragroup comparison of colonization of S. mutans over different types of brackets between different time intervals in Group 2 mouthwash. This was performed using Friedman Dunn's test. This comparison showed statistically significant differences (p value <0.05) between the T1 and T2 and T1 and T3 for Metal and Ceramic brackets.

Table 7 –Intragroup comparison of colonisation of *S. mutans* between different types of brackets at different time intervals in Group 1 mouthwash

Comparison between type of brackets	Time intervals	type of brackets	Mean Rank	Chi-square value	p value
A (Metal) vs B (Self-ligating) vs C (Ceramic)	T1	A	20.57	20.772	.000*
		B	11.43		
		C	32.50		
	T2	A	20.39	19.250	.000*
		B	11.93		
		C	32.18		
	T3	A	21.18	10.837	.004*
		B	14.04		
		C	29.29		

*p value <0.05 statistically significant, <0.01 highly significant

Table 7 shows intragroup comparison of colonisation of *S. mutans* between different types of brackets at different time intervals in Group 1 mouthwash. This was performed using Kruskal Wallis test. This comparison showed statistically significant differences (p value <0.05) between the Metal, Self ligating, and Ceramic bracket systems at T1,T2 and T3.

Table 8 –Pairwise multiple post hoc intragroup comparison of colonisation of *S. mutans* between different types of brackets at different time intervals in Group 1 mouthwash

Comparison between type of brackets	Time intervals	type of brackets	Comparison	p value
A (Metal) vs B (Self-ligating) vs C (Ceramic)	T1	A	B	0.06
			C	0.001*
		B	C	0.133
	T2	A	B	0.09
			C	0.012*
		B	C	0.194
	T3	A	B	0.091
			C	0.000*
		B	C	0.712

*p value <0.05 statistically significant, <0.01 highly significant

Table 8 shows pairwise multiple post hoc intragroup comparison of colonization of *S. mutans* over different types of brackets at different time intervals in Group 1 mouthwash. This was performed using Friedman Dunn's test. This comparison showed statistically significant differences (p-value <0.05) between the Metal and Ceramic brackets for T1, T2 and T3 respectively.

Table 9– Intragroup comparison of colonisation of *S. mutans* between different types of brackets at different time intervals in Group 2 mouthwash

Comparison between type of brackets	Time intervals	type of brackets	Mean Rank	Chi-square value	p value
A (Metal) vs B (Self-ligating) vs C (Ceramic)	T1	A	22.54	20.045	.000*
		B	10.64		
		C	31.32		
	T2	A	22.57	15.114	.001*
		B	12.00		
		C	29.93		
	T3	A	20.50	17.188	.000*
		B	12.43		
		C	31.57		

*p value <0.05 statistically significant, <0.01 highly significant

Table 9 shows intragroup comparison of colonisation of *S. mutans* between different types of brackets at different time intervals in Group 2 mouthwash. This was performed using Kruskal Wallis test. This comparison showed statistically significant differences (p value <0.05) between the Metal, Self ligating, and Ceramic bracket systems at T1,T2 and T3.

Table 10 –Pairwise multiple post hoc intragroup comparison of colonisation of *S. mutans* between different types of brackets at different time intervals in Group 2 mouthwash

Comparison between type of brackets	Time intervals	type of brackets	Comparison	p value
A (Metal) vs B (Self-ligating) vs C (Ceramic)	T1	A	B	0.136
			C	0.021*
		B	C	0.713
	T2	A	B	0.078
			C	0.001*
		B	C	0.381
	T3	A	B	0.211
			C	0.028*
		B	C	0.898

*p value <0.05 statistically significant, <0.01 highly significant

Table 10 shows pairwise multiple post hoc intragroup comparison of colonization of *S. mutans* between different types of brackets at different time intervals in Group 2 mouthwash. This was performed using Friedman Dunn's test. This comparison showed statistically significant differences (p-value <0.05) between the Metal and Ceramic brackets for T1, T2 and T3 respectively.

Table 11: Descriptive (mean) statistics of the difference (T3-T1) and % difference in different groups

Parameter	Group 1			Group 2		
	A	B	C	A	B	C
T3-T1	35.714	14.5	51.5	66.785	35.714	60.928
% difference	20.466 %	11.071%	18.285%	41.253 %	32.897 %	27.352 %

Table 11 shows the descriptive (mean) statistics of the difference (T3-T1) and percentage difference in different groups.

- The mean difference between T3-T1 difference and percentage in group 1 for Metal bracket is 35.714 and 20.466%, for Self ligating bracket is 14.5 and 11.071%, and for Ceramic bracket is 51.5 and 18.285%.
- The mean difference between T3-T1 difference and percentage in group 2 for Metal bracket is 66.785 and 41..253%, for Self ligating bracket is 35.714 and 32.897%, and for Ceramic bracket is 60.92 and 27.352%..

Table 12: Intragroup comparison of the difference (T3-T1) and % difference in different groups

Parameter	Group 1			Group 2		
	A	B	C	A	B	C
T3-T1	35.714	14.5	51.5	66.785	35.714	60.928
% difference	20.466 %	11.071%	18.285%	41.253 %	32.897 %	27.352 %
Chi-square	0.03*			0.001*		
P value						

*p value <0.05 statistically significant, <0.01 highly significant

The intragroup comparison of the difference(T3-T1) and percentage difference in different groups shows a statistical significance in both Group 1 and Group 2 respectively.

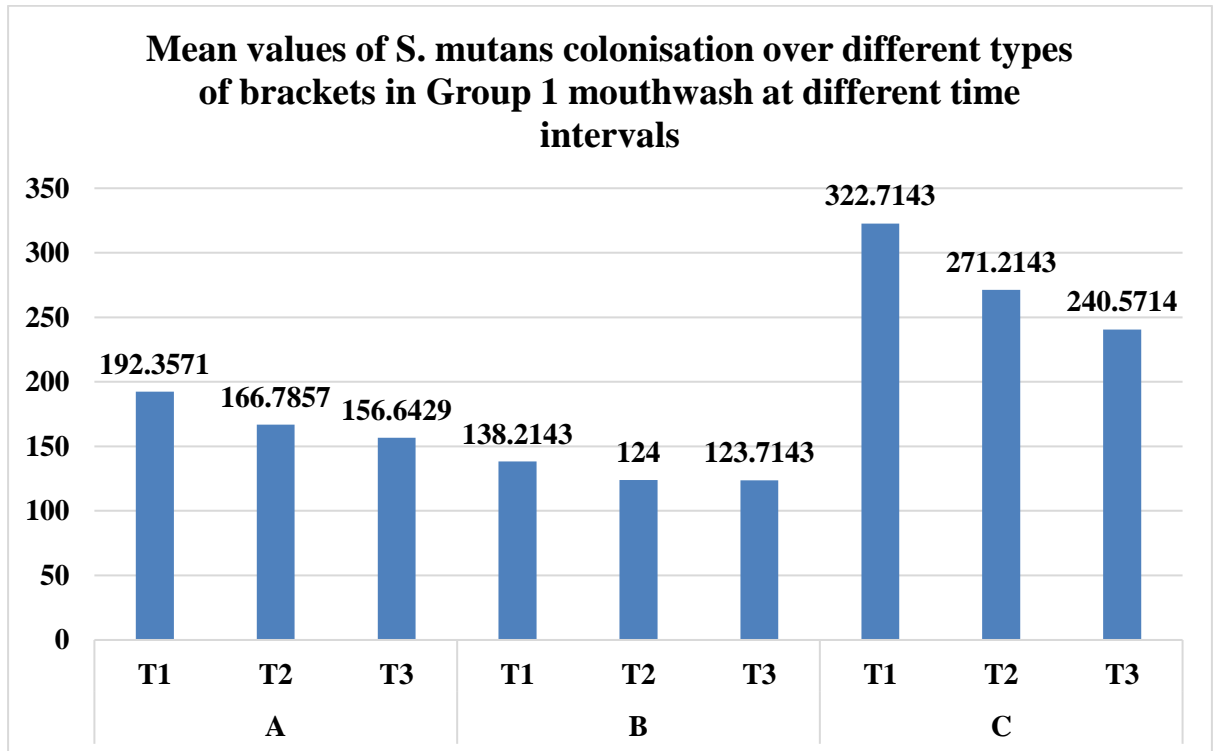
Table 13: Intergroup comparison of the difference (T3-T1) and % difference in different groups

Parameter	Group 1 vs Group 2					
	A	A	B	B	C	C
T3-T1	35.714	66.785	14.5	35.714	51.5	60.928
% difference	20.466 %	41.253 %	11.071%	32.897 %	18.285%	27.352 %
Chi-square	0.708		0.321		0.021*	
P value						

*p value <0.05 statistically significant, <0.01 highly significant

The intergroup comparison of the difference (T3-T1) and percentage difference in different groups shows that the it is significant in Ceramic bracket between the two group of nouthwash.

