“THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE .”

Dissertation submitted to

BABU BANARASI DAS UNIVERSITY

LUCKNOW, UTTAR PRADESH

In the partial fulfillment of the requirements for the degree

Of

MASTER OF DENTAL SURGERY

In

PROSTHODONTICS, CROWN & BRIDGE

By

DR. RASHMIKA KAPOOR

Under the guidance of

DR. SHIKHA GUPTA

READER

DEPARTMENT OF PROSTHODONTICS , CROWN &BRIDGE

BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES ,

LUCKNOW

(FACULTY OF BABU BANARASI DAS UNIVERSITY)

Batch:2021-2024

ENROLLMENT NUMBER: 12103292960

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **"THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE."** is a bonafide and genuine research work carried out by me under the guidance of **DR. SHIKHA GUPTA** , Reader, Department of Prosthodontics, Babu Banarasi Das College Of Dental Sciences, Lucknow, Uttar Pradesh .

Place: Lucknow

Date: **DR RASHMIKA KAPOOR**

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled **"THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE"** is a bonafide work done by **DR. RASHMIKA KAPOOR,** under my direct supervision and guidance in partial fulfilment of the requirements for the degree of master of dental surgery (MDS) in Department of Prosthodontics.

Gupta

DR. SHIKHA GUPTA

READER

Department of prosthodontics, crown &bridge

Place: lucknow

Date:

ENDORSEMENT BY THE HEAD OF THE DEPARTMENT

This is to certify that the dissertation entitled **"THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE"** is a bonafide work done by **DR. RASHMIKA KAPOOR**, under the supervision of **DR. SWATI GUPTA**, Head of the Department of Prosthodontics in partial fulfillment of the requirements for the degree of Master of Dental Surgery (MDS) in Department of Prosthodontics.

Place : Lucknow

Date : 4/3/24

DR. SWATI GUPTA

Professor & Head of the Department

Departmenty Of Prosthodontics, Crown & Bridge

ENDORSEMENT BY THE HEAD OF THE INSTITUTION

This is to certify that the dissertation entitled **"THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE"** is a bonafide work done by **DR. RASHMIKA KAPOOR**, under the supervision of **DR. SHIKHA GUPTA, READER** in Department of Prosthodontics in partial fulfillment of the requirements for the degree of Master of Dental Surgery (MDS) in Department of Prosthodontics

Place: lucknow

Date:

DR PUNEET AHUJA

PRINCIPAL

COPYRIGHT

DECLARATION BY THE CANDIDATE

I hereby declare that Babu Banarasi Das University shall have the right to preserve, use and disseminate this dissertation in print or electronic format for academic/ research purposes.

Place: Lucknow

Date: **Dr. Rashmika kapoor**

EVERYTHING IS WITHIN YOUR POWER AND THE POWER IS WITHIN YOU !

DEDICATED TO MY PARENTS

MR. RAJ KAPOOR

MRS. SHIKHA KAPOOR

AND TO MY GRANDMOTHER

SMT. VIMLA KAPOOR

ACKNOWLEDGEMENT

With a deep sense of sincerity and appreciation, I take the opportunity to express gratitude and indebtedness to my guide, ***DR. SHIKHA GUPTA*** *Reader, Department of Prosthodontics, Babu Banarasi Das College of Dental Sciences, Lucknow. The one, who is endowed with remarkable foresight and the ability to attain excellence via a wealth of Knowledge. Her support and advice throughout the research project, as well as her guidance, have always helped me in my studies and, clinical work to improve myself and rectify my mistakes. I consider myself blessed for this opportunity & I sincerely thank you ma'am for always being an inspiration, support & believing in me even when I didn't believe in myself.*

With high regards, I take the opportunity to express gratitude to, ***Dr. Swati Gupta,*** *Professor& Head, Department of Prosthodontics, Babu Banarasi Das College of Dental Sciences, Lucknow. With her support and guidance in right direction I could complete my work.*

I am grateful to ***Dr. Amrit Tandan, Dr. Virag srivastav*** *sir for their guidance and support.*

It brings me great pleasure to express my gratitude to my respected principal Dr. Puneet Ahuja, for his permission and advice over the course of this project.

I am deeply indebted to my beloved teacher ***Dr. Manoj Upadhyay*** *for helping me throughout my studies.*

I'm thankful to the reader ***Dr. Garima agarawal*** *an epitome of knowledge, and positivity, she has always been there, believed, and supported me. I would like to extend my gratitude to* ***Dr. Praveen rai*** *sir and all the senior lecturers for their unwavering support and excellent ideas whenever I sought them.*

I am grateful to ***Dr Ashish Singhal****, for providing valuable assistance in data analysis*

I would like to express my gratitude to all my colleagues ***Dr. Naina Singh, Dr.Namra kausar, Dr.Aishwarya, Dr.deeksha, Dr. khirod,*** *and my beloved friends* ***Dr. Roopali Sharma*** *and* ***Dr.sarah jameel*** *for always cheering me up and a special thanks to* ***Dr. Ranjeet singh*** *for helping and for being there. I thank my juniors* ***Dr. Prithu Singh , Dr.Reesav Gupta*** *and for their support and assistance in the most critical moments.I'm also grateful towards* ***Dr. Naina Singh, Dr. Chirag Yadav, Dr Abhijit Patra ,*** *for being there and extending there help whenever needed .*

*I am always indebted to my parents **Mr. Raj Kapoor** and **Mrs. Shikha Kapoor** whose innumerable sacrifices have brought me to the position where I stand today . I would deeply thank my beloved brother **Jash kapoor** who always believed in me and stood beside me, for making me realise my own potential so that I could take up any & every work confidently. I would also like to mention my grandmother whom I love more than anyone on this world **Mrs. Vimla Kapoor** .It was through my family's sacrifices and support that I pledged to fulfill all my dreams that I wished for. My special thanks to my all-time support and love, my sisters **Vidisha rai , swati Singh , Radhika Mehrotra, Rhea Mehrotra** . Without their boundless love and care, neither my life story nor could this thesis have been written.*

*I would like to express my gratitude to my constant support and care throughout this journey **Dr. Namra kausar** and **Dr. Aishwarya Gunjan .** It was through their support and belief I could do this with positivity and handwork.*

Best Regards

Dr.Rashmika kapoor

TABLE OF CONTENTS

List of tables

List of figures

List of graphs

LIST OF ANNEXURES

LIST OF ABBREVIATIONS

CHX	Chlorhexidine
T	Turmeric liquid
A	Ayurvedic right sure mouthwash
BAM	Blood Agar Media
CFU	Colony forming unit

ABSTRACT

AIM: “THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE”

MATERIALS AND METHODS:

A total no. of 60 patients were tested who were denture wearers. Sample size was divided into 4 groups .Microbiota colony were to study on each sample. For the control groups no disinfectant was given. Second sample was given chlorhexidine as a denture cleaning agent and the third one with turmeric liquid as a denture cleaning agent . The fourth group was given ayurvedic liquid as a denture cleaning agent .The three samples were further processed for growth of microbiota colony, The efficacy of the disinfectants was compared between the three treated with disinfectants with respect to the control.

STATISTICAL ANALYSIS USED:

The statistical analysis was performed using SPSS software (version 23).

The statistical difference in CFU between three groups-

The intragroup comparison of CFU between different time interval of72hrs) in four groups (control, CHX, A, T) were performed using One -Way ANOVA and Independent T test.

The intergroup difference in the CFU at 72hrs were analysed using the one-way ANOVA followed by independent t test . The level of significance for the present study was fixed at 5% level. (p= 0.05).

RESULTS:The data obtained from the above study demonstrates that the efficacy of turmeric liquid extract is comparable to chlorhexidine (a gold standard) as a disinfectant .

CONCLUSION : Efficacy of , the turmeric disinfectant comparable to chlorhexidine, the chemical disinfectant as a denture cleaning agent . While the ayurvedic disinfectant was the least effective .

Since the number of people who are edentulous is always increasing, maintaining dentures and their hygiene is crucial. Poor denture hygiene has been linked in several studies to systemic infections such pneumonia and endocarditis. Chemical denture disinfectants play a crucial role because they are less expensive, easier to use, and don't harm prosthetics too much [1]. There are many different denture disinfectants on the market, but it is the dentist's responsibility to recommend the right kind of disinfectant to the patient. Dental professionals are required to provide patients with information regarding the availability of each denture disinfectant as well as its benefits and drawbacks.

Use of chemical disinfectant is a very common in dental practice but use of herbal for the same is evolving too.

An essential component of turmeric called curcumin is thought to be safe to use orally in the treatment of bacterial infections. Numerous investigations revealed that curcumin had antibacterial properties against both Gram-positive and Gram-negative microorganisms. Curcumin's antibacterial activity includes rupturing the bacterial membrane, causing oxidative stress, and inhibiting the synthesis of virulence factors and biofilm formation in bacteria.[2]These qualities also help to explain how curcumin functions as a broad-spectrum antibacterial adjuvant, as demonstrated by the compound's notably additive or synergistic effects with different kinds of non-antibiotic or traditional antibiotics.

Chlorhexidine (CHX) is a bisbiguanide developed in the 1940s in the UK and initially marketed as a general disinfectant. In the 1970s, its effectiveness against dental plaque was discovered, leading to the introduction of a mouthwash version in 1976. Various oral conditions like halitosis, caries, gingivitis, and periodontitis are associated with the development of oral biofilm and the bacteria within it. To reduce bacterial load, it is recommended to use a 0.2% CHX mouthwash for one minute before surgery. This precaution is essential as bacterial contamination during implant insertion often results in biofilm formation and premature failure.[3]

An ayurvedic mouthwash it is a chemical free and contains several ayurvedic contents which have shown significant inhibitory action against wide variety of bacteria and fungi.This mouthwash contains asparagus racemosus, Bacopa momieri, Glycyrrhizaglabra, Nigella sativa , rosemarinus officials.

The subject of the study chosen are healthy edentulous individuals who are denture wearers .

AIM: To Compare and Evaluate the effect of herbal and chemical disinfectants on denture intaglio surface from healthy edentulous denture wearers .

OBJECTIVES

1- To study the efficacy of chemical disinfectant as denture cleaning agent .

2- To study the efficacy of herbal disinfectant as denture cleaning agent.

4- To study the efficacy of ayurvedic antiviral mouthwash as a denture cleaning agent.

3. To compare efficacy of herbal and chemical disinfectant as denture cleaning agent.

1) **Drake D, Wells J, Ettinger R.(1992) :** Efficacy of denture cleansing agents in an in vitro bacteria-yeast colonization model. As a result Both Efferdent and Super-Strength Polident were able to substantially reduce or eliminate colonizing S mutans.

2) **Neil Mac S, Rindler E,Walker A,Brown A R, Cobb C M (1997)** : This study examined the effects of tetracycline hydrochloride (TCN) and chlorhexidine gluconate (CHX) on the growth and viability of Candida albicans. Subcultures of Candida albicans on Sabotiraud's agar. were divided into 5 treatment groups: group 1. untreated control; group 2. 0.12% CHX; group 3. 3.0 mg,'m! TCN adjusted to pH 4.5; groups 4 and 5, sodium azide free Tris buffer adjusted to pH 4.5 and pH 7.4. respectively. The results show that TCN even when used at high concentrations, in vitro, will allow uninhibited growth of Candida albicans whereas CHX inhibits cell growth and replication.

3) **Nikawa H (1999):**A review of in vitro and in vivo methods to evaluate the efficacy of denture cleansers .The results obtained vary depending on the methods used to evaluate the efficacy of denture cleansers, particularly among in vitro and in vivo assays. In addition, it is pointed out that chemical denture cleansers are not as efficacious in clinical use as in the in vitro assay. The uncertainty over efficacy may be caused by non standardized methodology and reports of conflicting results.

4) **Paranhos Hde F(2000):** This study was done to check the capacity of denture plaque/ biofilm removal and antimicrobial action of a new denture paste.The paste was widely accepted by the patients, and effective in denture plaque removal and antimicrobial action. The species of yeasts most frequently isolated were C. albicans, C. tropicalis and C. glabrata. We conclude that it is possible for complete denture wearers to keep their dentures clean with the regular use of a paste-like hygienic product.

