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ORIGINAL RESEARCH

# Prevalence of pathogenic bacteria in dental prostheses at Zawia private clinics

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## ABSTRACT

**Purpose:** The oral cavity's dental prosthesis may serve as a reservoir for bacteria that are connected to systemic infections. For this purpose, this study aimed to investigate and identify the bacteria pathogenic strains in the oral cavity and their prevalence in dentures, fixed prosthodontics, and orthodontic appliances wearers.

**Materials and Methods:** One hundred samples of swabs were collected from private dental clinics in Zawia, Libya. These samples were taken from male and female patients who wear dental prosthesis. The swabs were cultured, and the bacterial strains were identified.

**Results:** Forty-three percent of samples were pathogenic, which showed the following strains: *K. pneumoniae, S. aureus, E. cloacae, P. aeruginosa, Pneumococcus, E. coli, A. bumanii, and S. pyogenes* strains were found, and they were in males more than females. Moreover, the results showed that most of these strains existed on orthodontic appliances.

**Conclusion:** The prevalence of oral pathogens is higher in males than females (50% and 38.7%, respectively). Most pathogenic bacteria were found on the surface of orthodontic appliances more than the other dental prosthesis. *(Open J Biomed Res 2023;2:3-7.)*

### Keywords

Dental prosthesis, oral pathogens, antibiotic resistance, bacteria, orthodontic appliances.

## AUDIOABSTRACT

## INTRODUCTION

In the human oral cavity, there is a large and diverse microbial population that includes bacteria and fungi.[1] The majority of the bacteria in the human mouth are anaerobic gram-negative and gram-positive bacteria. Since this bacteria plays an essential role in preventing the colonization of pathogenic microbiota, any changes to this normal flora have an impact on dental health.[1,2] The main entrance to the human body is through the mouth cavity, which is a complex and dynamic environment.[3,4] Over 1000 species of oral microbiota have been identified by many studies.[5,6] The oral microbiota of humans has been used as a model system for research on multispecies microbial communities,[7-9] ever since Antonie van Leeuwenhoek first identified bacteria from the oral cavity in the 18th century.[10]

Dentures may affect the environment in the oral cavity due to lowered pH levels, reduced saliva flow on tissue surfaces, and a lack of mechanical tongue cleansing.[11] Moreover, the chance of microbe accumulation increases due to the roughness of the acrylic resin, which encourages plaque formation on denture surfaces.[12]

Adults and the elderly use complete or partial dentures in response to a variety of disorders that affect tooth extraction.[13,14] Denture wearers should be aware that dentures can act as a breeding ground for oral bacteria and the growth of halitosis.[15,16] The microbial community of the mouth undergoes some modifications when removable dental prostheses are used. This circumstance can occasionally result in stomatitis linked to dentures or dental prosthetics.[17]

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## MATERIALS AND METHODS

One hundred patient' participants were chosen for swab collection for this study, all those patients were wearing dental prostheses, which included fixed and removable prostheses as well as orthodontic appliances. The samples were collected from the local dental clinics in Zawia city. Any random patient visiting a dental clinic, excluding those under the age of five or those suffering from viral infections, met the study's inclusion criteria. Swabs were obtained and sent to the ALFA medical laboratory in Zawia, Libya. There, they were incubated overnight at 37°C in a shaking incubator. By inoculating the material on nutritional agar media plates which included beef extract 0.3%, peptone 0.5%, and agar 1.5% in water.

For this purpose, a sterilized inoculating loop was used to streak samples onto nutrient agar plates. After being inoculated, the nutrient agar plates underwent a 24h at 37°C thermal incubator incubation.

Using a gram staining kit, all pure bacterial isolates were initially processed. Under a microscope with a 100x magnification, the prepared slides were examined. Based on the colors and cell arrangement of the bacterium, observations were made.

To distinguish between bacterial strains, various biochemical assays were carried out after gram staining and microscopy. Basic biochemical (Api-20E) assays like the Oxidase, Catalase test (H2O2), and Coagulase test (EDTA) were used to distinguish between bacterial strains, and *Staphylococcus* colonies were also cultured on mannitol salt agar.