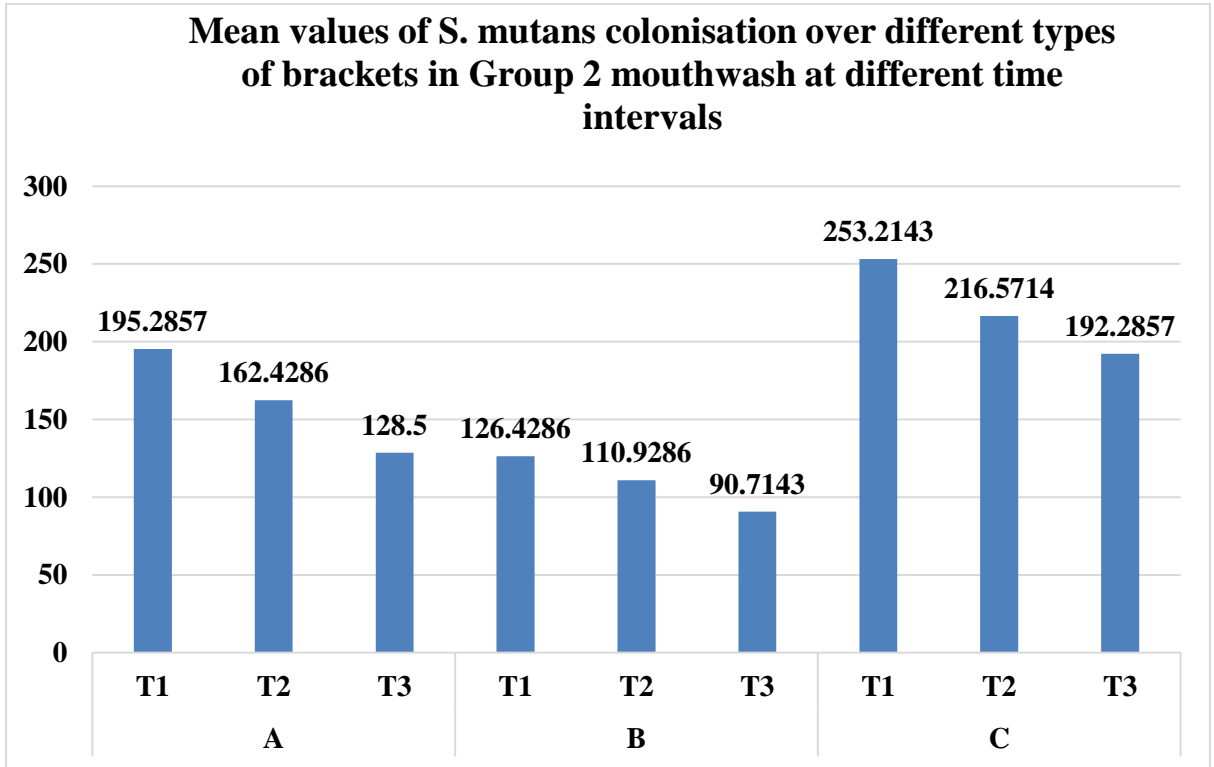
Graph number 1: Mean values of S. mutans colonisation over different types of brackets in Group 1 mouthwash at different time intervals



The mean values of S. mutans colonisation with usage of Group 1 mouthwash over different brackets are as follows:

- Metal brackets in T1,T2, and T3 is 192.3571 ± 58.51707 , 166.7857 ± 46.78787 , and 156.6429 ± 41.66645 respectively.
- Self ligating brackets in T1,T2 and T3 is 138.2143 ± 39.26474 , 124 ± 35.17866 , and 123.7143 ± 46.64337 respectively.
- Ceramic brackets in T1,T2, and T3 is 322.7143 ± 119.01547 , 271.2143 ± 98.91735 , and 240.5714 ± 106.0222 .

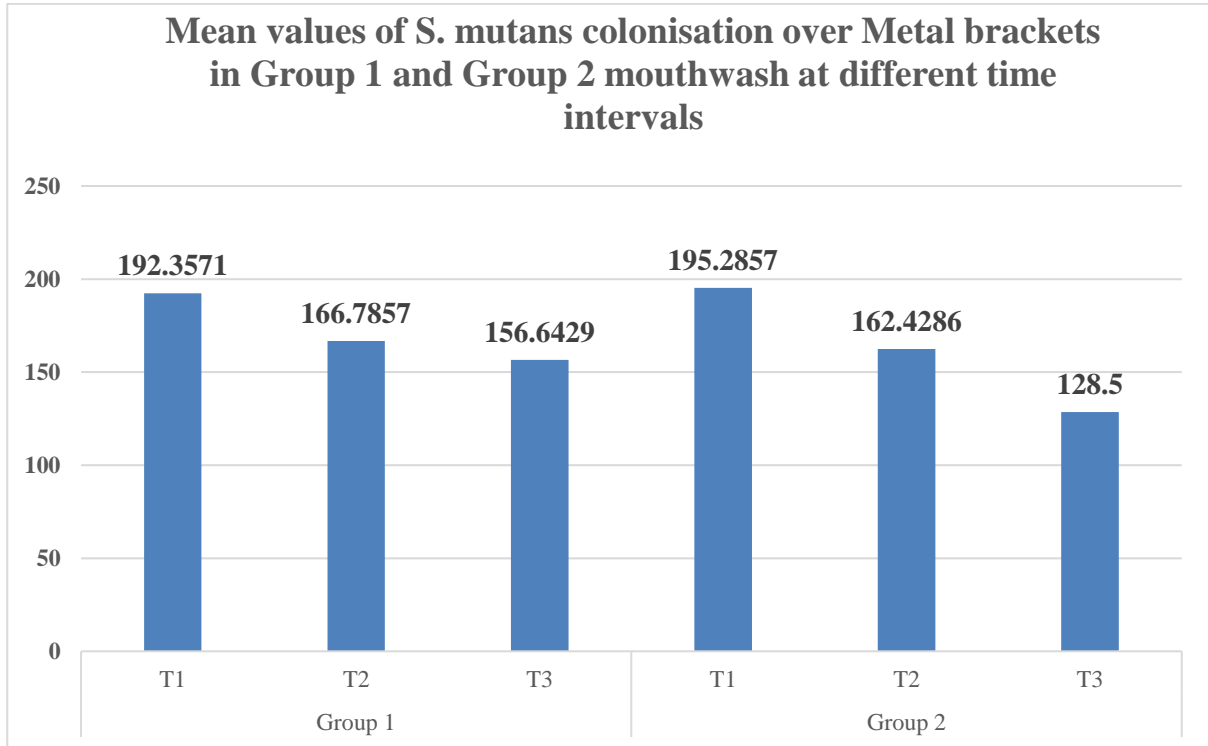
Graph number 2: Mean values of S. mutans colonisation over different types of brackets in Group 2 mouthwash at different time intervals



The mean values of S. mutans colonisation with usage of Group 2 mouthwash over different brackets are as follows:

- Metal brackets in T1, T2, and T3 is 195.2857 ± 52.14098 , 162.4286 ± 61.01666 , and 128.5 ± 55.81804 respectively.
- Self ligating brackets in T1, T2 and T3 is 126.4286 ± 59.10058 , 110.9286 ± 51.97405 , and 90.7143 ± 51.26917 respectively.
- Ceramic brackets in T1, T2, and T3 is 253.2143 ± 81.08512 , 216.5714 ± 76.36624 , and 192.2857 ± 61.84525 respectively.

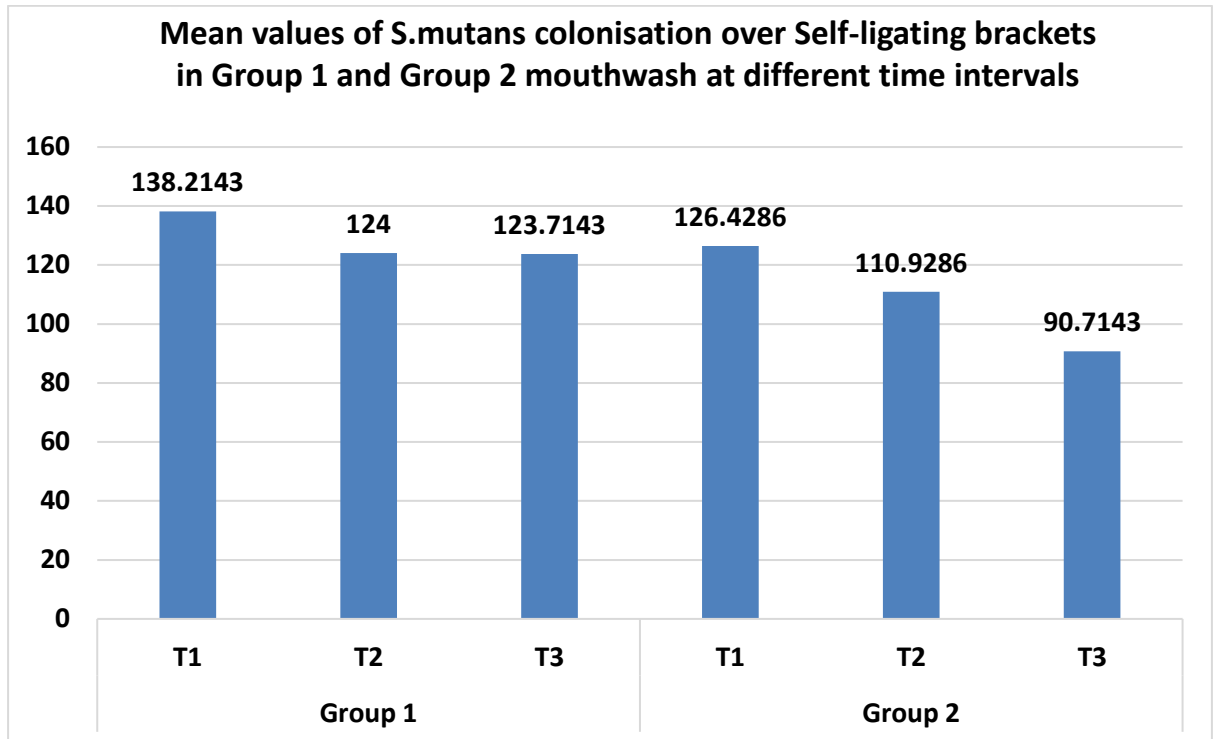
Graph number 3: Mean values of *S. mutans* colonisation over Metal brackets in Group 1 and Group 2 mouthwash at different time intervals



The mean values of *S. mutans* colonisation at T1, T2, and T3 with usage of Group 1 and Group 2 mouthwash over Metal brackets are as follows:

- At T1, the mean values with Group 1 and Group 2 are 192.3571 ± 58.51707 and 195.2857 ± 52.14098 respectively.
- At T2, the mean values with Group 1 and Group 2 are 166.7857 ± 46.78787 and 162.4286 ± 61.01666 respectively.
- At T3, the mean values with Group 1 and Group 2 are 156.6429 ± 41.66645 and 128.5 ± 55.81804 respectively.