5) **Lefebvre A. Carol et al (2001):** This study aimed to determine whether the addition to microban to permasoft denture liner prevents the growth of C. Albicans and affects the

cytotoxicity of the permasoft material. The addition of microban did not significantly reduce the adherence of viable C Albicans to a smooth surface of permasoft denture lining material.

6) **mervin gornitsky et. al., (2002):**A clinical and microbiological evaluation of denture cleansers for geriatric patients in long-term care institutions.there were no significant differences among the cleansers in reduction of Candida spp. or Streptococcus mutans. Dentures cleaned with Denture Brite, Polident or Efferdent appeared to have similar reductions in the level of plaque, stain and food, and all had substantially greater reductions than dentures cleaned with water only. The significant difference in the rank of the reduction in Candida spp. CFUs ($p = 0.005$) was related to the variance between study periods ($p = 0.01$) and the variance between subjects ($p = 0.008$).

7) **Barnabé W (2004):** Efficacy of sodium hypochlorite and coconut soap used as disinfecting agents in the reduction of denture stomatitis, Streptococcus mutans and Candida albicans.The association of coconut soap and 0.05% sodium hypochlorite significantly reduced clinical signs of denture stomatitis

8) **Yilmaz H (2005):** Effects of disinfectants on resilient denture-lining materials contaminated with Staphylococcus aureus, Streptococcus sobrinus, and Candida albicans.For all microorganisms, soaking in 5.25% sodium hypochlorite reduced the number of viable adherent microorganisms significantly compared to soaking in 2% sodium hypochlorite, which led to greater reduction than soaking either 5% Deconex or 3.5% Savlex. The use of 5.25% sodium hypochlorite in all groups is statistically significant.

9) **da Silva FC (2008):** Effectiveness of six different disinfectants on removing five microbial species and effects on the topographic characteristics of acrylic resin.The results

showed that 1% sodium hypochlorite, 2% glutaraldehyde, and 2% chlorhexidine digluconate were most effective against the analyzed microorganisms, followed by 100% vinegar, 3.8% sodium perborate, and tabs of sodium perborate-based denture cleanser. Superficial roughness of the specimens was higher after disinfection cycles with 3.8% sodium perborate ($p= 0.03$) and lower after the cycles with 2% chlorhexidine digluconate ($p= 0.04$).

10) L Coulthwaite et al (2009): Evaluation of in vivo denture plaque assessment methods.The results show that blinded image scoring is more representative of the true plaque area coverage than 'live' denture scoring, detecting significant decreases in plaque coverage.However, analysis is very time consuming. Thus, a number of recommendations are made regarding quantification of denture plaque for the assessment of cleanser products.

11) Işeri U, Uludamar A, Ozkan YK(2011) : Effectiveness of different cleaning agents on the adherence of Candida albicans to acrylic denture base resin . Gerodontology..Mouth rinses showed the highest removal activity for all the treatment times and completely eliminated the adherence of C. albicans.

12) Dahlan AA (2011): chlorhexidine gluconate, and commercial denture cleansers as disinfecting agents against Candida albicans: An in vitro comparison study.For the results, it appears appropriate for providers to recommend a solution of two teaspoons of sodium hypochlorite in one cup of water (1:25) for 30 minutes to treat dentures contaminated with C. albicans.

13) **de Andrade IM (2012):** This study evaluated the efficacy of complete denture biofilm removal using a chlorhexidine solution in two concentrations: 0.12% and 2.0%.Both chlorhexidine-based treatments had a similar ability to remove denture biofilm. Immersion in 0.12% or 2.0% chlorhexidine solutions can be used as an auxiliary method for cleaning complete dentures.

14) **Bartłomiej W. Loster (2012):** Did a study on Mycological Analysis of the Oral Cavity of Patients Using Acrylic Removable Dentures and as a result a large percentage of persons wearing removable denture has been affected by Candida species and that could lead to the mycosis of farther gastrointestinal tract sections. The mycological examination before treatment, especially in patients using acrylic denture, appears to be necessary.

15) **Skupien JA (2013):** Prevention and treatment of Candida colonization on denture liners: a systematic review. The use of 0.5% sodium hypochlorite can help disinfect denture liners and tissue conditioners. The incorporation of nystatin in those materials is also able to treat or prevent oral candidiasis

16) **Silvia carneiro de Lucena-ferreira et al (2014):**The aim of this study was to evaluate the effect of daily exposure to a denture cleanser on a multispecies biofilm.Daily exposure of a multispecies biofilm to a denture cleanser reduces the number of total microorganisms but favors C. albicans development

17) Aoun G, Cassia A (2015): This study aimed to evaluate the efficacy of a solution containing 0.12% chlorhexidine (CHX) digluconate and 0.05% cetylpyridinium chloride (CPC) in eliminating Candida albicans colonizing dentures.A solution of 0.12% CHX and

0.05% CPC tested as a product of disinfection of the acrylic dentures showed significant results after immersion of 8 night hours for 4 days.

18) Salles Moreira Marcela et al (2015): This study evaluated the antimicrobial activity of sodium hypochlorite (0.25% and 0.50%) and 10% Ricinus communis' solutions against specific microorganisms.The 0.5% sodium hypochlorite solution was the most effective and might be used to control denture biofilm. C. albicans was the most frequently isolated Candida sp.

19) Nair V. (2016):The present study is a randomised , three group parallel study among 45 patients aged between 42 and 80 years wearing removable dental prosthesis.Total, 45 patients wearing removable dental prosthesis were randomly selected. Patients were divided into three groups as per duration of usage since 1 month, 6 month and ≥1 year.Streptococcus species and Staphylococcus aureus were the common microorganisms isolated in all three groups and was statistically significant at P <0.05. Candida albicans, Diphtheroid, Escherichia coli, Micrococcus species were isolated from Group II and Group III.

20) Baochen shi (2016): Twenty adult denture-wearing volunteers with a minimum of four remaining teeth and one complete denture were recruited for this study under Institutional

Review Board no. 2012-0004 to West China University (Chengdu, China). Ten individuals were healthy denture wearers, and 10 were patients with denture-associated stomatitis according to published guideline for diagnosis of denture stomatitis .we were able to identify distinct species such as F. nucleatum subsp. animalis and several species of *Streptococcus* that were strongly associated with diseased and healthy denture samples, respectively. Our findings that significant differences in colonization were observed predominantly on the phylotype/species level highlight the importance of species/phylotype or even oligotype level analysis.

21) Peracini A(2017) : Antimicrobial action and long-term effect of overnight denture cleansers.There was a reduction of Candida spp. counts after using both solutions (AP and SH). The Candida spp. most often isolated was C. albicans, followed by the C. glabrata. Only 24.7% of isolate strains were resistant to at least one of the tested antifungals, highlighting azole compounds.

22) R Sushma et al. (2017): This study was done to evaluate ann alternative herbal formulation as a denture cleanser.(1) To evaluate antifungal properties of triphala churna on the heat cure denture base material. (2) To evaluate the antifungal effect of chlorhexidine gluconate on the heat cure denture base material. (3) To compare the antifungal effect of triphala churna and chlorhexidine gluconate with a control. (4) To evaluate which among triphala churna and chlorhexidine gluconate has a better antifungal property on the heat cure denture base material.Triphala as an antifungal is shown to have more efficacy than the conventional chlorhexidine mouthwash.

23) Ramage G et al (2018): This two-part study (i) developed an *in vitro* model of

denture plaque removal, and (ii) assessed effectiveness of these approaches in a randomised clinical trial.This study demonstrated that daily denture cleansing regimens are superior to intermittent denture cleansing, and that cleansing regimens can induce denture plaque compositional changes.

24) Procópio ALF (2018): Antimicrobial and cytotoxic effects of denture base acrylic resin impregnated with cleaning agents after long-term immersion. In conclusion,the antimicrobial effect remained effective only for 2%CHX, which resulted in progressive inhibition of C. albicans and S. aureus over 14 days of incubation for both simulated overnight immersion periods.

25) Masetti P, Arbeláez MIA (2018): Cytotoxic potential of denture base and reline acrylic resins after immersion in disinfectant solutions. The purpose of this in vitro study was to evaluate the cytotoxic potential of cell cultures of denture base and reline acrylic resins after immersion in disinfectant solutions.The type of acrylic resin (base or reline) had no significant effect on the viability of cells. Vinegar and chlorhexidine digluconate solutions increased in cytotoxic effect over time, and were strongly cytotoxic after 6 months of immersion. Sodium perborate and sodium hypochlorite were noncytotoxic in all periods of time tested.

26) Karthikeyan et.al.(2018):. Denture disinfectants used in prosthodontics - a review which concluded Educating the patient in denture hygiene is vital. Dentists must continually learn about the chemical content of products used at work.

27) Chiaki tsutsumi-arai (2019:) Grapefruit seed extract effectively inhibits the Candida albicans biofilms development on polymethyl methacrylate denture-base resin.As a result, the treatment with 1% GSE for 5 min almost completely eliminated the biofilm formed on the

resin; whereas, the treatment with 0.1% GSE, Polident, and 0.1% G+P for 5 min showed a statistically significant inhibitory effect on biofilms. In addition, 0.1% GSE and 0.1% G+P exerted a persistent inhibitory effect on biofilms.

28) Mohammed Moustafa Gad(2020): The aim of this article was to review the antifungal effects of the different methods that have been suggested for the prevention and/or control of DS as well as the antimicrobial activity of denture base acrylic resin additives, including nanoparticles. perspectives and the future of Candida albicans-associated denture stomatitis treatment. Based on the literature review, it can be concluded that the incorporation of different antifungal agents into the PMMA denture base material can control DS. In addition, coating the denture base resin with antifungal agents and topically applying cleaning agents are both effective in the treatment of DS in vitro. However, most of the published articles were based on in vitro studies, with or without simulating the clinical situations. There is also a lack of studies investigating the long-term effects of these treatment methods, and the relationship between surface properties and nanofiller ad- ditives.

29) Adamczak et.al. (2020): this study was done on Curcumin to check its antimicrobial activity for strain specific activity and as a result the study exhibited a broad spectrum of antimicrobial activity of curcumin. The in vitro tests included over 100 bacterial and fungal strains belonging to 19 species.

30) Oza et.al. (2021): The aim of this article is to check the anti fungal activity of turmeric (curcuma longa) rhizome against different fungi.The results obtained in present study indicates that Curcuma longa is rich in different phytochemicals. Curcuma longa shows the antifungal activity against Aspergillus sp. And Fusarium sp. Curcuma longa having more antifungal potential as compare to other plants

31) Adriana barbosa ribeiro (2022): This study is done to evaluate the Effect of a Hygiene Protocol on Denture-Related Stomatitis Remission, Local Inflammatory Factors, and Hemodynamic Responses by Arterial Pressure.As a result The current hygiene protocol reduced the score of the DRS, the biofilm percentage of the inner surface, and microbial load count of the *Candida* spp. on dentures. In addition, the protocol promoted improvement in local inflammatory factors with an increase in MUC 1 and a decrease in IL-6, Il-2, Il-10, and INFγ combined with a reduction in systolic and media arterial pressures.

32) Lee EH (2022): Removal effect of *Candida albicans* biofilms from the PMMA resin surface by using a manganese oxide nanoenzyme-doped diatom microbubbler..Co-treatment of DM and H2O2 effectively removed *C. albicans* biofilms formed on autopolymerizing, heat-activated, milled, and 3D-printed denture base resin specimens.

33) Sansare et al.(2022): Herbal denture cleanser :examples and recent developments and as a conclusion. As modernization of world is on race, in this race the use of herbal denture cleansers for oral health is the golden way for developing countries.

34) Eman M AlHamdan (2023): Influence of contemporary photoactivated disinfection on the mechanical properties and antimicrobial activity of PMMA denture base.
According to the systematic review (qualitative synthesis), photoactivated disinfectants demonstrated comparable mechanical features and antimicrobial activity of PMMA dentures bases to conventional chemical disinfectants suggesting their potential to be utilized as an alternative to conventional chemical disinfectants. However, the meta-analysis (quantitative synthesis) revealed that the application of conventional disinfectants demonstrated better

outcomes related to antimicrobial activity and flexural strength of PMMA-based denture based.