The findings of all samples were compared between the two groups using the paired t-test. And the χ2 test were used for categorical variables of more than two groups. The significant difference between the groups was indicated by a P-value of 0.05.

## RESULTS

### Bacteria Strain Identification and Data Distribution of Gender:

This study included 100 samples of oral cavity swabs from dental patients at clinics located in Zawia, Libya, gathered from people aged from 12 to 58 years old. The samples were taken from both genders: 38 males (38% of the total) and 62 females (62% of the total), (P= 0.08) as shown in Figure 1.

Among 100 samples collected (Fig. 2), 43 samples (43%) showed growth on the cultured media, and the majority of pathogenic bacteria were *K. pneumoniae*

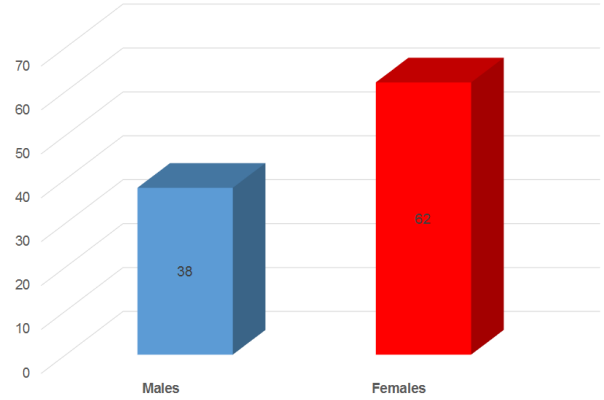



**Fig 1.** Gender distribution.

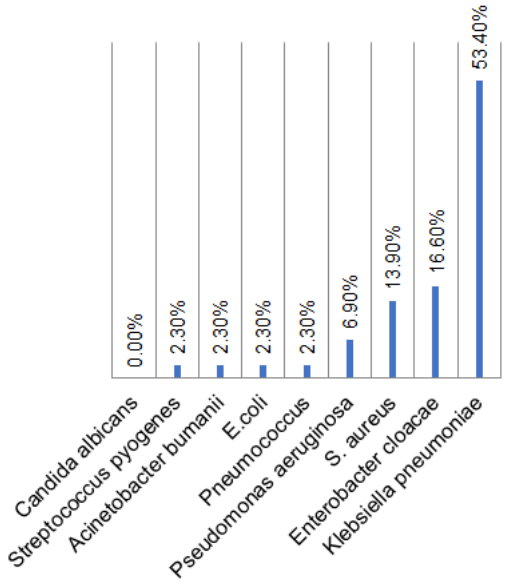



**Fig 2.** Bacterial strains identified in the oral cavity.

(53.4%), followed by *E. cloacae* (16.6%), *S. aureus* (13.9%), and *P. aeruginosa* (6.9%) (Table 1).

Apart from these significant findings, from the total 100 samples, 43 % showed growth on the cultured media; it showed significant differences at ages 13-35 years with 34 (44.2%) samples. The other 57% of samples did not show any bacterial growth (Table 2).

Due to the different age groups used in these studies, it is difficult to compare our findings to those of previous studies. Microorganism isolation was highest among those aged 13 to 65 with risk factors such as smoking, diabetes, and infrequent brushing of the teeth ( Fig. 3).

**Table 1**. Number and types of strains.

| Name of bacteria | *Klebsiella pneumoniae* | *Enterobacter cloacae* | *S. aureus* | *Pseudomonas aeruginosa* | *Pneumococcus* | *E.coli* | *Acinetobacter bumanii* | *Streptococcus pyogenes* | *Candida albicans* | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Number | 23 | 7 | 6 | 3 | 1 | 1 | 1 | 1 | 0 | 43 |
| Percentages | 53.4% | 16.6% | 13.9% | 6.9% | 2.3% | 2.3% | 2.3% | 2.3% | 0.0% | 100% |