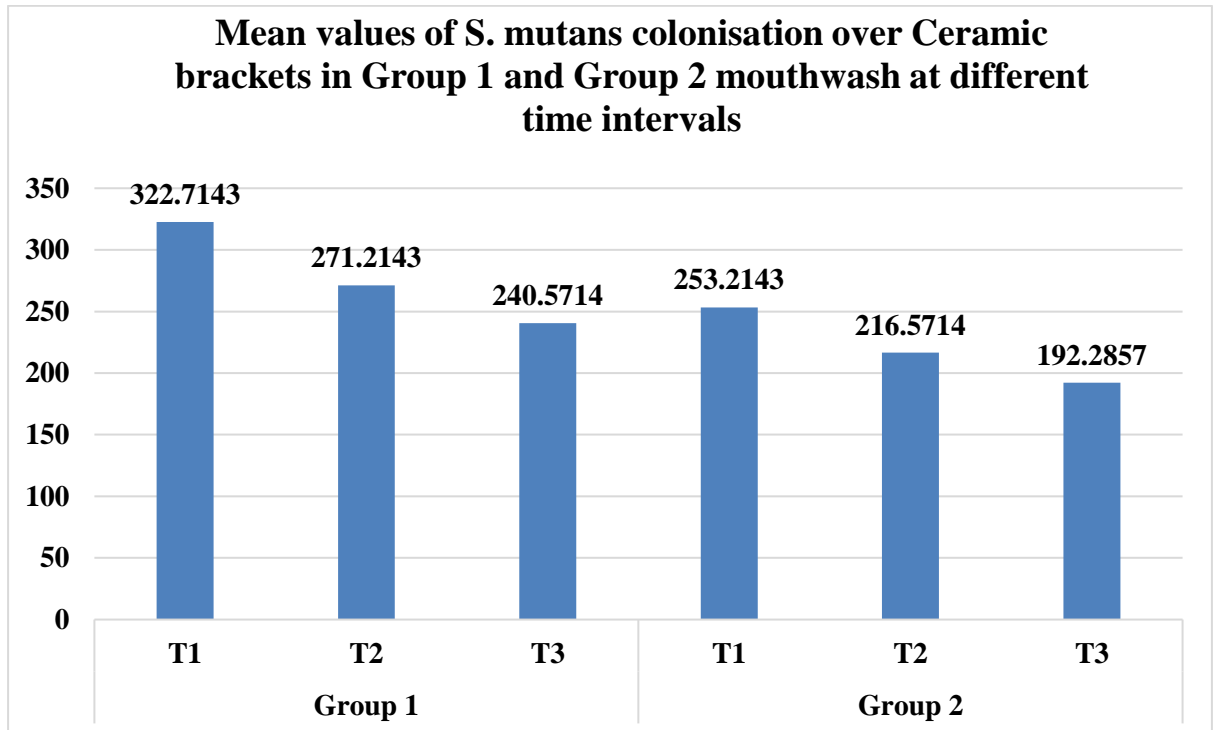
Graph number 4: Mean values of S. mutans colonisation over Self ligating brackets in Group 1 and Group 2 mouthwash at different time intervals



The mean values of S. mutans colonisation at T1, T2, and T3 with usage of Group 1 and Group 2 mouthwash over self ligating brackets are as follows:

- At T1, the mean values with Group 1 and Group 2 are 138.2143 ± 39.26474 and 126.4286 ± 59.10058 respectively.
- At T2, the mean values with Group 1 and Group 2 are 124 ± 35.17866 and 110.9286 ± 51.97405 respectively.
- At T3, the mean values with Group 1 and Group 2 are 123.7143 ± 46.64337 and 90.7143 ± 51.26917 respectively.

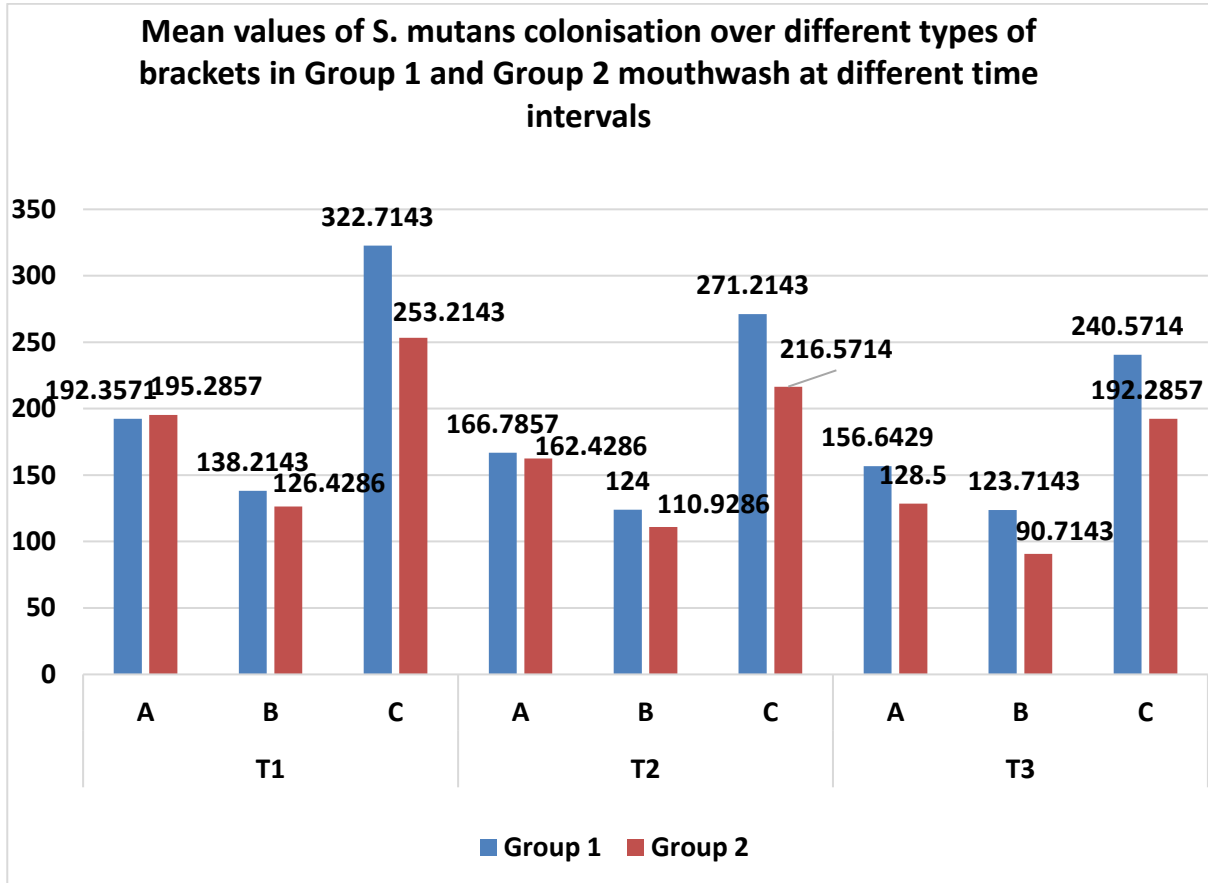
Graph number 5: Mean values of *S. mutans* colonisation over ceramic brackets in Group 1 and Group 2 mouthwash at different time intervals



The mean values of *S. mutans* colonisation at T1, T2, and T3 with usage of Group 1 and Group 2 mouthwash over ceramic brackets are as follows:

- At T1, the mean values with Group 1 and Group 2 are 322.7143 ± 119.01547 and 253.2143 ± 81.08512 respectively.
- At T2, the mean values with Group 1 and Group 2 are 271.2143 ± 98.91735 and 216.5714 ± 76.36624 respectively.
- At T3, the mean values with Group 1 and Group 2 are 240.5714 ± 106.02229 and 192.2857 ± 61.84525 respectively.

Graph number 6: Mean values of *S. mutans* colonisation over different types of brackets in Group 1 and Group 2 mouthwash at different time intervals



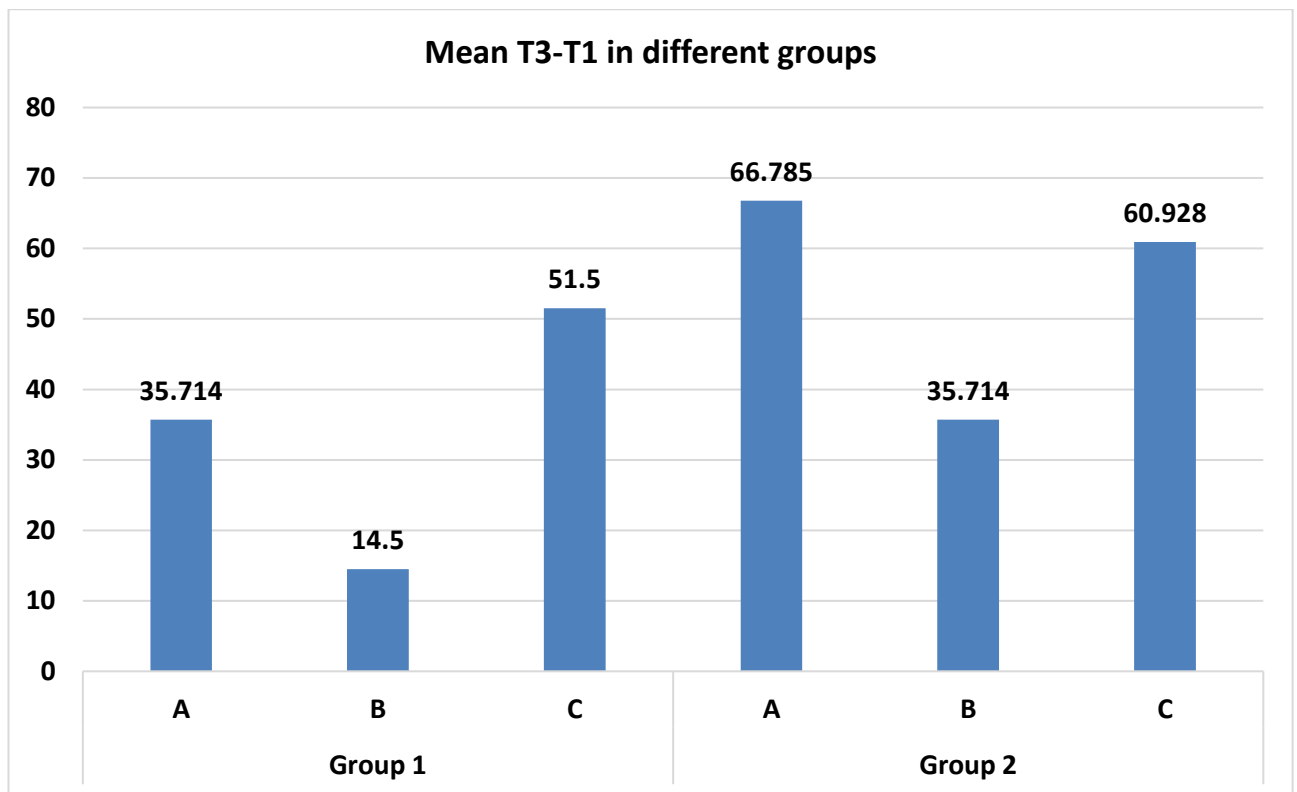
The mean values of *S. mutans* colonisation at T1, T2, and T3 with usage of Group 1 and Group 2 mouthwash over different types of brackets are as follows:

- At T1,
 - the mean values with Group 1 and Group 2 for Metal brackets are 192.3571 ± 58.51707 and 195.2857 ± 52.14098 respectively
 - the mean values with Group 1 and Group 2 for Self ligating are 138.2143 ± 39.26474 and 126.4286 ± 59.10058 respectively.
 - the mean values with Group 1 and Group 2 for Ceramic brackets are 322.7143 ± 119.01547 and 253.2143 ± 81.08512 respectively..