35) **Rattiporn kaypetch (2023):** Study on effects of two novel denture cleansers on multispecies microbial biofilms, stain removal and the denture surface: an in vitro study.Two novel denture cleansing agents containing natural products, GE and TM exhibited effective antimicrobial activity, antibiofilm and stain removal capabilities without toxicity or disturbance of the physical properties of acrylics.

The study was conducted in the Department of Prosthodontics and Crown & Bridge, at Babu Banarasi Das College of Dental Sciences, Lucknow,to See the effects of different anti microbial agents on the oral microbiome and fungal growth on the denture surface.

Study sample and size

Total no. of sample /specimen -60:

Completely edentulous patients reporting to the department of prosthodontics, were selected for study as per the inclusion and exclusion criteria.

The study was approved by the ethical committee of babu Banarasi Das college of dental sciences, BBD university.

ARMAMENTARIUM

The Materials and instruments that were used during the course of this study.

Materials and equipments used in the study:-

1- Denture

2- Disinfectants - chx (vavi-fresh) , Ayurvedic (right sure), turmeric extract liquid

3- Media plates - Blood agar plates

4- Laminar air flow (mangat ramn and sons)

5- normal saline

6- sterile swabs

7- Incubator (Surgical industries)

Figure 1: Turmeric liquid extract

Figure 2: vavi -fresh (chlorhexidine)

Figure 3: sterile swabs

Figure 4: test tubes

Figure 5: Right sure (ayurvedic)

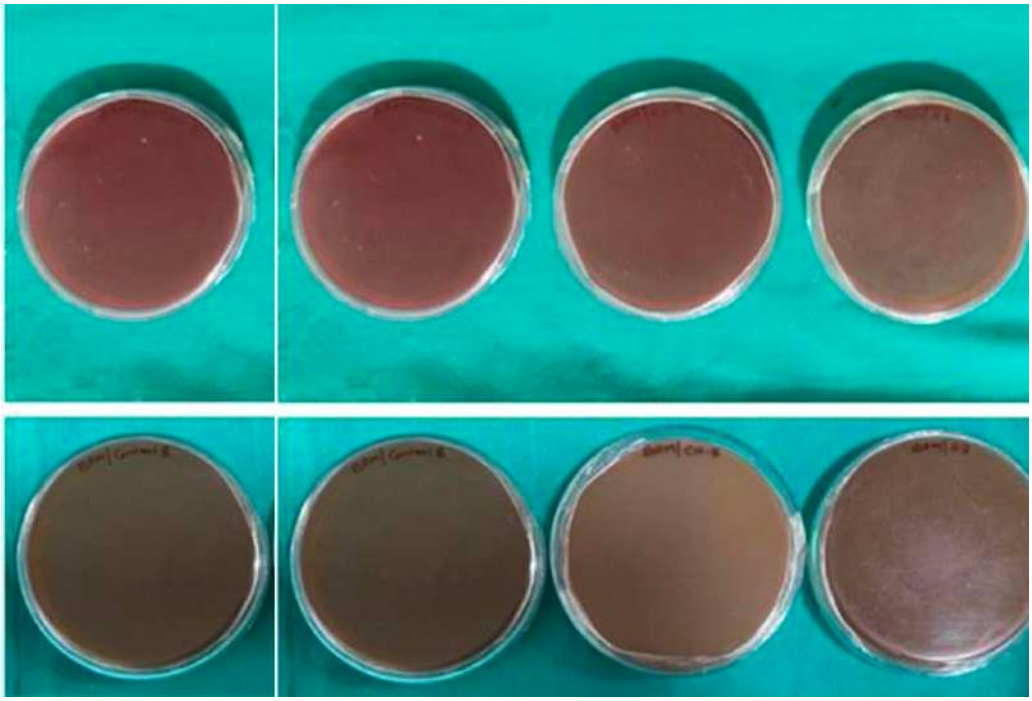


Figure 6: blood agar plates

Figure 7: Incubator

Figure 8: Laminar flow

Figure 9: laminar flow

SELECTION CRITERIA

INCLUSION CRITERIA

- Completely Edentulous patient
- Age (50 to 70 years)

EXCLUSION CRITERIA

- Medically compromised patient
- Partially edentulous

METHODOLOGUY

DENTURE FABRICATION

Completely edentulous patients were chosen and complete dentures were fabricated following the conventional method.Impression was recorded using compound for primary impression , border moulding was done and secondary impression was recorded using desired material according to the ridge. Jaw relation was done and the bites were articulated. Teeth arrangement was done and after final try in denture was fabricated . On the day of denture delivery as a denture cleaning agent chlorhexidine 0.2%, turmeric liquid extract , ayurvedic mouthwash was handed to each patient respectively .

After three months of using the denture and cleaning it with the given denture cleaning agents patients were called for follow up and intaglio surface of the dentures swab was taken .

The swab used were sterile and were stored in a cold storage box and was send to the lab for further analysis .

MICROBIOLOGICAL ANALYSIS

Statistical analysis would be done for the results obtained.

1. To investigate the effect off different disinfectant materials i.e. chlorhexidine(vavi-fresh), ayurvedic solution(right sure) , turmeric liquid extract , 60 samples were used for work.

2. The antimicrobial effect of disinfectants is studied by three methods namely: rinse, spray, immersion methods. In the present study immersion method was used. It has been earlier reported that Spraying and immersing methods are almost equal while mere water rinsing showed no significant disinfection effects.[35]

3. All 60 swab samples were used which were taken from the intaglio surface of the denture.

4. 15 samples which were disinfected with the emersion method by the patient at home with "chx", 15 samples were disinfected with emersion method in ayurvedic disinfectant "A", 15 samples were disinfected with emersion method in turmeric liquid extract "T", 15 samples with no treatment as "control" group.

5. On the other hand, TSB broth was prepared and sterilised (autoclaving at 121C, 15 psi, 25 minutes) in separate test tubes.

6. TSB broth were then incubated at 37°C for 24 hours

7. Blood Agar plates were prepared by using standard composition of Hi-Media according to manufacturer‟s instruction.

8. 0.1 ml of inoculum was transferred from TSB broth onto sterile Blood Agar Plates and spread using L-shaped sterile rod.

9. Plates were then sealed with para film and placed in inverted position in the incubator at 37°C.

10. Colonies were counted at an incubation period of 24, 48 and 72 hours on each plate.

11. CFU/ml were calculated on each plate using formula CFU/ml = No. colonies observed x Dilution factor/Volume of sample plated (In this case no dilution was made).

Test : Determination of colony forming unit (CFU/ml) from the swab taken from disinfected intaglio surface of the denture.

Test sample : Swabs

Sample no./name : 60 / control, chx (chlorehexidine treated denture swab), T (turmeric liquid extract treated denture swab), A (ayurvedic mouthwash treated swab).