**Table 2**. Distribution of positive and negative bacterial growth, and age groups.

| Age Groups | Bacterial growth | | Total samples (%), p-value=0.07 |
|---|---|---|---|
| | Positive samples (%) | Negative samples (%) | |
| 5-12years | 3 (50.0%) | 3 (50.0%) | 6 (6%), |
| 13- 35 years | 34 (44.2%) | 43 (55.8%) | 77 (77%) |
| 36-65 years | 6 (35.3%) | 11 (64.7%) | 17 (17%) |
| Total | 43 (7%) | 57 (7%) | 100% |

## Presence of Bacteria

*Pneumococcus, A. bumanii*, and *S. pyogenes* were present only in female samples. While *E. coli* was present only in male patients, *S. aureus* was detected in female samples more than male samples. while *K. pneumoniae* was presented almost the same in male and female cases (12 and 11, respectively).

Table 3 shows that the orthodontic appliances were the most commonly found bacteria strain, with 22 samples of *K. pneumonia*, 5 samples of *S. aureus*, 6 samples of *E. cloacae*, and one sample for these strains, *P.aeruginosa, P.neumococcus*, *E. coli, A. bumanii,* and *S. pyogenes*. While, the microbiological composition of the white filling cases are 2 samples of *K. pneumonia* and 1 samples of *E. coli*. Various degrees of contamination of gingival sulcus with microorganisms were noted at Gingiva, Amalgam, and PFM Bridge constructions with one *P. aeruginosa* sample in Gingiva. However, In the Amalgam sample showed 3 samples of *K. pneumonia*, 2 *S. aureus*, and 1 *P. aeruginosa*. And bridge constructions have just 1 sample containing *E.cloacae bacteria.*

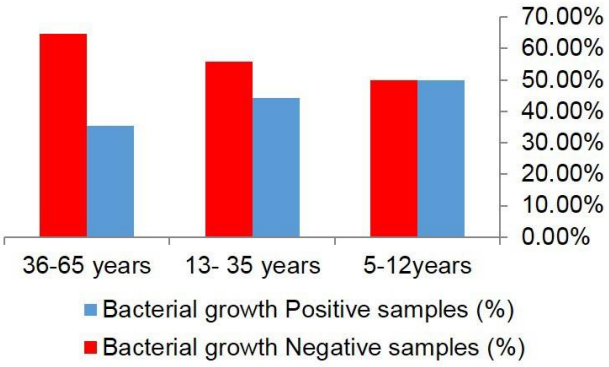



**Fig 3**. Distribution of positive and negative bacterial growth with age groups.

**Table 3**. Number and types of strains related to location in the oral cavity.

| *C. albicans* | *S. pyogenes* | *A. bumanii* | *E. coli* | *Pneumococcus* | *P. aeruginosa* | *E. cloacae* | *S. aureus* | *K. pneumoniae* | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 1 | 1 | 6 | 5 | 22 | **Orthodontic Appliance** |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | **White Filling** |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | **Gingiva** |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | **Amalgam** |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | **PFM Bridge** |

## DISCUSSION

This study analyzed the prevalence of micro-organisms in dental prosthesis at dental private clinics. Our meta-analysis consisted of 100 samples from dental patients who were wearing this prosthesis.

Healthy individuals with or without teeth may have yeast and bacteria colonizing their mouths that cohabit in a commensal relationship. Numerous circumstances may cause the number of bacteria in the oral cavity to rise, which might encourage colonization and allow them to develop into harmful organisms. Denture wearing and poor denture cleanliness are among the predisposing factors.[18]

A study conducted by Dag Istan S et al.[18] confirmed the presence of *Candida spp*. and *S. aureus* on 90 patients' maxillary full dentures. The majority of

the microorganisms on the dentures were discovered to be *Candida* species (65.5%), followed by *Strep* mutans (53.3%) and *S. aureus* (34.4%). These findings support those made by Baena-Monroy et al. [19], who showed that *C. albicans*, *S. aureus*, and Strep. mutans were present on the inner surface of complete dentures. In their investigation, *S. aureus* and Strep. mutans were isolated from 49.5% of the dentures, while *C. albicans* were found in 66.7% of them. Comparably, another study discovered that 64.2% of people who wear dentures have *Candida* spp.[20]