- At T2,
 - the mean values with Group 1 and Group 2 for Metal brackets are 166.7857 ± 46.78787 and 162.4286 ± 61.01666 respectively.
 - the mean values with Group 1 and Group 2 for Self ligating are 124 ± 35.17866 and 110.9286 ± 51.97405
 - the mean values with Group 1 and Group 2 for Ceramic brackets are 271.2143 ± 98.91735 and 216.5714 ± 76.36624

- At T3,
 - the mean values with Group 1 and Group 2 for Metal brackets are 156.6429 ± 41.66645 and 128.5 ± 55.81804 respectively.
 - the mean values with Group 1 and Group 2 for Self ligating are 123.7143 ± 46.64337 and 90.7143 ± 51.26917
 - the mean values with Group 1 and Group 2 for Ceramic brackets are 240.5714 ± 106.02229 and 192.2857 ± 61.84525 respectively.

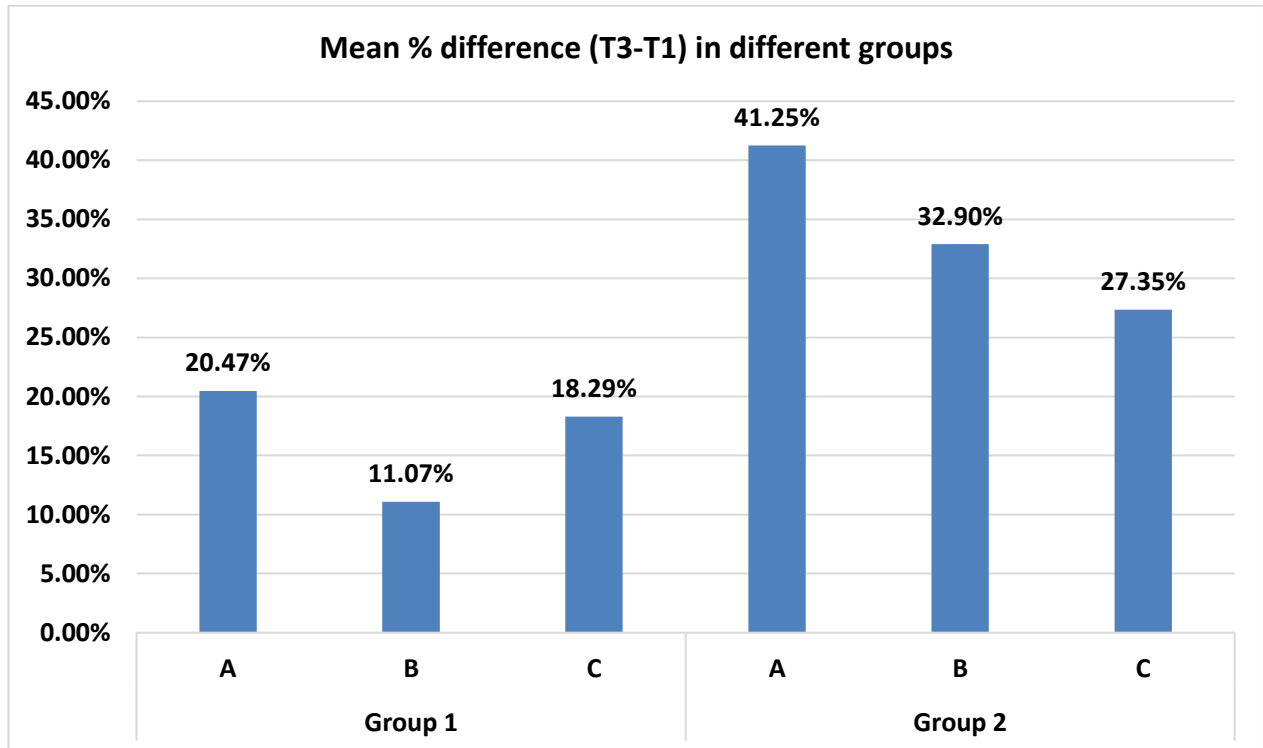
Graph 7: Mean values of difference between T3 and T1 over different types of brackets in group 1 and group 2 mouthwash.



The mean difference between T3-T1 in different types of bracket in group 1 and group 2 mouthwash are as follows:

- The mean difference between Group 1 in Metal, Self ligating and Ceramic brackets are 35.714, 14.5 and 51.5 respectively.
- The mean difference between Group 2 in Metal, Self ligating and Ceramic brackets are 66.785, 35.714 and 60.928 respectively.

Graph 8: Mean percentage difference between T3-T1 in different types of bracket in group 1 and group 2 mouthwash



The mean percentage difference between T3-T1 in different types of bracket in group 1 and group 2 mouthwash are as follows:

- The mean difference percentage between Group 1 in Metal, Self ligating and Ceramic brackets are 20.47%, 11.07% and 18.29% respectively.
- The mean difference between Group 2 in Metal, Self ligating and Ceramic brackets are 41.25%, 32.90% and 27.35% respectively.

DISCUSSION

The randomized clinical trial was designed to compare the effects of two different types of mouthwash on the colonization of *S. mutans* over Metal, Self-ligating, and Ceramic brackets. Good oral hygiene prevents a huge number of oral diseases. Oral hygiene in a majority of the population constitutes mechanical methods which majorly accounts for toothbrushes. Using mouthwash as an adjunct has a positive synergistic effect on the oral cavity.¹⁸ *S. mutans* is a gram-positive, facultative anaerobe that is the initiator in dental caries. The metabolization leads to the production of lactic acid from sucrose with the help of the glucansucrase enzyme. Thus, an acidic environment in the oral cavity is created which facilitates demineralization of the enamel. A dextran-based polysaccharide is formed by utilizing sucrose that helps in adhering to the tooth surface. Around twelve out of fifty strains of *S. mutans* are known to cause dental caries.¹⁹

There is a high correlation between oral microbiology and orthodontic appliances. The studies in past signify an enhancement of cariogenic bacteria which includes *S. mutans* and *Lactobacillus* sp.²⁰ a change in oral environment with fixed mechanotherapy insertion creates niches that harbor carbohydrates and this reduced access by saliva to cleanse such areas lead to colonization of *S. mutans* and *Lactobacillus*.^{21,7}

Some studies have found that plaque deposition is greater on elastomeric rings rather than stainless steel ligature wires.^{23,24} Pellegrini et al showed that self-ligating brackets had lower concentrations of bacteria in the oral cavity compared to elastomeric ligating brackets.²⁵ Raju et al in their study highlighted the increased retention of plaque in ceramic brackets ligated with elastomeric ring followed by

metal brackets ligated with stainless steel ligature wire and comparatively less retention of plaque in Self-ligating brackets.²⁷ However several studies suggested that Self-ligating brackets are linked to more colonies of bacteria than conventional esthetic brackets. The difference in the formation of plaque were attributed to the bracket material and surface.²⁶

Table No.14: Studies that show and do not show differences in the effectiveness of Fluoride and Chlorhexidine mouthwash in orthodontic patients.

Studies showing difference	Studies with no difference
Villa et al in their study showed that the mixture containing CHX and NaF in mouth rinse had a similar effect as that of Chlorhexidine. ⁴⁹	Fard et al suggested that orthokin is more effective than Chlorhexidine. ³¹
Giertsen et al concluded that F-CHX mouthwash reduced Salivary S. mutans count significantly after two weeks. The side effects were more. ²⁹	Ren et al in their systematic conclude that Fluoride, CHX and herbal mouthwashes appear to be effective in the short term but the long-term effects are inconclusive. ²⁸
Sajadi et al stated that the S. mutans significantly reduced after two weeks with Fluoride - Chlorhexidine mouthwash with higher side effects. ³⁰	According to the results of Jothika et al, the use of Chlorhexidine, Fluoride, and probiotic mouthwash have statistically similar and equivalent effectiveness against S. mutans. ³²

Though there are several studies done in this area, the results remain inconclusive and vague about the

- Plaque retention in different bracket systems
- Comparison of Chlorhexidine and Fluoride mouthwash in different orthodontic bracket systems

This study is an attempt to bring a clearer picture of this ambiguous area.

In our study, we compared the effects of Chlorhexidine and Fluoride mouthwash in Metal, Self-ligating, and Ceramic brackets. The CFU was obtained at the first appointment before the use of mouthwash. The results obtained showed that the CFU was the highest amongst the Ceramic brackets group and the least with Self-ligating brackets with metal brackets being in between. Fournier, Payant, and Bouclin in their study concluded that the Metal brackets had a lower potential for accumulation of bacteria as compared to plastic and ceramic brackets¹². But it was also added that no statistical difference over time was obtained regarding the same. Tripathi et al concluded that the self-ligating bracket is considered to be the most hygienic bracket and that it should be used in patients with poor oral hygiene. Nascimento et al in their systematic review concluded that there the colony formation and adhesion of *S. mutans* was not influenced by the bracket design, namely, conventional or self-ligating.⁴⁰

The difference in mean between the initial and at the end of 3 months reduced in the three types of brackets in both fluoride and chlorhexidine mouthwash showed a reduction in the colonization of *S. mutans*. Similar results have been observed in previous studies done by Gedam et al., Dehghani et al., Gehsen et al., and Otten et al.^{41,42,43,44} In our study, based on Table 13; though statistical significance was

obtained in the ceramic bracket between Chlorhexidine and Fluoride mouthwash; the intergroup comparison of the initial and final period and percentage difference in the different groups showed that the fluoride mouthwash had a better reduction of colonization when compared to Chlorhexidine mouthwash. But in the study conducted by Sundas et al., it was concluded that both Chlorhexidine and Fluoride mouthwash were potent antimicrobial agents but Fluoride was better due to its additional remineralization property for preventing dental caries and gingivitis.