Sample code : control 1-15 , Chx1-15, T1-15, A1-15

Figure 10: Initial plate images before incubation: samples blood agar media

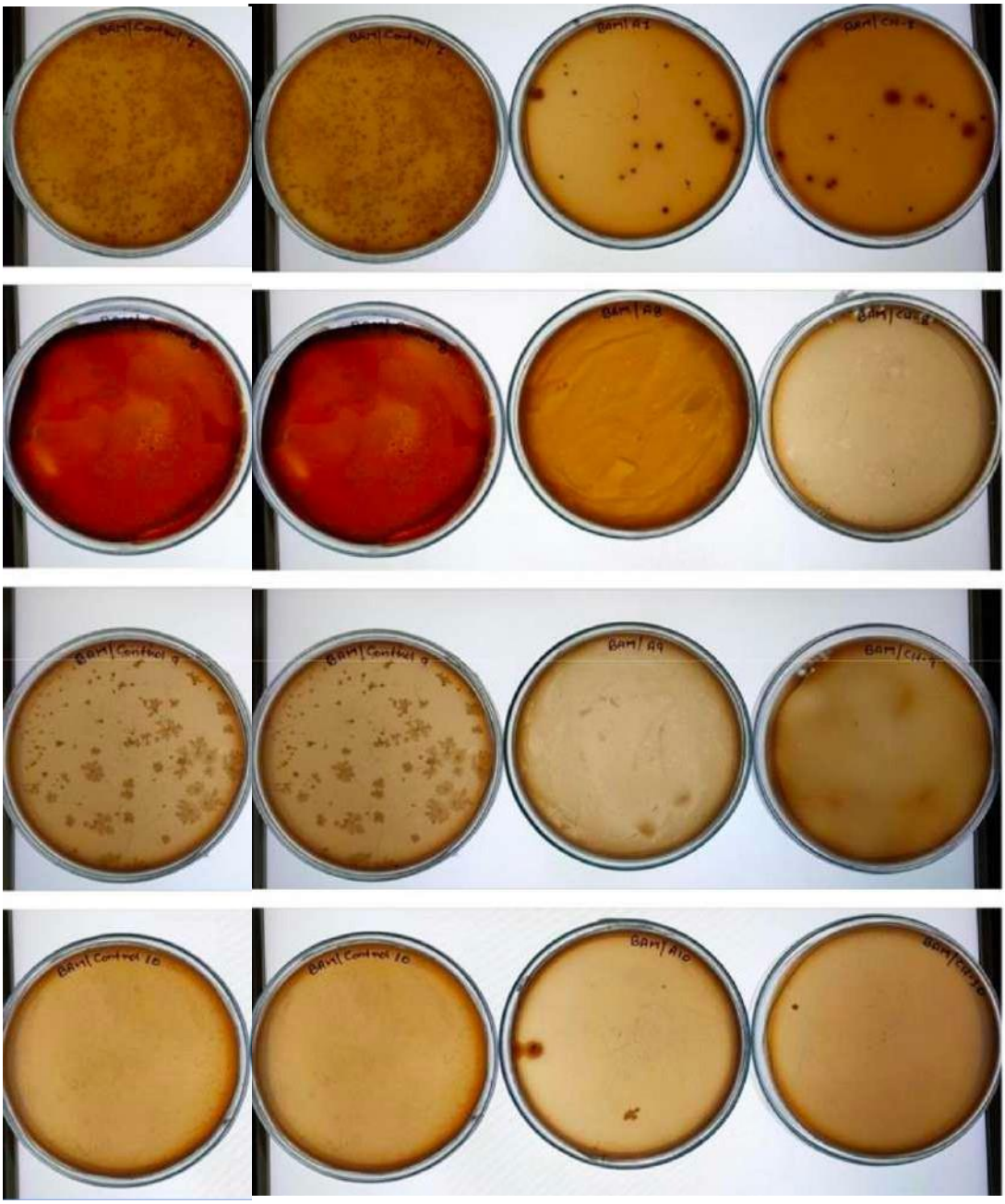


Figure 11: plate images after 24 hours incubation

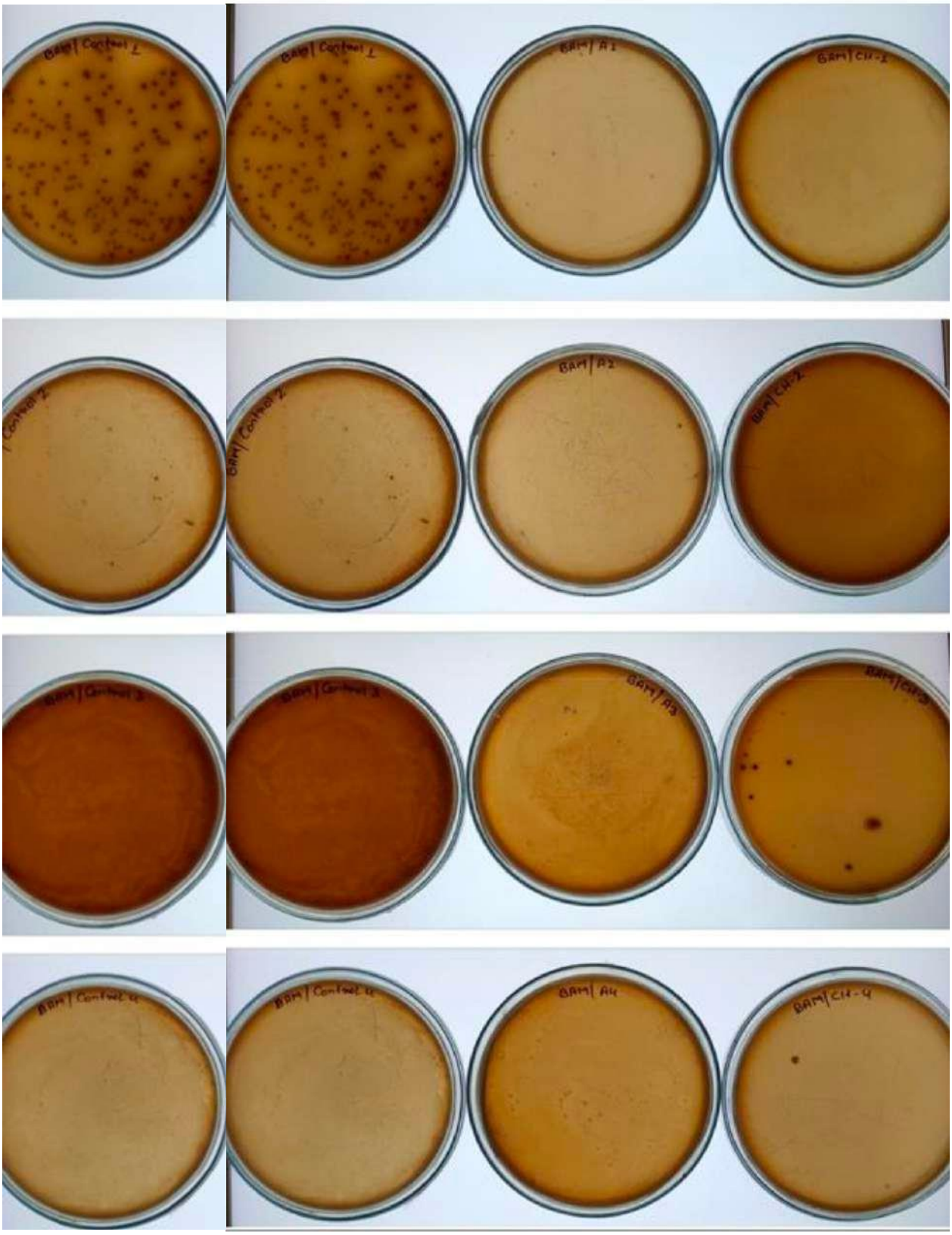


Figure 12: plate images after 48 hrs of incubation

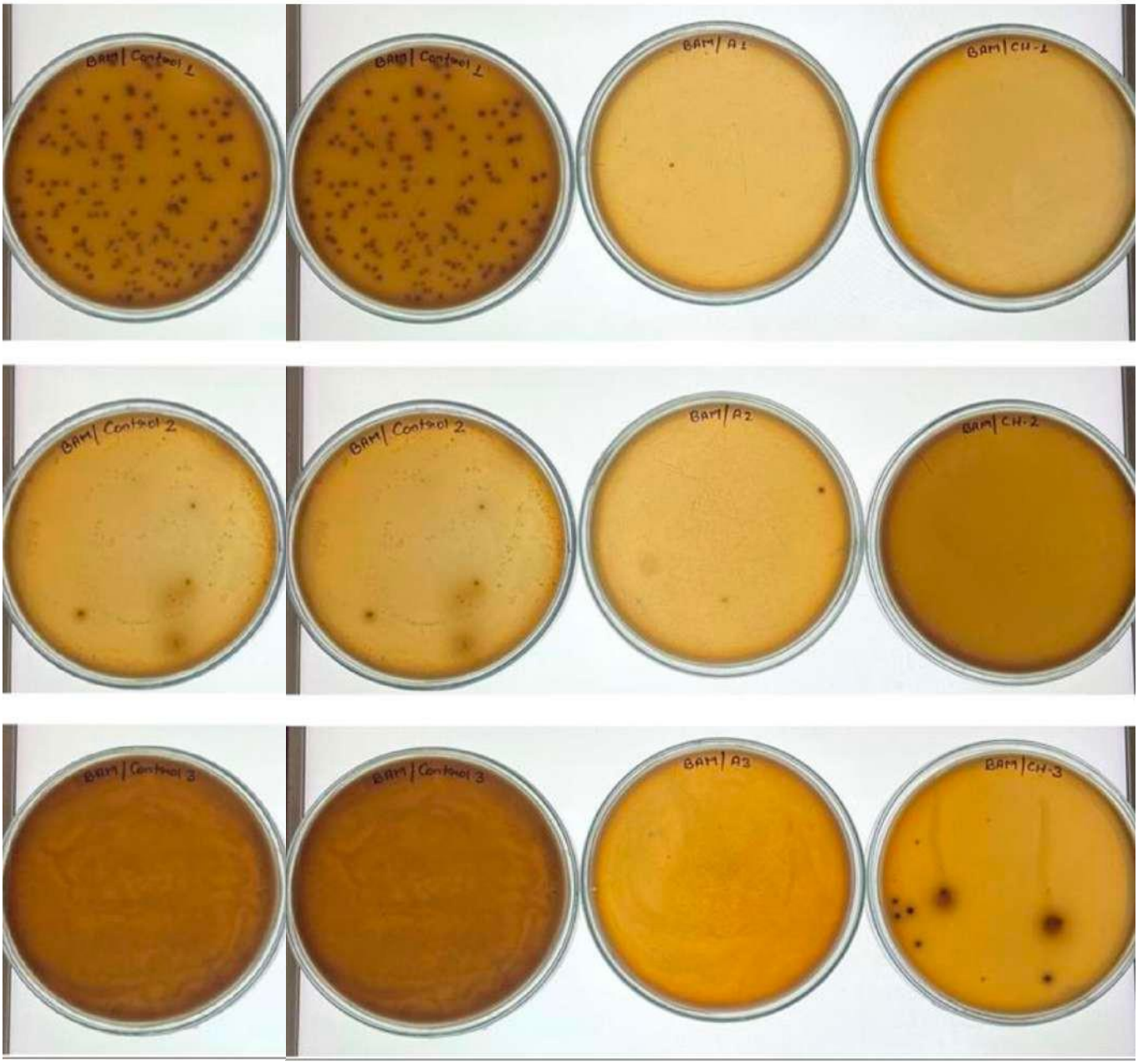


Figure 13: plates images after 72 hrs of incubation

The data for the present

study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation, standard error. The level of the significance for the present study was fixed at 5%.

The intergroup comparison will be done using the One Way ANOVA and independent t test The Shapiro–Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables.

INTERGROUP COMPARIOSN OF MEAN CFU/ML OF CONTROL GROUP WITH DIFFERENT THERAPEUTIC GROUPS AT 72 HRS

	Mean	Std. Deviation	Std. Error	Minimum	Maximum	P value
Control Group	566.25	318.923	112.757	240.00	1200.00	0.001 (Significant)
Chlorhexidine Group	26.153	40.934	11.353	.00	120.00	
Turmeric Group	108.01	103.45	26.711	10.00	310.00	
Ayurvedic Group	192.67	105.32	27.193	30.00	380.00	

One Way ANOVA test with p value less than 0.001 as highly significant

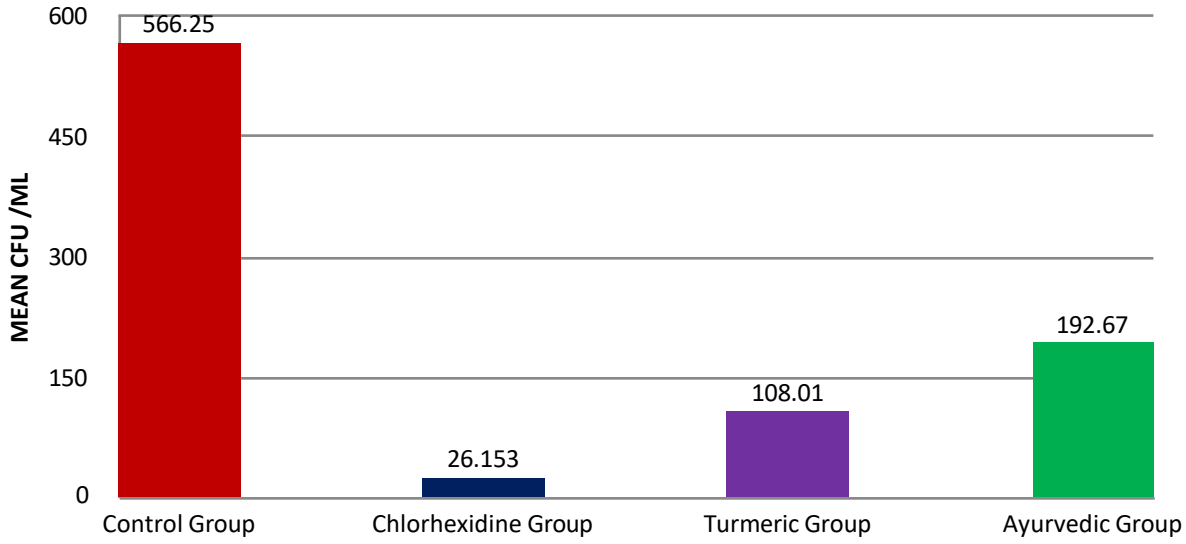
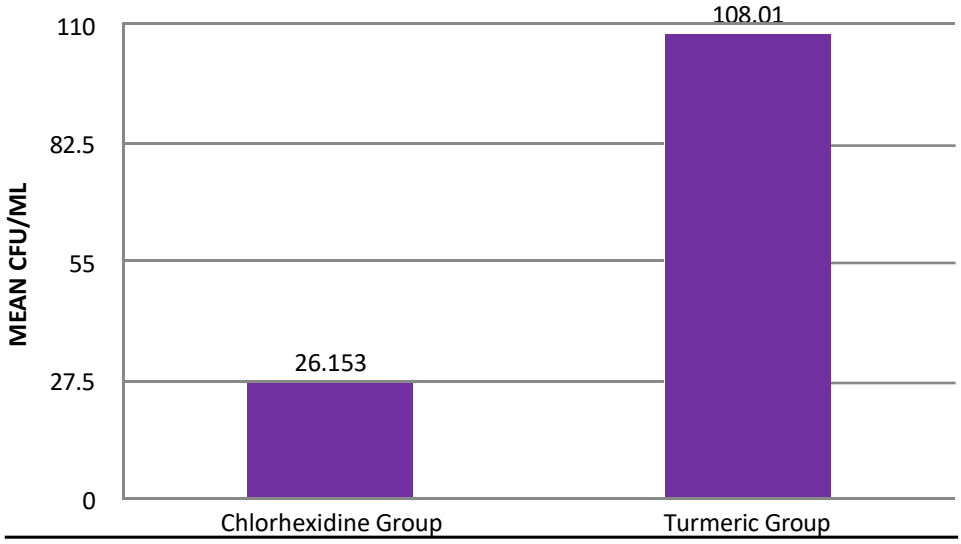


TABLE :1

The table -1 describes the intergroup comparison of mean CFU/ML count in the control group as compared to three different groups-Chlorhexidine, Turmeric and Ayurvedic Group at 72 hrs . The mean Colony count was highest in the Control Group (566.25±318.92), followed by Ayurvedic Group (192.67±105.32), Turmeric Group (108.01±103.45) and least in the Chlorhexidine, Group (26.153±40.934). The intergroup comparison of Control group with the three other groups gave the statistically significant results with p value of 0.001 which denotes a highly significant statistical difference when analyzed using One Way ANOVA

INTERGROUP COMPARISON OF CHLORHEXIDINE WITH TURMERIC AT 72HRS

	Mean	Std. Deviation	Std. Error	Mean Difference	P value
Chlorhexidine Group	26.153	40.934	11.353	81.84	0.039 (Sig)
Turmeric Group	108.01	103.45	26.711		