There aren't many studies looking at *P. gingivalis* colonization in adolescents using fixed orthodontic appliances for extended periods of time (up to six months). According to prior studies, several periodontal bacteria significantly increased after 6 months of fixed appliance therapy but decreased after 12 months of orthodontic therapy.[21] According to Ristic et al., the detection rate of *P. gingivalis* changed with changes in the gingiva index and increased from baseline to three months after bonding before declining at six months.[22]

The association between oral bacteria and orthodontic therapy has been the subject of numerous studies using traditional techniques, such as culturing, and these studies have concentrated on certain bacterial species. For instance, with fixed orthodontic appliances, increases in the prevalence of tooth caries and *S. mutans bacterial* counts were observed[23,24] The positioning of orthodontic appliances also had an impact on clinical indicators and the colonization of periodontal pathogenic bacteria like *P. gingivalis*, *P. intermedia, P. nigrescens*, and *F. nucleatum*.[25-27]

In another study done by Derafshi R et al.[28], the difference in the salivary microbial population between persons wearing removable dentures and the control group was examined, indicating a variety of pathogens in removable dentures, including *E. coli, K. pneumoniae*, and *E. aerogenes*. Gram-negative bacteria belonging to the *Entero-bacteriaceae* family and nonfermenting bacteria were significantly more prevalent in the case group than in the control group. Potentially harmful microorganisms, such as gram-negative bacilli from the *Acinetobacter*, *Pseudomonas*, *Moraxella Micrococcus*, and *Alcaligenes* species, have been identified as causes of contamination in industrial dentistry laboratories.[29,30]

Pathogens that cause pneumonia from inhalation can be significantly harmed by dentures.[31] It has been demonstrated that some rare microbes can be isolated from dentures, including *P. aeruginosa, S. pneumoniae*, Haemophilus influenzae, Haemophilus parainfluenzae, *E. coli,* and *K. pneumoniae*.[32]

The eradication of the germs that cause this condition is necessary for an endodontic treatment to be successful. Although it has been demonstrated that chemo-mechanical disinfection is successful in lowering intracanal bacteria.[33]

Our finding indicates that wearing dental prosthesis can be considered a risk factor for colonization by different species of microbiota. The results of our experiments showed that there are pathogenic bacteria such as *K. pneumoniae*, *S. aureus, E. cloacae, P. aeruginosa, Pneumococcus, E.coli, A. bumanii,* and *S. pyogenes* by 43%. However, no *C. albicans* was detected in this study. It's important to note that, at 50% and 38.7%, respectively, males were found to have a considerably higher prevalence of these germs than females. *K. pneumoniae* was present in 53.4% of the total pathogenic samples, while *E. cloacae* was 16.6%, *S. aureus* 13.9%, *P. aeruginosa* 6.9%, *Pneumococcus* 2.3%, *E. coli* 2.3%, *A. bumanii* 2.3%, and *S. pyogenes* 2.3%.

Additional studies are advised to investigate the oral biofilm in the general population, including those in Zawia, Libya, who are not currently receiving orthodontic and prosthetic treatment. The assessments should be made with the intent of evaluating the biological impact of the bacterial species on the oral cavity, their frequency in the development of oral diseases, and potential techniques for bacterial prevention and management.

## CONCLUSION

This study verified the prevalence of *K. pneumoniae*, *S. aureus*, *E. cloacae*, *P. aeruginosa*, *Pneumococcus*, *E. coli*, *A. bumanii*, and *S. pyogenes* on dental prosthesis surfaces, especially on orthodontic appliances.

These results highlight the significance of practicing good oral hygiene while receiving orthodontic treatment, as well as the necessity of routinely cleaning dental prosthesis to reduce the risk of bacterial colonization and potential oral health issues.

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