Along with the reduction in the load of *S. mutans*, an overall improvement in the oral hygiene and gingival health was also observed in our study.⁴² Though there was a decrease in plaque reduction, many patients needed a consistent motivation to use the prescribed mouthwash. The major reason for this is the taste of the mouthwashes. The taste of chlorhexidine in particular mouthwash was not very welcoming among the patients. In addition, there are very few studies in the literature that focuses on the side effects such as discoloration and bad odour.^{45,30,46} However, the long-term effect of these mouthwashes during the entire orthodontic treatment still is a question for which an evidence-based answer has to be provided. There have been studies that assess the mechanical properties, and frictional resistance of the arch wires with the use of mouthwash. It was noted that the mouthwash altered the mechanical properties and surface quality of the archwire.^{47,48,39,50} There was an increased frictional resistance of certain arch wires with the brackets with Fluoride mouthwash which was considered worthy in critical anchorage cases.³⁹ This could also increase the treatment duration if the mouthwashes are prescribed during the space closure. The corrosion resistance of the archwire was found to decrease with the mouthwashes. However, Chlorhexidine mouthwash was considered as mouthwash of choice in all phases of treatment.²²

Taking the literature and our study into account, both mouthwashes are effective in plaque reduction. However, the clinician must keep in mind the other factors and side effects associated with the usage of mouthwash. Though several studies were done on the surface and mechanical properties of the archwire and brackets with the usage of mouth rinses, they are majorly in vitro studies. A long-term study with a larger controlled trial and longer follow-up period is necessary taking into consideration the clinical and microbiological improvement along with the side effects of mouthwash will be required to obtain a more promising outcome.

Thus a clinician must bear this in mind before prescribing a mouthwash and should not only be aware of the favourable outcomes but also the possible side effects.

LIMITATIONS OF THE STUDY

- The limitation of the study is that only the microbiological assessment was done and just for *S. mutans*. However, the study aimed to concentrate on the initiator of dental caries.
- A periodic clinical evaluation of the gingiva could have been done.
- Constant monitoring and recording of the development of white spot lesions and the prevalence of dental caries would have strengthened the study.

SCOPE OF THE STUDY

The scope of the study is aimed

- To overcome the limitations.
- To assess the mouthwashes based on their efficacy and desirable outcomes.
- To evaluate the side effects in the oral cavity, different brackets and the archwire with the use of mouthwashes
- To evaluate any possible changes in the treatment duration due to the alterations in frictional resistance of the wire and bracket with the use of mouthwash.
- Addition of patients with aligners as their treatment modality.

CONCLUSION

This study was conducted to evaluate and compare the effectiveness of two different mouthwash on colonisation of *Streptococcus mutans*.

Two mouthwashes were considered in the study. They were:

- 0.2% chlorhexidine
- 0.05% Fluoride containing mouthwash

The three bracket system were

- Metal
- Self ligating
- Ceramic

The following conclusions can be drawn from the present study

- The colonisation of *S. mutans* before mouthwash is most in the Ceramic brackets and least in self-ligating brackets
- The *S. mutans* colonization is reduced with both the Chlorhexidine and Fluoride mouthwash at the end of one and three month.
- The effectiveness of Fluoride mouthwash was better statistically in the Ceramic bracket group.

Thus, the use of mouthwash is beneficial in patients undergoing orthodontic therapy. Fluoride mouthwash can be preferred in Ceramic brackets. This is due to the significant reduction in colonization with Fluoride mouthwash

Further studies are required to evaluate the longer effects of the mouthwash to assess if it is desirable to prescribe the mouthwash during the entire orthodontic treatment.

SUMMARY

The study aimed to assess and compare the quantitative analysis of *Streptococcus mutans* over metal, self-ligating, and ceramic brackets at the baseline, end of one month, three months with the use of two different mouthwash.

In the trial, Chlorhexidine and Fluoride mouthwashes were employed. Metal, Self-ligating, and Ceramic brackets were considered for the trial. Based on the bracket system and mouthwash prescribed, 6 groups were created. There were 14 patients in each of the group.

First, the sample was collected at baseline for all the patients. After randomly dividing them into groups, mouthwash was assigned. The samples were again collected at the end of one month and three months.

The CFU was counted and recorded. At the end of the study, the recorded values were analysed after the study to determine the colonization and effectiveness of the two types of mouthwash.

The values obtained were compared between the groups and sub groups.

The results obtained showed that:

- The colonization of *S. mutans* at baseline is most in the Ceramic brackets and least in Self-ligating brackets
- The *S. mutans* colonization is reduced with both the Chlorhexidine and Fluoride mouthwash at the end of one and three months.
- The effectiveness of Fluoride mouthwash was better statistically in the Ceramic bracket group.

Thus, the use of mouthwash is beneficial in patients undergoing orthodontic therapy. Fluoride mouthwash can be preferred in Ceramic brackets. This is due to the statistically significant reduction in colonization with Fluoride mouthwash.

BIBLIOGRAPHY

1. Ferreira FV, Monteiro EB. Aspectos psicológicos do tratamento ortodôntico. Rev. Fac. Odontol. FZL. 1989;21-8.
2. Meeran NA, Parveen MJ. The scope and limitations of adult orthodontics. Indian Journal of Multidisciplinary Dentistry. 2011 Nov 1;2(1).
3. Gazit-Rappaport T, Haisraeli-Shalish M, Gazit E. Psychosocial reward of orthodontic treatment in adult patients. Eur J Orthod 2010;32(4):441-6.
4. Capelloza Filho L, Braga SA, Cavassan AD, Ozawa TO. Tratamento ortodôntico em adultos: uma abordagem direcionada. Rev. dent. press ortodon. ortop. maxilar. 2001:63-80.
5. Cozzani M, Ragazzini G, Delucchi A, Mutinelli S, Barreca C, Rinchuse DJ, Servetto R, Piras V. Oral hygiene compliance in orthodontic patients: a randomized controlled study on the effects of a post-treatment communication. Progress in orthodontics. 2016 Dec;17(1):1-6.
6. Camorali C. The role of the dental hygienist in orthodontic practice. Prevenzione & Assistenza Dentale. 1991 Mar 1;17(2):39-43.
7. Lundström F, Krasse BO. Caries incidence in orthodontic patients with high levels of Streptococcus mutans. The European Journal of Orthodontics. 1987 Jan 1;9(1):117-21.
8. Bloom RH, Brown LR. A study of the effects of orthodontic appliances on the oral microbial flora. Oral Surgery, Oral Medicine, Oral Pathology. 1964 May 1;17(5):658-67.
9. Ogaard B, Rølla G, Arends J, Ten Cate JM. Orthodontic appliances and enamel demineralization Part 2. Prevention and treatment of lesions. American Journal of Orthodontics and Dentofacial Orthopedics. 1988 Aug 1;94(2):123-8.

10. Rolla G, Melsen B. On the mechanism of the plaque inhibition by chlorhexidine. *Journal of Dental Research*. 1975 Jun;54(2_suppl):57-62.
11. Eliades T, Eliades G, Brantley WA. Microbial attachment on orthodontic appliances: I. Wettability and early pellicle formation on bracket materials. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1995 Oct 1;108(4):351-60.
12. Fournier A, Payant L, Bouclin R. Adherence of *Streptococcus mutans* to orthodontic brackets. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1998 Oct 1;114(4):414-7.
13. Ahn SJ, Kho HS, Lee SW, Nahm DS. Roles of salivary proteins in the adherence of oral streptococci to various orthodontic brackets. *Journal of dental research*. 2002 Jun;81(6):411-5.
14. Lemos JA, Palmer SR, Zeng L, Wen ZT, Kajfasz JK, Freires IA, Abranches J, Brady LJ. The biology of *Streptococcus mutans*. *Microbiology spectrum*. 2019 Feb 27;7(1):10-128.
15. Dadgar S, Heydarian A, Sobouti F, Goli H, Rakhshan V, Heidari M. Effects of probiotic and fluoride mouthrinses on *Streptococcus mutans* in dental plaque around orthodontic brackets: A preliminary explorative randomized placebo-controlled clinical trial. *Dental Research Journal*. 2021 Jan 1;18(1):74.
16. Sari E, Birinci I. Microbiological evaluation of 0.2% chlorhexidine gluconate mouth rinse in orthodontic patients. *The Angle Orthodontist*. 2007 Sep 1;77(5):881-4.
17. Thaweboon S, Aung Y, Luppapornlarp S, Boonpratham S, Thaweboon B. Adhesion of *Streptococcus mutans* on different types of orthodontic brackets. *Advanced Materials Research*. 2014 May 8;893:467-71.

18. Gerardu VAM, van Loveren C, Heijnsbroek M, Buijs MJ, van der Weijden GA, ten Cate JM. Effects of various rinsing protocols after the use of amine fluoride/stannous fluoride toothpaste on the acid production of dental plaque and tongue flora. *Caries Research*. 2006;40:245-250. doi: 10.1159/000092233
19. Cornejo OE, Lefébure T, Pavinski Bitar PD, Lang P, Richards VP, Eilertson K, Do T, Beighton D, Zeng L, Ahn SJ, Burne RA. Evolutionary and population genomics of the cavity causing bacteria *Streptococcus mutans*. *Molecular biology and evolution*. 2013 Apr 1;30(4):881-93.
20. Topaloglu-Ak A, Ertugrul F, Eden E, Ates M, Bulut H. Effect of orthodontic appliances on oral microbiota—6 month follow-up. *Journal of Clinical Pediatric Dentistry*. 2011 Jul 1;35(4):433-6.
21. Rosenbloom RG, Tinanoff N. Salivary *Streptococcus mutans* levels in patients before, during, and after orthodontic treatment. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1991 Jul 1;100(1):35-7.
22. Nalbantgil D, Ulkur F, Kardas G, Culha M. Evaluation of corrosion resistance and surface characteristics of orthodontic wires immersed in different mouthwashes. *Bio-Medical Materials and Engineering*. 2016 Nov 25;27(5):539–49.
23. Türkkahraman H, Sayın M, Bozkurt FY, Yetkin Z, Kaya S, Önal S. Archwire ligation techniques, microbial colonization, and periodontal status in orthodontically treated patients. *The Angle Orthodontist*. 2005 Mar 1;75(2):231-
24. Forsberg CM, Brattström V, Malmberg E, Nord CE. Ligature wires and elastomeric rings: two methods of ligation, and their association with microbial colonization of *Streptococcus mutans* and *Lactobacilli*. *The European Journal of Orthodontics*. 1991 Oct 1;13(5):416-20.