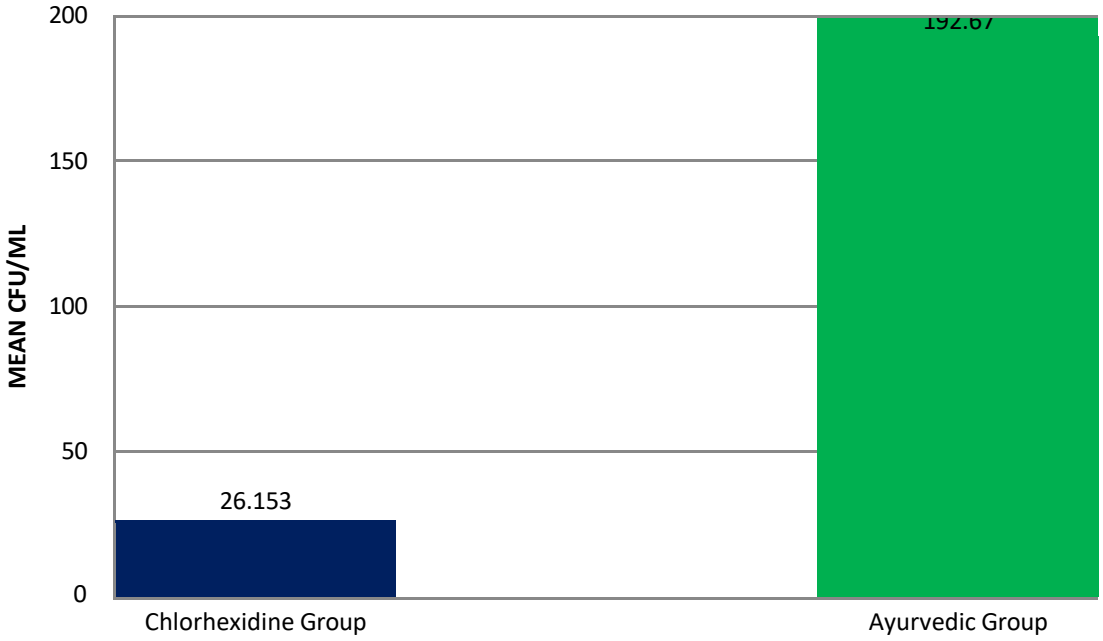
Independent t test with p value less than 0.001 as highly significant

The table -2 describes the intergroup comparison of mean CFU/ML count in the Chlorhexidine as compared to Turmeric Group at 72 hrs . The mean Colony count in the Chlorhexidine Group was 26.153±40.934 and in the Turmeric Group was 108.01±103.45. The CFU/ml was higher in the Turmeric group as compared to the Chlorhexidine group and difference was statistically significant when analyzed using Independent t test

TABLE -3 INTERGROUP COMPARISON OF CHLORHEXIDINE WITH AYURVEDIC GROUP AT 72HRS

	Mean	Std. Deviation	Std. Error	Mean Difference	P value
Chlorhexidine Group	26.153	40.934	11.353	166.51	0.001 (Sig)
Ayurvedic Group	192.67	105.32	27.193		

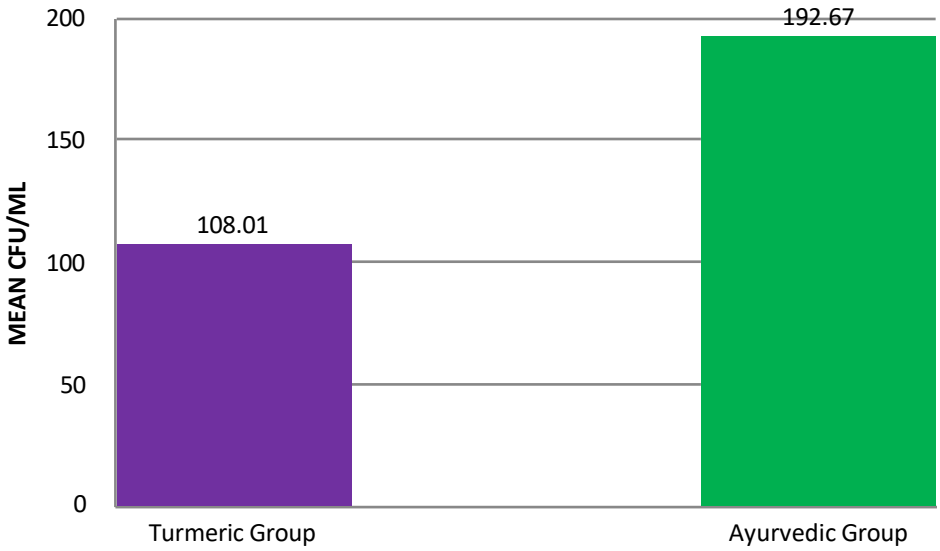
Independent t test with p value less than 0.001 as highly significant



The table -3 describes the intergroup comparison of mean CFU/ML count in the Chlorhexidine as compared to Ayurvedic Group at 72 hrs. The mean Colony count in the Chlorhexidine Group was 26.153±40.934 and in the Ayurvedic Group was 192.67±105.32. The CFU/ml was higher in the Ayurvedic group as compared to the Chlorhexidine group and difference was statistically significant when analyzed using Independent t test

TABLE -4 INTERGROUP COMPARISON OF TURMERIC WITH AYURVEDIC GROUP AT 72HRS

	Mean	Std. Deviation	Std. Error	Mean Difference	P value
Turmeric Group	108.01	103.45	26.711	84.67	0.042 (Sig)
Ayurvedic Group	192.67	105.32	27.193		



The table -4 describes the intergroup comparison of mean CFU/ML count in the Turmeric group as compared to Ayurvedic Group at 72 hrs. The mean Colony count in the Turmeric Group was 108.01±103.45 and in the Ayurvedic Group was 192.67±105.32. The CFU/ml was higher in the Ayurvedic group as compared to the Turmeric group and difference was statistically significant when analyzed using Independent t test

The mean Colony count was highest in the Control Group (566.25±318.92), followed by Ayurvedic Group (192.67±105.32), Turmeric Group (108.01±103.45) and least in the Chlorhexidine, Group (26.153±40.934). The CFU/ml was higher in the Turmeric group as compared to the Chlorhexidine group and difference was statistically significant. The CFU/ml was higher in the Ayurvedic group as compared to the Chlorhexidine group and difference was statistically significant. The CFU/ml was higher in the Ayurvedic group as compared to the Turmeric group and difference was statistically significant

Control Group > Ayurvedic Group > Turmeric Group > Chlorhexidine, Group

The majority of individuals who have complete or partial dentures leave the dental office knowing very little or nothing about how to take care of their appliances. This may have resulted from dental professionals' inadequate patient education regarding the various denture cleaning and disinfection options, post-insertion issues, and systemic effects of improperly maintained dentures. This situation is frequently encountered because the dentist is ignorant of the many methods of disinfection, there is insufficient time dedicated to providing personalized care for each patient, the patient is unable to apply the disinfection, and the patient neglects to maintain denture hygiene.[29]

When the denture hygiene is not maintained and the denture is not cleaned with a disinfectant plaque accumulation begins.

Pathogenic bacteria found in denture plaque include Streptococcus mutans, which is linked to the development of caries, and Candida albicans, which is associated with denture stomatitis. In general practice and general hospitals, methicillin-resistant Staphylococcus aureus has been isolated from denture patients in the past.[39] it has traditionally been advised that patients combine the two primary techniques—mechanical and chemical—to achieve the best possible denture plaque clearance.[39] The broad category concerned here is chemical and herbal.

In order to actually disinfect prostheses, a variety of chemical agents are used, such as aldehyde compounds, iodophors, and chlorine.As alternate means of dental prosthesis disinfection, six studies included immersion in 2% alkaline glutaraldehyde, 0.5% and 1% sodium hypochlorite, 3% aqueous formaldehyde, and hydrogen peroxide. Furthermore, it was found that 1% sodium hypochlorite, 4% chlorhexidine gluconate, and 3.78% sodium perborate were helpful in lowering the microbe count on dental prostheses.Microorganisms can be successfully removed from the inside and exterior surfaces of acrylic resin using chlorine dioxide.[41]

The oldest medical system in the world, Ayurveda is a traditional practice in India.It is a natural medical system that is applied to the treatment of different illnesses. because of its

low side effect rate, wide range of practical applications, accessibility, and affordability. Herbal medications are now preferred for a wide range of treatments.

In order to facilitate oral hygiene maintenance, traditional medicinal plants like triphala, clove, cashew leaves, meswak, aloe vera, and guava leaves are effective. To combat the candida albican species, triphala is utilized. The same is true for cashew leaves and candida albicans. Aloe vera exhibits strong antibacterial, viral, and fungal properties. In recent decades, there has been a considerable deal of study conducted worldwide on essential oils with strong antibacterial activity that can be used to preserve dental health.

Three to five percent of curcuminoids, such as demethoxycurcumin , eugenol, bisdemethoxycurcumin (BOMC), dihydrocircumin , azulene, borneol , dcamphene,caprylic acid,cineol turmerone are found in turmeric.Haridra, or turmeric, has been utilized for many years in Ayurvedic therapy. The main ingredient in turmeric, curcumin, is what gives it its vivid yellow color. It helps recover from stroke and Alzheimer's disease and repairs the brain's stem cells. Since turmeric is a natural cure for attractive skin, it plays a crucial function in cosmetics. Its antibacterial and anti-inflammatory qualities are widely known. It is a homeopathic treatment for dental attention. Compared to other mouthwashes, it has a higher capacity to eliminate bacteria, plaque, and inflammation when used correctly. Gum disease, such as gingivitis, is prevented by curcumin.[36]

Considering the rising shift from chemical to herbal disinfectants this study suggests that turmeric liquid extract is comparable to chlorhexidine in reducing bacterial and fungal accumulation and ayurvedic disinfectant is less effective in comparison to chlorhexidine and turmeic liquid.

In a study done to check the effects of chlorhexidine on denture biofilm accumulation participants were instructed to keep their dentures immersed in 0.12% and 2.0% chlorhexidine overnight .The experimental approaches yielded comparable findings, while the water-soaking control group showed a substantial difference. Denture hygiene can be enhanced by using immersion in 0.12% or 2.0% chlorhexidine solutions as a secondary cleaning technique for whole dentures.

By rupturing bacterial membranes and causing cytoplasmic precipitation, chlorhexidine kills bacteria.26 It is a cationic molecule that may form connections with negatively charged surfaces like the cell wall of bacteria and interact with inorganic human dentine particles.12,20 Several studies that have conducted antimicrobial analyses concur with these results about the effectiveness, despite the fact that antimicrobial analysis was not the focus of this study.[16]

In another study efficacy of sodium hypochlorite and a herbal disinfectant that is coconut soap was used to as a disinfectant agent .There were three groups , group one used coconut soap and immersed denture in 10ml distilled water, group 2 used coconut soap to clean denture and immersed denture in 200ml distilled water , group 3 immersed in a solution of hypochlorite 10ml.The patients' oral mucosa showed a clinical improvement, but there was no discernible decrease in Candida sp. in either group. This is likely because Candida sp. is a component of the mouth's autochthonous microbiota. This fact demonstrates that the treatment was successful in reducing the pathogenicity of candida and blocking its opportunistic activity, which is harmful to prosthesis users, especially when combined with other risk factors.[10]

several herbal alternatives have shown a good result in reduction of accumulation of plaque and microbes on the intaglio surface of the denture. In a study done to check anticandidal efficacy of the denture cleansing tablets of Triphala , aloe vera and cashew leaf concluded that Only the denture cleaning tablet and triphala demonstrated a substantial reduction in total Candida count when compared to the control (water), despite the fact that aloe vera and cashew leaves did.The use of these products will help those who have less access to dental hygiene practices. It is important to investigate the possible applications of these natural items in order to lower the microbial load and enhance peoples' oral health in general.[40]

The best denture cleansers should be non-toxic, compatible with denture materials, short acting, easy to use, taste good, and economically priced. They should also have antibiofilm activity and show bactericidal and fungicidal properties.[42]

According to the Literature turmeric has shown both anti fungal and antibacterial properties. In a study done at a university in Gujarat on the antifungal properties of curcuma longa, or turmeric Rhizome defense Against Various Fungi and the results obtained indicated that Curcuma longa is rich in a variety of phytochemicals, according to the study's conclusions. Curcuma longa possesses antifungal properties against Fusarium sp. and Aspergillus sp. When it comes to antifungal properties, Curcuma longa is superior than other herbs. Researchers have noted that the three examined phytopathogenic fungal species—E. turicicum, F. oxysporum, and C. cassiicola—showed antifungal activity against the pure C. longa lectin at doses of 47 and 94 µg/0.3 cm2 disc. The growth of all three isolates was modestly suppressed by a lectin dose of 47 µg/0.3 cm2 disc; however, a higher and significant degree of antifungal activity was observed on all three isolates at 94 µg/0.3 cm2 disc [8].Turmeric's antifungal properties were extracted and tested at 121°C and room temperature using methanol, chloroform, n-hexane, and water.[33]
Similarly in another study Curcumin's antimicrobial activity was examined in relation to the growth of six species of Gram-positive bacteria (Enterococcus faecalis, Staphylococcus aureus, S. epidermidis, S. haemolyticus, Streptococcus agalactiae, S. pyogenes), nine species of Gram-negative bacteria (Acinetobacter baumannii, A. lwoffii, Escherichia coli, Klebsiella oxytoca, K. pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, Serratia marcescens, and Stenotrophomonas maltophilia), and four species of yeast-like fungi (Candida albicans, C. glabrata, C. tropicalis, Saccharomyces cerevisiae). For each microbial species, an average of six clinical strains were analyzed (Table 1). Four reference strains were also employed as controls: S. aureus ATCC 29213, E. coli ATCC 25922, P. aeruginosa ATCC 27853 (Boston 41501), and P. aeruginosa NCTC 6749. We conducted in vitro tests on sixteen clinical isolates of methicillin-resistant S. aureus (MRSA) and methicillin-resistant S. haemolyticus from the multidrug-resistant (MDR) bacterial population and the results of the research demonstrated curcumin's wide range of antibacterial action. More than 100 bacterial and fungal strains from 19 different species were used in the in vitro experiments. To our

knowledge, this natural plant compound's minimum inhibitory concentrations (MICs) against Klebsiella oxytoca and Staphylococcus haemolyticus planktonic forms were determined for the first time. Likewise, no research has been done on curcumin's impact on vancomycin-resistant Enterococcus faecalis (VRE), methicillin-resistant S. haemolyticus (MRCNS), Escherichia coli that is positive for extended-spectrum β-lactamases (ESβL), and Proteus mirabilis that is positive for ESβL.

The acquired data verified that Gram-positive bacteria are significantly more sensitive to curcumin than Gram-negative bacteria.[32]

In our case study the intergroup comparison of mean CFU/ML count in the control group as compared to three different groups-Chlorhexidine, Turmeric and Ayurvedic Group at 72 hrs . The mean Colony count was highest in the Control Group (566.25±318.92), followed by Ayurvedic Group (192.67±105.32), Turmeric Group (108.01±103.45) and least in the Chlorhexidine, Group (26.153±40.934). As correlated to the study where the objective was to compare the antibacterial efficacy of a formulation based on curcumin, calcium hydroxide, and chlorhexidine gel against Enterococcus faecalis and as the result indicated there was a discernible difference between each test group. Chlorhexidine gel, on the other hand, had the greatest mean difference value, making it the best antibacterial medication followed by C. Long extract which came in second and the least effective method for getting rid of E. faecalis was calcium hydroxide paste. [43]

The ingredients of the ayurvedic disinfectant have antimicrobial properties according to the literature The standard reference drug streptomycin, which has an antibacterial activity of 5µg/ml, was very well comparable to the antibacterial activity of various extracts, such as petroleum ether, methanol, chloroform, acetone, ethyl acetate, and water of the root extract of the Asparagus racemosus plant, at different concentrations of 100µg/ml, 50µg/ml, and 25µg/ml. The antifungal efficacy of the extracts was also evaluated, and the results showed that they were just as effective against candida as the conventional medication fluconozole (5µg/

ml).[44] Bacopa Monnieri leaf extracts herb can treat many pathogenic conditions and may have therapeutic benefits. These extracts include bioactive chemicals that could be exploited to create new antibacterial medications.[45]

The intergroup comparison of mean CFU/ML count in the Chlorhexidine as compared to Ayurvedic Group at 72 hrs. The mean Colony count in the Chlorhexidine Group was 26.153±40.934 and in the Ayurvedic Group was 192.67±105.32. The CFU/ml was higher in the Ayurvedic group as compared to the Chlorhexidine group.where as compared to chlorhexidine ayurvedic disinfectant showed more number of microbial colonies and chlorhexidine showed least colonies.

In comparing the mean CFU/ML count in the Turmeric group as compared to Ayurvedic Group at 72 hrs. The mean Colony count in the Turmeric Group was 108.01±103.45 and in the Ayurvedic Group was 192.67±105.32. The CFU/ml was higher in the Ayurvedic group as compared to the Turmeric group .The result showed turmeric group had less number of colony formation when compared to the ayurvedic group.

The CFU/ml was higher in the Turmeric group as compared to the Chlorhexidine group and difference was statistically significant. The CFU/ml was higher in the Ayurvedic group as compared to the Chlorhexidine group and difference was statistically significant. The CFU/ml was higher in the Ayurvedic group as compared to the Turmeric group and difference was statistically significant.

As the result indicated that chlorhexidine showed the least CFU/ML and can be considered the best denture cleaning agent among the three other disinfectant.whereas turmeric extracts showed more CFU/ML as compared to the “CHX “group though it was significantly less that the control group and ayurvedic group.

Ayurvedic group (A) in comparison to “CHX” and “T” showed the highest number of CFU/ ML but in comparison to the control group it showed significant decrease in CFU/ML hence it is the least effective denture cleaning agent as compared to “CHX” and “T”.

Control Group > Ayurvedic Group > Turmeric Group > Chlorhexidine, Group.

The present study was conducted in department of prosthodontics ,crown & bridge, Babu Banarasi Das College of dental Sciences ,Lucknow. The study conducted presented the following results.

1. The efficacy of turmeric liquid extract to reduce the microbiota from intaglio denture surface at 72 hrs of incubation was found to be statistically significant.
2. The reduction of CFU count on the blood agar culture at 72hrs of turmeric liquid extract treated swabs was statistically significant.
3. The efficacy of chlorhexidine to reduce the microbiota count on the intaglio surface of denture was statistically significant.
4. The reduction in CFU count on blood agar culture at 72 hrs of chlorhexidine treated denture swabs was statistically significant.
5. The efficacy of ayurvedic mouthwash disinfectant to reduce the microbiota was the least among the other two and was statistically significant.
6. The reduction in CFU count on blood agar culture at 72 hrs of ayurvedic mouthwash treated denture swabs was least as compared to the other two disinfectants and it was satistically significant.
7. The microbiological efficacy of turmeric liquid extract as a disinfectant is comparable to chlorhexidine (as a gold standard) as a denture cleaning agent on healthy completely edentulous patients.
8. The microbiological efficacy of ayurvedic mouthwash is not comparable to chlorhexidine as a denture cleaning agent on healthy completely edentulous patients.

1) Suma Karthikeyan, Leoney A, Seyed Asharaf Ali. Denture disinfectants used in prosthodontics - a review. International Journal of Contemporary Medical Research 2018;5(3):C19-C22.International Journal of Contemporary Medical Research

2) Hussain Y, Alam W, Ullah H, Dacrema M, Daglia M, Khan H, Arciola CR. Antimicrobial Potential of Curcumin: Therapeutic Potential and Challenges to Clinical Applications. Antibiotics (Basel). 2022 Feb 28;11(3):322. doi: 10.3390/antibiotics11030322. PMID: 35326785; PMCID: PMC8944843.

3) Poppolo Deus F, Ouanounou A. Chlorhexidine in Dentistry: Pharmacology, Uses, and Adverse Effects. Int Dent J. 2022 Jun;72(3):269-277. doi: 10.1016/j.identj.2022.01.005. Epub 2022 Mar 12. PMID: 35287956; PMCID: PMC9275362.

4) Drake D, Wells J, Ettinger R. Efficacy of denture cleansing agents in an in vitro bacteria-yeast colonization model. Int J Prosthodont. 1992 May-Jun;5(3):214-20. PMID: 1524643.

5) MacNeill S, Rindler E, Walker A, Brown AR, Cobb CM. Effects of tetracycline hydrochloride and chlorhexidine gluconate on Candida albicans. An in vitro study. J Clin Periodontol. 1997Oct;24(10):753-60. doi: 10.1111/j.1600-051x.1997.tb00193.x. PMID: 9350560.

6) Nikawa H, Hamada T, Yamashiro H, Kumagai H. A review of in vitro and in vivo methods to evaluate the efficacy of denture cleansers. Int J Prosthodont. 1999 Mar-Apr;12(2):153-9. PMID: 10371918.

7) Paranhos Hde F, Panzeri H, Lara EH, Candido RC, Ito IY. Capacity of denture plaque/biofilm removal and antimicrobial action of a new denture paste. Braz Dent J. 2000;11(2):97-104. PMID: 11210269.

8) Lefebvre CA, Wataha JC, Cibirka RM, Schuster GS, Parr GR. Effects of triclosan on the cytotoxicity and fungal growth on a soft denture liner. J Prosthet Dent. 2001 Apr;85(4):352-6. doi: 10.1067/mpr.2001.115249. PMID: 11319532.

9) Gornitsky M, ParadisI I, Landaverde G, Malo AM, Velly AM. clinical and microbiological evaluation of denture cleansers for geriatric patients in long-term care institutions. J Can Dent Assoc. 2002 Jan;68(1):39-45. PMID: 11844417.

10) Barnabé W, de Mendonça Neto T, Pimenta FC, Pegoraro LF, Scolaro JM. Efficacy of sodium hypochlorite and coconut soap used as disinfecting agents in the reduction of denture stomatitis, Streptococcus mutans and Candida albicans. J Oral Rehabil. 2004 May;31(5):453-9. doi: 10.1111/j.1365-2842.2004.01254.x. PMID: 15140171.9)

11) Yilmaz H, Aydin C, Bal BT, Ozçelik B. Effects of disinfectants on resilient denture-lining materials contaminated with Staphylococcus aureus, Streptococcus sobrinus, and Candida albicans. Quintessence Int. 2005 May;36(5):373-81. PMID: 15892535.

12) da Silva FC, Kimpara ET, Mancini MN, Balducci I, Jorge AO, Koga-Ito CY. Effectiveness of six different disinfectants on removing five microbial species and effects on the topographic characteristics of acrylic resin. J Prosthodont. 2008 Dec;17(8):627-33. doi: 10.1111/j.1532-849X.2008.00358.x. Epub 2008 Aug 26. PMID: 18761581.

13) Coulthwaite L, Verran J. Evaluation of in vivo denture plaque assessment methods. Br Dent J. 2009 Sep 26;207(6):E12; discussion 282-3. doi: 10.1038/sj.bdj.2009.854. PMID: 19779501.

14) Işeri U, Uludamar A, Ozkan YK. Effectiveness of different cleaning agents on the adherence of Candida albicans to acrylic denture base resin. Gerodontology. 2011 Dec;28(4):271-6. doi: 10.1111/j.1741-2358.2010.00379.x. Epub 2011 May 9. PMID: 21554382.

15) Dahlan AA, Haveman CW, Ramage G, Lopez-Ribot JL, Redding SW. Sodium hypochlorite, chlorhexidine gluconate, and commercial denture cleansers as disinfecting agents against Candida albicans: An in vitro comparison study. Gen Dent. 2011 Nov-Dec;59(6):e224-9. PMID: 22313927.

16) de Andrade IM, Cruz PC, Silva-Lovato CH, de Souza RF, Souza-Gugelmin MC, Paranhos Hde F. Effect of chlorhexidine on denture biofilm accumulation. J Prosthodont. 2012 Jan;21(1):2-6. doi: 10.1111/j.1532-849X.2011.00774.x. Epub 2011 Oct 4. PMID: 21972847.

17) Loster BW, Loster J, Wieczorek A, Ryniewicz W. Mycological analysis of the oral cavity of patients using acrylic removable dentures. Gastroenterol Res Pract. 2012;2012:951572. doi: 10.1155/2012/951572. Epub 2012 Apr 8. PMID: 22550480; PMCID: PMC3328923.