25. Pellegrini P, Sauerwein R, Finlayson T, McLeod J, Covell DA Jr, Maier T, Machida CA. Plaque retention by self-ligating vs elastomeric orthodontic brackets: quantitative comparison of oral bacteria and detection with adenosine triphosphate-driven bioluminescence. *Am J Orthod Dentofacial Orthop*. 2009 Apr
26. Nascimento LE, Pithon MM, dos Santos RL, Freitas AO, Alviano DS, Nojima LI, Nojima MC, Ruellas AC. Colonization of *Streptococcus mutans* on esthetic brackets: self-ligating vs conventional. *Am J Orthod Dentofacial Orthop*. 2013 Apr;143(4 Suppl):S72-7
27. Raju AS, Hegde NA, Reddy VP, Chandrashekar BS, Mahendra S, Harishkoushik SR. An in vivo study on bacterial colonization with metal, ceramic and self-ligating brackets: A scanning electron microscopy study. *Journal of Indian Orthodontic Society*. 2013 Apr;47(2):88-96.
28. Ren X, Zhang Y, Xiang Y, Hu T, Cheng R, Cai H. The efficacy of mouthwashes on oral microorganisms and gingivitis in patients undergoing orthodontic treatment: a systematic review and meta-analysis. *BMC Oral Health*. 2023 Apr 6;23(1):204.
29. Giertsen E, Scheie AA. Effects of chlorhexidine-fluoride mouthrinses on viability, acidogenic potential, and glycolytic profile of established dental plaque. *Caries Research*. 1995 Nov 24;29(3):181-7.
30. Sajadi FS, Moradi M, Pardakhty A, Yazdizadeh R, Madani F. Effect of fluoride, chlorhexidine and fluoride-chlorhexidine mouthwashes on salivary *Streptococcus mutans* count and the prevalence of oral side effects. *Journal of dental research, dental clinics, dental prospects*. 2015;9(1):49.


31. Fard BK, Ghasemi M, Rastgariyan H, Sajjadi SH, Emami H, Amani M, et al. Effectiveness of Mouth Washes on Streptococci in Plaque around Orthodontic Appliances. *ISRN Dentistry* [Internet]. 2011;2011:1–4.
32. Jothika M, Vanajassun PP, Someshwar B. Effectiveness of probiotic, chlorhexidine and fluoride mouthwash against *Streptococcus mutans* – Randomized, single-blind, in vivo study. *Journal of International Society of Preventive & Community Dentistry* [Internet]. 2015 May 1;5(Suppl 1):S44–8.
33. Mummolo S, Tieri M, Nota A, Caruso S, Darvizeh A, Albani F, Gatto R, Marzo G, Marchetti E, Quinzi V, Tecco S. Salivary concentrations of *Streptococcus mutans* and *Lactobacilli* during an orthodontic treatment. An observational study comparing fixed and removable orthodontic appliances. *Clinical and Experimental Dental Research*. 2020 Apr;6(2):181-7.
34. Abraham KS, Jagdish N, Kailasam V, Padmanabhan S. *Streptococcus mutans* adhesion on nickel titanium (NiTi) and copper-NiTi archwires: A comparative prospective clinical study. *The Angle Orthodontist*. 2017 May 1;87(3):448-54.
35. Faltermeier A, Bürgers R, Rosentritt M. Bacterial adhesion of *Streptococcus mutans* to orthodontic adhesives with various filler-volume fractions. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2007 Dec 1;132(6):728-e7.
36. Raúl O, Ramberg P, Fukui H, Claes-Göran Emilson, Papanikolaou G, Lars Heijl, et al. Interaction between chlorhexidine and fluoride in a mouth rinse solution—a 4-day and 6-week randomized clinical pilot study. 2017 Oct 14;22(3):1439–48.


37. Shukla C, Maurya RK, Singh V, Tijare M. Evaluation of changes in *Streptococcus mutans* colonies in microflora of the Indian population with fixed orthodontics appliances. *Dental research journal*. 2016 Jul 1;13(4):309-14.
38. Ghorbani F, Haghgoo R, Aramjoo H, Rakhshandeh H, Jamehdar SA, Zare-Bidaki M. The antibacterial effect of *Magnolia* mouthwash on the levels of salivary *Streptococcus mutans* in dental plaque: a randomized, single-blind, placebo-controlled trial. *Iranian Journal of Microbiology*. 2021 Feb;13(1):104.
39. Geramy A, Hooshmand T, Etezadi T. Effect of Sodium Fluoride Mouthwash on the Frictional Resistance of Orthodontic Wires. *Journal of Dentistry (Tehran, Iran)* [Internet]. 2017 Sep 1;14(5):254–8.
40. Nascimento LEAG do, Souza MMG de, Azevedo ARP, Maia LC. Are self-ligating brackets related to less formation of *Streptococcus mutans* colonies? A systematic review. *Dental Press Journal of Orthodontics* [Internet]. 2014 Jan [cited 2023 Nov 20];19(1):60–8.
41. Gedam KY, Katre AN. Efficacy of Probiotic, Chlorhexidine, and Sodium Fluoride Mouthrinses on *Mutans Streptococci* in 8- to 12-Year-Old Children: A Crossover Randomized Trial. *Lifestyle Genomics*. 2022;15(1):35–44.
42. Dehghani M, Abtahi M, Sadeghian H, Shafae H, Tanbakuchi B. Combined chlorhexidine-sodiumfluoride mouthrinse for orthodontic patients: Clinical and microbiological study. *Journal of Clinical and Experimental Dentistry* [Internet].
43. Gehlen I, Netuschil L, Georg T, Reich E, Berg R, Katsaros C. The influence of a 0.2% chlorhexidine mouthrinse on plaque regrowth in orthodontic patients. A randomized prospective study. Part II: Bacteriological parameters. *Journal of*

- Orofacial Orthopedics= Fortschritte der Kieferorthopädie: Organ/official Journal Deutsche Gesellschaft für Kieferorthopädie. 2000 Jan 1;61(2):138-48.
44. Otten MP, Busscher HJ, van der Mei HC, Abbas F, van Hoogmoed CG. Retention of antimicrobial activity in plaque and saliva following mouthrinse use in vivo. *Caries research*. 2010 Sep 13;44(5):459-64.
45. Harris N, Garcia-Godoy F. *Primary Preventive Dentistry: The Essentials*.
46. Luoma H. Chlorhexidine solutions, gels and varnishes in caries prevention. *Proceedings of the Finnish Dental Society. Suomen Hammaslaakariseuran Toimituksia*. 1992 Jan 1;88(3-4):147-53.
47. Aghili H, Sogra Yassaei, Eslami F. Evaluation of the effect of three mouthwashes on the mechanical properties and surface morphology of several orthodontic wires: An in vitro study. *Dental research journal [Internet]*. 2017 Jan 1 [cited 2024 Apr 10];14(4):252–2.
48. Choudhary J, Shashikumar B, Patil AK. Evaluation and Comparison of Two Different Mouthwashes on Frictional Resistance Between Orthodontic Bracket and Archwire: An in Vitro Study. *Journal of Indian Orthodontic Society*. 2019 Apr;53(2):117–25.
49. Villa O, Ramberg P, Fukui H, Emilson CG, Papanikolaou G, Heijl L, Birkhed D. Interaction between chlorhexidine and fluoride in a mouthrinse solution—a 4-day and 6-week randomized clinical pilot study. *Clinical oral investigations*. 2018 Apr;22:1439-48.

ANNEXURE – I

ETHICAL CLEARANCE

 **Research and Ethics Committee**
KLE VK INSTITUTE OF DENTAL SCIENCES
A Constituent Unit of KLE Academy of Higher Education & Research
Accredited 'A' Grade by NAAC Placed In Category 'A' by MHRD (Gol)
Nehru Nagar, Belagavi - 590 010, Karnataka State
☎: 0831-2470362 Web: <http://www.kledental-bgm.edu.in>
FAX: 0831-2470640 E-mail: principal@kledental-bgm.edu.in



SI. No. : **1607**

CERTIFICATE

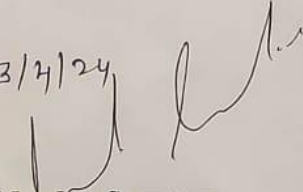
EC/NEW/INST/2021/2435
Research & Ethics Committee


This is to Certify that the synopsis titled

Effect of two different mouthwashes against colonisation
of Streptococcus mutans over metal, self-ligating and
ceramic brackets: A Randomized Controlled Trial Submitted by

Dr. Reg No: II0221005 P. G. Student /
Staff, Guided from Department of
Orthodontics and Dentofacial Orthopedics has been critically evaluated by
committee members and granted ethical clearance to conduct the above
mentioned study

Date : 3/7/24


Member Secretary
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi


Chairman
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

MEMBER SECRETARY
Research and Ethical Committee
KLEVK Institute of Dental Sciences
BELAGAVI

Chairman
Research and Ethical Committee
KLEVK Institute of Dental Sciences
BELAGAVI

ANNEXURE – II

CONSENT FORM

KLE Vishwanath Katti Institute of Dental Sciences, Belagavi
Department of Orthodontics and Dentofacial Orthopedics
“Effect of two different mouthwashes against colonization of Streptococcus mutans in Metal, self-ligating and ceramic brackets: A randomized controlled trial.”

Description of the Study:

To evaluate the effect of mouthwash on adherence of streptococcus mutans in Metal, self-ligating, and ceramic brackets..