18) Skupien JA, Valentini F, Boscato N, Pereira-Cenci T. Prevention and treatment of Candida colonization on denture liners: a systematic review. J Prosthet Dent. 2013 Nov;110(5):356-62. doi: 10.1016/j.prosdent.2013.07.003. Epub 2013 Aug 30. PMID: 23998622.

19) Lucena-Ferreira SC, Ricomini-Filho AP, Silva WJ, Cury JA, Cury AA. Influence of daily immersion in denture cleanser on multispecies biofilm. Clin Oral Investig. 2014 Dec;18(9):2179-85. doi: 10.1007/s00784-014-1210-9. Epub 2014 Mar 4. PMID: 24590620.

20) Aoun G, Cassia A, Berberi A. Effectiveness of a Chlorhexidine Digluconate 0.12% and Cetylpyridinium Chloride 0.05% Solution in eliminating Candida albicans Colonizing Dentures: A Randomized Clinical in vivo Study. J Contemp Dent Pract. 2015 Jun 1;16(6):433-6. doi: 10.5005/jp-journals-10024-1702.

21) Salles MM, Badaró MM, Arruda CN, Leite VM, Silva CH, Watanabe E, Oliveira Vde C, Paranhos Hde F. Antimicrobial activity of complete denture cleanser solutions based on sodium hypochlorite and Ricinus communis - a randomized clinical study. J Appl Oral Sci. 2015 Nov-Dec;23(6):637-42. doi: 10.1590/1678-775720150204. PMID: 26814466; PMCID: PMC4716702.

22) Nair VV, Karibasappa GN, Dodamani A, Prashanth VK. Microbial contamination of removable dental prosthesis at different interval of usage: An *in vitro* study. J Indian Prosthodont Soc. 2016 Oct-Dec;16(4):346-351. doi: 10.4103/0972-4052.176536. PMID: 27746598; PMCID: PMC5062147.

23) Shi B, Wu T, McLean J, Edlund A, Young Y, He X, Lv H, Zhou X, Shi W, Li H, Lux R. The Denture-Associated Oral Microbiome in Health and Stomatitis. mSphere. 2016 Dec 28;1(6):e00215-16. doi: 10.1128/mSphere.00215-16. PMID: 28066812; PMCID: PMC5196032.

24) Peracini A, Machado Andrade I, Oliveira VC, Macedo AP, Silva-Lovato CH, Oliveira Pagnano V, Watanabe E, Oliveira Paranhos HF. Antimicrobial action

and long-term effect of overnight denture cleansers. Am J Dent. 2017 Apr;30(2):101-108. PMID: 29178772.

25) Sushma R, Sathe TT, Farias A, Sanyal PK, Kiran S. "Nature cures:" An alternative herbal formulation as a denture cleanser. Ann Afr Med. 2017 Jan-Mar;16(1):6-12. doi: 10.4103/aam.aam_43_16. PMID: 28300045; PMCID: PMC5452698.

26) Ramage G, O'Donnell L, Sherry L, Culshaw S, Bagg J, Czesnikiewicz-Guzik M, Brown C, McKenzie D, Cross L, MacInnes A, Bradshaw D, Varghese R, Gomez Pereira P, Jose A, Sanyal S, Robertson D. Impact of frequency of denture cleaning on microbial and clinical parameters - a bench to chairside approach. J Oral Microbiol. 2018 Oct 29;11(1):1538437. doi: 10.1080/20002297.2018.1538437. PMID: 30598732; PMCID: PMC6225516.

27) Procópio ALF, da Silva RA, Maciel JG, Sugio CYC, Soares S, Urban VM, Neppelenbroek KH. Antimicrobial and cytotoxic effects of denture base acrylic resin impregnated with cleaning agents after long-term immersion. Toxicol In Vitro. 2018 Oct;52:8-13. doi: 10.1016/j.tiv.2018.05.012. Epub 2018 May 25. PMID: 29807097.

28) Masetti P, Arbeláez MIA, Pavarina AC, Sanitá PV, Jorge JH. Cytotoxic potential of denture base and reline acrylic resins after immersion in disinfectant solutions. J Prosthet Dent. 2018 Jul;120(1):155.e1-155.e7. doi: 10.1016/j.prosdent.2018.01.001. Epub 2018 Apr 30. PMID: 29724556.

29) Suma Karthikeyan, Leoney A, Seyed Asharaf Ali. Denture disinfectants used in prosthodontics - a review. International Journal of Contemporary Medical Research 2018;5(3):C19-C22.)

30) Tsutsumi-Arai C, Takakusaki K, Arai Y, Terada-Ito C, Takebe Y, Imamura T, Ide S, Tatehara S, Tokuyama-Toda R, Wakabayashi N, Satomura K. Grapefruit seed extract effectively inhibits the Candida albicans biofilms development on polymethyl methacrylate denture-base resin. PLoS One. 2019 May 28;14(5):e0217496. doi: 10.1371/journal.pone.0217496. PMID: 31136636; PMCID: PMC6538181.

31) Gad MM, Fouda SM. Current perspectives and the future of Candida albicans-associated denture stomatitis treatment. Dent Med Probl. 2020 Jan-Mar;57(1):95-102. doi: 10.17219/dmp/112861. PMID: 32307934.

32) Adamczak A, Ożarowski M, Karpiński TM. Curcumin, a Natural Antimicrobial Agent with Strain-Specific Activity. Pharmaceuticals (Basel). 2020 Jul 16;13(7):153. doi: 10.3390/ph13070153. PMID: 32708619; PMCID: PMC7408453.

33) Oza, Kalpa & Khumji, Jain & Maitreya, Bharat. (2021). Antifungal Activity of Turmeric (Curcuma longa) Rhizome against Different Fungi. Journal of Natural Sciences and Mathematics. 11. 29014-29017.

34) Ribeiro AB, Ribeiro AB, de Araújo CB, Fortes CV, Clemente LM, Paranhos HFO, Watanabe E, Salgado HC, Silva-Lovato CH. Effect of a Hygiene Protocol on Denture-Related Stomatitis Remission, Local Inflammatory Factors, and Hemodynamic Responses by Arterial Pressure. Antibiotics (Basel). 2022 Sep 28;11(10):1320. doi: 10.3390/antibiotics11101320. PMID: 36289978; PMCID: PMC9598829.

35) Lee EH, Jeon YH, An SJ, Deng YH, Kwon HB, Lim YJ, Kong H, Kim MJ. Removal effect of *Candida albicans* biofilms from the PMMA resin surface by using a manganese oxide nanozyme-doped diatom microbubbler. Heliyon. 2022 Dec 23;8(12):e12290. doi: 10.1016/j.heliyon.2022.e12290. PMID: 36593839; PMCID: PMC9803711.

36) Anam Kalekar1, Maya Hipparkar1, Sneha Karande1, Vipul Sansare, Herbal denture cleanser:examples and recent developments.J.Bio.Innov11(2), pp: 538-549, 2022 |ISSN 2277-8330 (Electronic) https://doi.org/10.46344/ JBINO.2022.v11i02.26

37) AlHamdan EM. Influence of contemporary photoactivated disinfection on the mechanical properties and antimicrobial activity of PMMA denture base: A systematic review and meta analysis. Photodiagnosis Photodyn Ther. 2023 Jun;42:103523. doi: 10.1016/j.pdpdt.2023.103523. Epub 2023 Mar 21. PMID: 36958538.

38) Kaypetch R, Rudrakanjana P, Tua-Ngam P, Tosrisawatkasem O, Thairat S, Tonput P, Tantivitayakul P. Effects of two novel denture cleansers on multispecies microbial biofilms, stain removal and the denture surface: an in vitro study. BMC Oral Health. 2023 Nov 11;23(1):852. doi: 10.1186/ s12903-023-03535-5. PMID: 37951865; PMCID: PMC10640750.

39) Badrian H, Ghasemi E, Khalighinejad N, Hosseini N. The effect of three different disinfection materials on alginate impression by spray method. ISRN Dent. 2012;2012:695151. doi: 10.5402/2012/695151. Epub 2012 Jul 25. PMID: 22900196; PMCID: PMC3410321.

40) Mylonas, P., Milward, P. & McAndrew, R. Denture cleanliness and hygiene: an overview. *Br Dent J* 233, 20–26 (2022). https://doi.org/10.1038/s41415-022-4397-1

41) Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 2, 2021, Pages. 148 - 154 Received 20 January 2021; Accepted 08 February 2021. Effect of Chemical Disinfectants in Complete Dentures- A Comparative Study

42) Shetty PJ, Hegde V, Gomes L. Anticandidal efficacy of denture cleansing tablet, Triphala, Aloe vera, and Cashew leaf on complete dentures of institutionalized elderly. J Ayurveda Integr Med. 2014 Jan;5(1):11-4. doi: 10.4103/0975-9476.128847. PMID: 24812470; PMCID: PMC4012356.

43) Yadav RK, Tikku AP, Chandra A, Verma P, Bains R, Bhoot H. A comparative evaluation of the antimicrobial efficacy of calcium hydroxide, chlorhexidine gel, and a curcumin-based formulation against *Enterococcus faecalis*. Natl J Maxillofac Surg. 2018 Jan-Jun;9(1):52-55. doi: 10.4103/njms.NJMS_47_17. PMID: 29937659; PMCID: PMC5996653.

44) L. S. Patel, R. S. Patel. Antimicrobial Activity of Asparagus racemosus Willd from Root Extracts – A Medicinal Plant. Research J. Pharm. and Tech. 6(10): October 2013; Page 1141-1143.

45) Abdul Viqar Khana, Qamar Uddin Ahmedb, Indu Shuklac, Athar Ali Khana 10.2478/abm-2010-0084. Asian Biomedicine Vol. 4 No. 4 August 2010; 651-655.

BABU BANARASI DAS UNIVERSITY
BBD COLLEGE OF DENTAL SCIENCES, LUCKNOW

BBDCODS/IEC/09/2022 Dated: 16th September, 2022

Communication of the Decision of the Xth Institutional Ethics Sub-Committee Meeting

IEC Code: 07

Title of the Project: The Effects Of Different Anti Microbial Agents On The Oral Microbiome And Fungal Growth On The Denture Surface: An In Vivo Study.

Principal Investigator: Dr Rashmika Kapoor **Department:** Prosthodontics & Crown and Bridge

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: New, MDS Project Protocol

Dear Dr Rashmika Kapoor,

The Institutional Ethics Sub-Committee meeting comprising following members was held on 15th September, 2022.

1.	Dr. Lakshmi Bala Member Secretary	Prof. and Head, Department of Biochemistry
2.	Dr. Praveen Singh Samant Member	Prof. & Head, Department of Conservative Dentistry & Endodontics
3.	Dr. Jiji George Member	Prof. & Head, Department of Oral Pathology & Microbilogy
4.	Dr. Amrit Tandan Member	Professor, Department of Prosthodontics and Crown & Bridge
5.	Dr. Rana Pratap Maurya Member	Reader, Department of Orthodontics & Dentofacial Orthopaedics

The committee reviewed and discussed your submitted documents of the current MDS Project Protocol in the meeting.
The comments were communicated to PI, thereafter it was revised.

Decisions: The committee approved the above protocol from ethics point of view.

Forwarded by:

Prof. Dr. Puneet Ahuja
Principal 16/9
BBD College of Dental Sciences
BBD University, Lucknow
PRINCIPAL
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow-226028

Lakshmi Bala 16/09/22
Dr. Lakshmi Bala
Member-Secretary
Institutional Ethics Sub-Committee (IEC)
BBD College of Dental Sciences
BBD University, Lucknow
Member-Secretary
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

BABU BANARASI DAS UNIVERSITY

BBD COLLEGE OF DENTAL SCIENCES, LUCKNOW

INSTITUTIONAL RESEARCH COMMITTEE APPROVAL

The project titled **"The Effects Of Different Anti Microbial Agents On The Oral Microbiome And Fungal Growth On The Denture Surface : An In Vivo Study"** submitted by **Dr Rashmika Kapoor** Postgraduate student in the **Department of Prosthodontics & Crown and Bridge** for the Thesis Dissertation as part of MDS Curriculum for the academic year 2021-2024 with the accompanying proforma was reviewed by the Institutional Research Committee in its meeting held on **14th September, 2022** at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.

Prof. Dr. Puneet Ahuja
Chairperson

Dr. Mona Sharma
Co-Chairperson

Caption

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105

(INDIA)

Consent Form (English)

Title of the Study:THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE .

Study Number:

Subject's Full Name:

Date of Birth/Age:

Address of the Subject:

Phone no. and e-mail address:

Qualification:

Occupation: Student / Self Employed / Service / Housewife/ Other (Please tick as appropriate)

Annual income of the Subject……

Name and of the nominees(s) and his relation to the subject… .....(For the purpose of compensation in case of trial related death).

1. I confirm that I have read and understood the Participant Information Document dated ……..
   for the above study and have had the opportunity to ask questions. **OR** I have been explained the nature of the study by the Investigator and had the opportunity to ask questions.
2. I understand that my participation in the study is voluntary and given with free will without any duress and that I am free to withdraw at any time, without giving

any reason and without my medical care or legal rights being affected.

3. I understand that the sponsor of the project, others working on the Sponsor‘s behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. However, I understand that my Identity will not be revealed in any information released to third parties or published.
4. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
5. I permit the use of stored sample (tooth/tissue/blood) for future research. **Yes [ ] No [ ] Not Applicable [ ]**
6. I agree to participate in the above study. I have been explained about the complications and side effects, if any, and have fully understood them. I have also read and understood the participant/volunteer’s Information document given to me.

Signature (or Thumb impression) of the Subject/ Legally Acceptable Representative:……..

Signatory's Name……. Date …….

Signature of the Investigator…… Date……..

Study Investigator's Name..... Date……..

Signature of the witness……. Date……..

Name of the witness……

Received a signed copy of the PID and duly filled consent form

Signature/thumb impression of the subject or legally Date……..

Acceptable representative

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Guidelines for Devising a Participant / Legally Acceptable Representative Information Document (PID) in English

1. Study Title

The effects of different anti microbial agents on the oral microbiome and fungal growth on the denture surface .

2. Invitation Paragraph

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with friends, relatives and your treating physician/ family doctor if you wish. Ask us if there is anything that is not clear or if you would like more information.

3. What is the purpose of the study?

This study aims to assess effectiveness of different anti microbial agents on denture surface to control the microbial and fungal growth .

4. Why have I been chosen?

You are chosen as you fulfill the criteria for the study.

5. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and be asked

to sign a consent form. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

6. What will happen to me if I take part?

You will have to come 3 months after denture delivery and a swab will be taken from the intaglio surface of the denture . As a volunteer, your responsibility will be to arrive on time.

7. What do I have to do?

You do not have to change your regular lifestyles for the investigation of the study. This research study is self-sponsored by the candidate. You do not have to pay for any procedures involved.

8. What is the procedure that is being tested?

The procedure includes swab collection from the intaglio surface of the denture of the patient wearing dentures for 3months to check the effectiveness of anti microbial denture cleaning agents.

You are expected to follow all the instructions given by the doctors.

9. What are the interventions for the study?

No interventions are required for the study

10. What are the side effects of taking part?

There are no side effects on the patient of this study.

11. What are the possible disadvantages and risks of taking part?

There are no disadvantages of taking part in this study.

12. What are the possible benefits of taking part?

By taking part in this study you get to know that which the anti microbial ANNEXUREagent has been the most effective in cleaning the denture surface and reducing the microbial and fungal growth .

13. What if new information becomes available?

Sometimes during the course of a research project, new information becomes available about the research being studied. If this happens, you will be informed about it and the changes that can happen to the study will be informed. You are free to withdraw in the middle of the study. If you decide to continue in the study, you may be asked to sign an updated consent form.

14. What happens when the research study stops?

If the study finishes/stops before the stipulated time, then the reason for the same will be explained to the patients.

15. What if something goes wrong?

Volunteers will be taken care of by the doctors expertising in the field at BBDCODS opd.

16. Will my taking part in this study be kept confidential?

Your name, address or any personal or other information will not be shared outside the BBDCODS.

17. What will happen to the results of the research study?

Identity of the participants will not be disclosed in any result/ reports/ publications.

18. Who is organizing the research?

Study is organized by the researcher. Complete cost of the denture will be given by the patient.

19. Will the results of the study be made available after study is over?

If the patient wishes, the result of the study will be made available to him/ her.

20. Who has reviewed the study?

The HOD /IRC/IEC of the institution has reviewed and approved the study.

21.Contact for further information

Dr. Rashmika kapor
Department of Prosthodontics
Address: Banarasi Das University, Faizabad Road, Atif Vihar, Lucknow, UP. 226028
E.mail : rashmikakapoor08@gmail.com

Dr. Lakshmi Bala
Member Secretary of Ethics Committee of the institution,
Address: Babu Banarasi das University, Faizabad road, Atif Vihar, Lucknow, UP. 226028

Name of pt.

– Address –

Email –

Signature of PI……

Name……..

Date……..

The participant will be given a copy of the information sheet and the signed consent form.

Thank you for taking part in the study.

CONTROL GRPOUP

S.NO.	SAMPLE CODE	COUNT	CFU/ML COLONY FORMING UNIT AT 72 HOURS
1	Control 1	82	820
2	Control 2	TNTC	NA
3	Control 3	TNTC	NA
4	control 5	120	1200
5	Control 6	30	300
6	Control 7	48	480
7	Control 8	53	530
8	Control 9	Tntc	Na
9	Control 10	Tntc	Na
10	Control 11	63	630
11	Control 12	tntc	Na
12	Control 13	24	240
13	Control 14	Tntc	Na
14	Control 15	33	330

CHLORHEXIDINE

S.NO.	Sample code	Count	Colony forming units at 72 hrs Cfu/ ml
1	Chx-1	0	0
2	Chx2	0	0
3	Chx4	10	100
4	Chx5	2	20
5	Chx6	12	120
6	Chx7	1	1o
7	Chx8	0	0
8	Chx9	0	0
9	Chx10	1	10
10	Chx11	6	60
11	Chx12	2	20
12	Chx13	0	0
13	Chx14	1	10
14	Chix15	0	0

TURMERIC GROUP

S.NO.	SAMPPLE	COUNT	CFU/ML COLONY FORMING UNIT AT 72 HRS
1	T-1	1	10
2	T-2	2	20
3	T-3	31	310
4	T-4	27	270
5	T-5	2	20
6	T-6	6	60
7	T-7	17	170
8	T-8	4	40
9	T-9	28	280
10	T-10	4	40
11	T-11	2	20
12	T-12	4	40
13	T-13	12	120
14	T-14	12	120
15	T-15	10	100

AYURVEDIC GROUP

S.NO.	Sample	Count	Cfu/mlCOLONY FORMING UNIT AT 72 HRS
1	A-1	12	120
2	A-2	20	200
3	A-3	23	230
4	A-4	38	380
5	A-5	15	150
6	A-6	10	100
7	A-7	12	120
8	A-8	10	100
9	A-9	12	120
10	A-10	15	150
11	A-11	23	230
12	A-12	26	260
13	A-13	3	30
14	A-14	36	360
15	A-15	34	340

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation, standard error. The level of the significance for the present study was fixed at 5%.

The intergroup comparison will be done using the One Way ANOVA and independent t test The Shapiro–Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables.

Mean

$$\overline{X} = \frac{\Sigma X}{N}$$

Where:

$\overline{X}$ = the data set mean

$\sum$ = the sum of

X = the scores in the distribution

N = the number of scores in the distribution

Range

$$range = X_{highest} - X_{lowest}$$

Where:

$X_{highest}$ = largest score

X_{lowest} = smallest score

Variance

$$SD^2 = \frac{\Sigma(X - \overline{X})^2}{N}$$

The simplified variance formula

$$SD^2 = \frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N}$$

Where:

SD^2 = the variance

$\sum$ = the sum of

X = the obtained score

$\overline{X}$ = the mean score of the data

N = the number of scores

Standard Deviation (N)

$$SD = \sqrt{\frac{\Sigma(X - \overline{X})^2}{N}}$$

The simplified standard deviation formula

$$SD = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N}}$$

Where:

SD = the standard deviation

$\sum$ = the sum of

X = the obtained score

$\overline{X}$ = the mean score of the data

N = the number of scores

One Way ANOVA

The formula for the one-way **ANOVA** F-test statistic is

$$F = \frac{\text{between-group variability}}{\text{within-group variability}}.$$

The between-group variability" is

$$\sum_{i=1}^{K} n_i (\bar{Y}_{i\cdot} - \bar{Y})^2 / (K-1)$$

where Y_i denotes the sample mean in the i^{th} group, n_i is the number of observations in the i^{th} group, $\bar{Y}$ denotes the overall mean of the data, and K denotes the number of groups.

The "within-group variability" is

$$\sum_{i=1}^{K} \sum_{j=1}^{n_i} (Y_{ij} - \bar{Y}_{i\cdot})^2 / (N-K),$$

where Y_{ij} is the j^{th} observation in the i^{th} out of K groups and N is the overall sample size.

Independent t-test

Independent t Test can be used to determine if two sets of data are significantly different from each other, and is most commonly applied when the test statistic would follow a normal distribution. The independent samples *t*-test is used when two separate sets of independent and identically distributed samples are obtained, one from each of the two populations being compared

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left(\frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}\right)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

Where X1 =Mean of the first Group, X2 =Mean of the Second Group

PLAGARISM

DrillBit

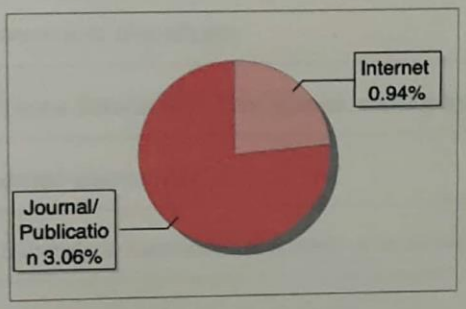
The Report is Generated by DrillBit Plagiarism Detection Software

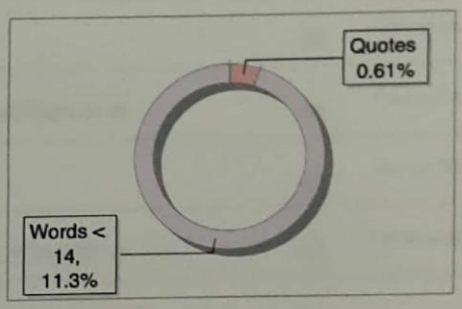
Submission Information

Author Name	RASHMIKA KAPOOR
Title	THE EFFECTS OF DIFFERENT ANTI MICROBIAL AGENTS ON THE ORAL MICROBIOME AND FUNGAL GROWTH ON THE DENTURE SURFACE ."
Paper/Submission ID	1466370
Submitted by	amarpal.singh056@bbdu.ac.in
Submission Date	2024-02-26 13:02:59
Total Pages	18
Document type	Dissertation

Result Information

Similarity **4 %**





Exclude Information

Quotes	Excluded
References/Bibliography	Excluded
Sources: Less than 14 Words %	Excluded
Excluded Source	0 %
Excluded Phrases	Not Excluded

Database Selection

Language	English
Student Papers	Yes
Journals & publishers	Yes
Internet or Web	Yes
Institution Repository	Yes

A Unique QR Code use to View/Download/Share Pdf File

Gupta

67

67

Caption

Caption

DrillBit

DrillBit Similarity Report

4	7	A
SIMILARITY %	MATCHED SOURCES	GRADE

A-Satisfactory (0-10%)
B-Upgrade (11-40%)
C-Poor (41-60%)
D-Unacceptable (61-100%)

LOCATION	MATCHED DOMAIN	%	SOURCE TYPE
1	Anticandidal efficacy of denture cleansing tablet, Triphala, Aloe vera, and Cash by Shetty-2014	1	Publication
2	Thesis submitted to shodhganga - shodhganga.inflibnet.ac.in	1	Publication
3	www.dx.doi.org	1	Publication
4	www.ncbi.nlm.nih.gov	<1	Internet Data
5	Thesis Submitted to Shodhganga, shodhganga.inflibnet.ac.in	<1	Publication
6	dental-almanac.org	<1	Internet Data
7	Synergistic interaction and mode of action of by Wongsariya-2013	<1	Publication

Caption