- I,____, aged__years old have been informed about my involvement in the study conducted by **REG NO: II0221005**
- I agree to give my personal details like name, age, sex, address, previous, medical history and any other details required for the study to the best of my knowledge
- I will cooperate with the dentist
- I will follow the instructions given by the dentist during study.
- I will visit the dentist as and when required for the study, at the given time and date.
- I permit the researcher to utilize the information given by me and results obtained from this study for presentation and publication purposes without disclosing my identity.
- I understand that the tests to be performed are non-invasive observational tests, and do not carry any risks.
- I have been informed about the need for multiple observations and I agree to cooperate for the same.

I will not claim any returns for my cooperation in the study, even if it is being sponsored by any agency. I am participating with my own will and wish

If for any reason I am unable to participate in the study, for reasons unknown, I can withdraw from the study

In my full consciousness and presence of mind, after understanding all the procedure in my vernacular language, I am willing and giving my consent to participate in this study.

Name of the Patient:

Signature of the participant:

Signature of the researcher:

Date:

Place:

**ಕೆ.ಎಲ್.ಇ ವಿಶ್ವನಾಥ ಕಟ್ಟಿ ದಂತ ವಿಜ್ಞಾನ ಸಂಸ್ಥೆ
ಬೆಳಗಾವಿ ಆರ್ಥೋಡಾಂಟಿಕ್ಸ್ ಮತ್ತು ಡೆಂಟೋಫೇಶಿಯಲ್ ಆರ್ಥೋಪೆಡಿಸ್
ಸಮ್ಮತಿ ಪತ್ರ:**

“ಲೋಹ, ಸ್ವಯಂ-ಲಿಗೇಟಿಂಗ್, ಮತ್ತು ಸೆರಾಮಿಕ್ ಬ್ರಾಕೆಟಗಳು ಸ್ಟೆಪ್ಪೋಕಾಕಸ್ ಮ್ಯುಟನ್‌ಗಳ ಅಂಟಿಕೊಳ್ಳುವಿಕೆಯ ಮೇಲೆ ಎರಡು ವಿಭಿನ್ನ ಮೌಥ್‌ವಾಶ್‌ಗಳ ಎಫಿಟ್: ಎ ಯಾದೃಷ್ಟಿಕ ನಿಯಂತ್ರಿತ ಪ್ರಯೋಗ.

ಅಧ್ಯಯನದ ವಿವರಣೆ : ಉತ್ತರ ಕರ್ನಾಟಕದ ಜನಸಂಖ್ಯೆಯಲ್ಲಿ ಲೋಹ, ಸ್ವಯಂ-ಲಿಗೇಟಿಂಗ್, ಮತ್ತು ಸೆರಾಮಿಕ್ ಬ್ರಾಕೆಟಗಳು ಸ್ಟೆಪ್ಪೋಕಾಕಸ್ ಮ್ಯುಟನ್‌ಗಳ ಅಂಟಿಕೊಂಡಂತೆ ಮೌಥ್‌ವಾಶ್‌ನ ಪರಿಣಾಮವನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು.

- **REG NO: II0221005** ಅವರು ನಡೆಸಿದ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನ ಪಾಲ್ಗೊಳ್ಳುವಿಕೆಯ ಬಗ್ಗೆ ವಯೋವೃದ್ಧರಿಗೆ ತಿಳಿಸಲಾಗಿದೆ.
- ನನ್ನ ವೈಯಕ್ತಿಕ ವಿವರಗಳಾದ ಹೆಸರು, ವಯಸ್ಸು, ಲಿಂಗ, ವಿಳಾಸ, ಹಿಂದಿನ ವೈದ್ಯಕೀಯ ಇತಿಹಾಸ ಮತ್ತು ಅಧ್ಯಯನಕ್ಕೆ ಅಗತ್ಯವಿರುವ ಯಾವುದೇ ವಿವರಗಳನ್ನು ನನಗೆ ತಿಳಿದಿರುವಂತೆ ನೀಡಲು ನಾನು ಒಪ್ಪುತ್ತೇನೆ.
- ದಂತ ವೈದ್ಯರೊಂದಿಗೆ ಸಹಕರಿಸುತ್ತೇನೆ.
- ನಾನು ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ದಂತವೈದ್ಯರು ನೀಡಿದ ಸೂಚನೆಗಳನ್ನು ಅನುಸರಿಸುತ್ತೇನೆ.
- ನಾನು ದಂತವೈದ್ಯರನ್ನು ಅಧ್ಯಯನಕ್ಕೆ ಅಗತ್ಯವಿರುವಾಗ, ನಿರ್ದಿಷ್ಟ ಸಮಯ ಮತ್ತು ದಿನಾಂಕದಂದು ಭೇಟಿ ಮಾಡುತ್ತೇನೆ.
- ನನ್ನ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸದೆ ಪ್ರಸ್ತುತಿ ಮತ್ತು ಪ್ರಕರಣಕ್ಕೆ ಉದ್ದೇಶಗಳಿಗಾಗಿ ನಾನು ನೀಡಿದ ಮಾಹಿತಿ ಮತ್ತು ಈ ಅಧ್ಯಯನದಿಂದ ಪಡೆದ ಫಲಿತಾಂಶಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳಲು ನಾನು ಸಂಶೋಧಕರಿಗೆ ಅನುಮತಿ ನೀಡುತ್ತೇನೆ.
- ನಡೆಸಬೇಕಾದ ಪರೀಕ್ಷೆಗಳು ಆಕ್ರಮಣಶೀಲವಲ್ಲದ ವೀಕ್ಷಣಾ ಪರೀಕ್ಷೆಗಳು ಮತ್ತು ಯಾವುದೇ ಅಪಾಯಗಳನ್ನು ಹೊಂದಿರುವುದಿಲ್ಲ ಎಂದು ನಾನು ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.
- ಬಹು ಅವಲೋಕನ ಅಗತ್ಯತೆಯ ಬಗ್ಗೆ ನನಗೆ ತಿಳಿಸಲಾಗಿದೆ ಮತ್ತು ಅದಕ್ಕಾಗಿ ನಾನು ಸಹಕರಿಸಲು ಒಪ್ಪುತ್ತೇನೆ.

ಯಾವುದೇ ಏಜೆನ್ಸಿಯಿಂದ ಪ್ರಾಯೋಜಿತವಾಗಿದ್ದರೂ ಸಹ, ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನ ಸಹಕಾರಕ್ಕಾಗಿ ನಾನು ಯಾವುದೇ ಆದಾಯವನ್ನು ಕ್ಲೇಮು ಮಾಡುವುದಿಲ್ಲ. ನಾನು ಸ್ವಂತ ಇಚ್ಛೆಯೊಂದಿಗೆ ಭಾಗವಹಿಸುತ್ತಿದ್ದೇನೆ.

ಯಾವುದೇ ಕಾರಣಕ್ಕಾಗಿ ನನಗೆ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಸಾಧ್ಯವಾಗದಿದ್ದರೆ, ಅಕ್ಷಾತ್ ಕಾರಣಗಳಿಗಾಗಿ, ನನ್ನ ಪೂರ್ಣ ಪ್ರಜ್ಞೆ ಮತ್ತು ಮನಸ್ಸಿನ ಉಪಸ್ಥಿತಿಯಲ್ಲಿ, ನನ್ನ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ಎಲ್ಲಾ ಕಾರ್ಯ ವಿಧಾನಗಳನ್ನು ಅರ್ಥಮಾಡಿಕೊಂಡ ನಂತರ ನಾನು ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು.

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಾನು ಸಿದ್ಧನಿದ್ದೇನೆ ಮತ್ತು ನನ್ನ ಒಪ್ಪಿಗೆಯನ್ನು ನೀಡುತ್ತೇನೆ.

ರೋಗಿಯ ಹೆಸರು:

ಭಾಗವಹಿಸುವವರ ಸಹಿ:

ಸಂಶೋಧಕರ ಸಹಿ:

ದಿನಾಂಕ:

ಸ್ಥಳ:

केएलई विश्वनाथ कट्टी इन्स्टिट्यूट ऑफ डेंटल सायन्सेस, बेलगावी ऑर्थोडॉन्टिक्स आणि डेंटोफेशियल
ऑर्थोपेडिक्स विभाग

संमती फॉर्म

“मेटल, सेल्फ लिगेटिंग, आणि सिरॅमिक ब्रॅकेट्स स्ट्रेटोकोकस म्युटॅन्सच्या कोलोनाइसेशनदोन
वेगवेगळ्या माउथवॉशचा परिणाम,: एक रांडोमाइज्ड कंट्रोल ट्रायल.”

अभ्यासाचे वर्णन:

मेटल, सेल्फ लिगेटिंग आणि सिरॅमिक ब्रॅकेट्स मधील माउथवॉशच्या परिणामाचे मूल्यांकन करणे.

- मी _____, _____ वर्ष **REG NO: II0221005** यांनी केलेल्या अभ्यासात माझ्या सहभागाबद्दल मला माहिती देण्यात आली आहे.
- मी माझे वैयक्तिक तपशील जसे की नाव, वय, लिंग, पत्ता, पूर्वीचा, वैद्यकीय इतिहास आणि अभ्यासासाठी आवश्यक इतर कोणतेही तपशील माझ्या ज्ञानानुसार देण्यास सहमत आहे
- मी डेंटिस्टला सहकार्य करेन
- अभ्यासादरम्यान दंतवैद्याने दिलेल्या सूचनांचे मी पालन करेन.
- मी अभ्यासासाठी आवश्यकतेनुसार, दिलेल्या वेळी आणि तारखेस दंतचिकित्सकांना भेट देईन.
- मी संशोधकाला मी दिलेली माहिती आणि या अभ्यासातून प्राप्त झालेल्या परिणामांचा उपयोग माझी ओळख उघड न करता सादरीकरण आणि प्रकाशनाच्या उद्देशाने करण्याची परवानगी देतो.
- मी समजतो की ज्या चाचण्या करायच्या आहेत त्या नॉन-इनव्हेसिव्ह ऑब्झर्वेशनल चाचण्या आहेत आणि त्यात कोणताही धोका नसतो.
- मला एकाधिक निरीक्षणांच्या आवश्यकतेबद्दल माहिती देण्यात आली आहे आणि मी त्यासाठी सहकार्य करण्यास सहमत आहे.

मी अभ्यासात माझ्या सहकार्याबद्दल कोणत्याही परताव्याचा दावा करणार नाही, जरी ते कोणत्याही एजन्सीद्वारे प्रायोजित केले जात असले तरीही. मी माझ्या इच्छेने आणि इच्छेने भाग घेत आहे जर कोणत्याही कारणास्तव मी अभ्यासात भाग घेऊ शकत नाही, अज्ञात कारणास्तव, तर मी अभ्यासातून माघार घेऊ शकतो

माझ्या पूर्ण चेतनेमध्ये आणि मनाच्या उपस्थितीमध्ये, माझ्या स्थानिक भाषेत सर्व प्रक्रिया समजून घेतल्यानंतर, मी या अभ्यासात भाग घेण्यास तयार आहे आणि माझी संमती देत आहे.

रुग्णाचे नाव:

सहभागी व्यक्तीची स्वाक्षरी :

संशोधकाची स्वाक्षरी :

तारीख:

जागा:

ANNEXURE – III

PATIENT INFORMATION SHEET

KLE Vishwanath Katti Institute of Dental Sciences, Belagavi

Department of Orthodontics and Dentofacial Orthopedics

“Effect of two different mouthwashes on adhesion of Streptococcus mutans in Metal, self-ligating, ceramic brackets: A randomized controlled trial.”

Dear Patient,

You are invited to take part in a research study to assess the effect of two different mouthwashes on adhesion of S mutans in different bracket system. This research is a part of a M.D.S. main dissertation at KLE Academy of Higher Education and Research. You will be also asked to sign a consent form.

The purpose of this research study is to assess the potential effects of the above two types of mouthwash on Streptococcus mutans adhesion so that the clinician can make appropriate treatment modifications and thus help in making it more efficient and effective.

The tests are non-invasive, and do not carry any side-effects.

The information gained from this research might be used to publish in scientific platforms/ journals without revealing your identity to make recommendations for the best practice and adequate methods to improve on reducing the fatigue, if any.

REG NO: II0221005

PG Student (MDS)

Dept. of Orthodontics and Dentofacial Orthopedics,

KLE-VKIDS, Belagavi

ಕೆ.ಎಲ್.ಇ ವಿಶ್ವನಾಥ ಕಟ್ಟಿ ದಂತ ವಿಜ್ಞಾನ ಸಂಸ್ಥೆ

ಬೆಳಗಾವಿ ಆರ್ಥೋಡಾಂಟಿಕ್ಸ್ ಮತ್ತು ಡೆಂಟೋಫೇಶಿಯಲ್ ಆರ್ಥೋಪೆಡಿಕ್ಸ್

ರೋಗಿಗಳ ಮಾಹಿತಿ ಹಾಳೆ

“ಎರಡು ವಿಭಿನ್ನ ಮೌಢ್ಯವಾಶ್‌ಗಳ ಮೇಲೆ ಸ್ಟ್ರೆಪ್ಟೋಕೋಕಸ್‌ನ ಮ್ಯೂಟಾನ್‌ಗಳ ಅಂಟಿಕೊಳ್ಳುವಿಕೆಯು ಲೋಹ, ಸ್ವಯಂ-ಲಿಗೇಟಿಂಗ್, ಮತ್ತು ಸೆರಾಮಿಕ್ ಬ್ರಾಕೆಟ್‌ಗಳ ಮೇಲೆ ಪರಿಣಾಮ ಬೀರುತ್ತದೆ. ಇದರ ಯಾದೃಚ್ಛಿಕ ನಿಯಂತ್ರಿತ ಪ್ರಯೋಗ”

ಆತ್ಮೀಯ ರೋಗಿಯೇ,

ವಿಭಿನ್ನ ಬ್ರಾಕೆಟ್ ಎಸ್ ಮ್ಯೂಟಾನ್‌ಗಳ ಅಂಟಿಕೊಳ್ಳುವಿಕೆಯ ಮೇಲೆ ಎರಡು ವಿಭಿನ್ನ ಮೌಢ್ಯವಾಶ್‌ಗಳ ಪರಿಣಾಮವನ್ನು ನಿರ್ಣಯಿಸಲು ಸಂಶೋಧನಾ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ನಿಮ್ಮನ್ನು ಆಹ್ವಾನಿಸಲಾಗಿದೆ. ಈ ಸಂಶೋಧನೆಯು ಒಂದು ಕೆಎಲ್‌ಇ ಅಕಾಡೆಮಿ ಆಫ್ ಹೈಯರ್ ಎಜುಕೇಷನ್ ಅಂಡ್ ರಿಸರ್ಚ್‌ನಲ್ಲಿ ಒಂದು ಮುಖ್ಯ ಪ್ರಬಂಧದ ಭಾಗ.

ಒಪ್ಪಿಗೆಯ ನಮೂನೆಗೆ ಸಹಿ ಹಾಕಲು ನಿಮ್ಮನ್ನು ಕೇಳಲಾಗುತ್ತದೆ. ಈ ಸಂಶೋಧನಾ ಅಧ್ಯಯನದ ಉದ್ದೇಶವು ಸ್ಟ್ರೆಪ್ಟೋಕೋಕಸ್ ಮ್ಯೂಟಾನ್ಸ್ ಅಂಟಿಕೊಳ್ಳುವಿಕೆಯ ಮೇಲಿನ ಎರಡು ರೀತಿಯ ಮೌಢ್ಯವಾಶ್‌ನ ಸಂಭಾವ್ಯ ಪರಿಣಾಮಗಳನ್ನು ನಿರ್ಣಯಿಸುವುದು. ವೈದ್ಯರು ಸೂಕ್ತವಾದ ಚಿಕಿತ್ಸಾ ಮಾರ್ಪಾಡುಗಳನ್ನು ಮಾಡಬಹುದು ಮತ್ತು ಇದರಿಂದಾಗಿ ಹೆಚ್ಚು ಪರಿಣಾಮಕಾರಿಯಾಗಲು ಸಹಾಯ ಮಾಡಬಹುದು.

ಪರೀಕ್ಷೆಗಳು ಆಕ್ರಮಣಶೀಲವಲ್ಲದವು ಮತ್ತು ಯಾವುದೇ ಅಡ್ಡ-ಪರಿಣಾಮಗಳನ್ನು ಹೊಂದಿರುವುದಿಲ್ಲ.

ಈ ಸಂಶೋಧನೆಯಿಂದ ಪಡೆದ ಮಾಹಿತಿಯನ್ನು ವೈಜ್ಞಾನಿಕ ವೇದಿಕೆಗಳಲ್ಲಿ/ನಿಯತಕಾಲಿಕೆಗಳಲ್ಲಿ ಪ್ರಕಟಿಸಲು ನಿಮ್ಮ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸದೇ ಉತ್ತಮ ಅಭ್ಯಾಸಕ್ಕಾಗಿ ಶಿಫಾರಸ್ಸುಗಳನ್ನು ಮಾಡಲು ಮತ್ತು ಆಯಾಸವನ್ನು ಕಡಿಮೆ ಮಾಡಲು ಸಾಕಷ್ಟು ವಿಧಾನಗಳನ್ನು ಶಿಫಾರಸ್ಸು ಮಾಡಲು ಬಳಸಬಹುದು.

REG NO: II0221005.

ಪಿಜಿ ವಿದ್ಯಾರ್ಥಿ (ಎಮ್‌ಡಿಎಸ್)

ಆರ್ಥೋಡಾಂಟಿಕ್ಸ್ ಮತ್ತು ಡೆಂಟೋಫೇಶಿಯಲ್ ಆರ್ಥೋಪೆಡಿಕ್ಸ್ ವಿಭಾಗ,

ಕೆಎಲ್‌ಇ-ವಿಕೆಐಡಿಎಸ್, ಬೆಳಗಾವಿ.

केएलई विश्वनाथ कट्टी इन्स्टिट्यूट ऑफ डेंटल सायन्सेस, बेलगावी ऑर्थोडॉन्टिक्स आणि
डेंटोफेशियल ऑर्थोपेडिक्स विभाग

रुग्ण माहिती पत्रक

“मेटल, सेल्फ लिगेटिंग, आणि सिरॅमिक ब्रॅकेट्समधील स्ट्रेप्टोकोकस म्युटॅन्सच्या
कोलोनाइसेशनदोन वेगवेगळ्या माउथवॉशचा परिणाम,: एक रांडोमाइज्ड कंट्रोल ट्रायल.”

वेगवेगळ्या ब्रॅकेट सिस्टीम मध्ये एस म्युटॅन्सच्या राहण्यावर दोन वेगवेगळ्या माउथवॉशच्या
प्रभावाचे मूल्यांकन करण्यासाठी तुम्हाला संशोधन अभ्यासात भाग घेण्यासाठी आमंत्रित केले
आहे. हे संशोधन M.D.S. चा एक भाग आहे. केएलई अकादमी ऑफ हायर एज्युकेशन अँड
रिसर्च येथे मुख्य प्रबंध. तुम्हाला संमती/संमती फॉर्मवर स्वाक्षरी करण्यास देखील सांगितले
जाईल.

या संशोधन अभ्यासाचा उद्देश वरील दोन प्रकारच्या माउथवॉशच्या स्ट्रेप्टोकोकस म्युटॅन्सच्या
चिकटपणावर होणाऱ्या संभाव्य परिणामांचे मूल्यांकन करणे हा आहे जेणेकरून डॉक्टर
उपचारात योग्य बदल करू शकतील आणि त्यामुळे ते अधिक कार्यक्षम आणि प्रभावी
बनविण्यात मदत होईल.

चाचण्या गैर-आक्रमक आहेत, आणि कोणतेही दुष्परिणाम नाहीत.

या संशोधनातून मिळालेली माहिती तुमची ओळख उघड न करता वैज्ञानिक
प्लॅटफॉर्म/नियतकालिकांमध्ये प्रकाशित करण्यासाठी सर्वोत्तम सराव आणि थकवा कमी
करण्यासाठी पुरेशा पद्धती सुधारण्यासाठी शिफारशी करण्यासाठी वापरली जाऊ शकते, जर
असेल तर.

REG NO: II0221005

PG विद्यार्थी (MDS)

ऑर्थोडॉन्टिक्स आणि डेंटोफेशियल ऑर्थोपेडिक्स विभाग

KLE-VKIDS, बेलगावी