Comparative Assessment of Changes in Microflora in Delayed and Immediately Placed Implant- A Clinical Study

Mohammad Jalaluddin
Professor, Department of Periodontics and Oral Implantology, Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha, India

Naman Awasthi
Assistant professor, Department of Dentistry, Government medical college, Shahdol, Madhya Pradesh, India

Santhosh Kumar V
Assistant Professor, Department of Prosthodontics, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (Deemed to be University), Salem, Tamilnadu, India

Uttam S Shetty
Reader, Department of Prosthodontics, Bharati Vidyapeeth Dental College and Hospital, Navi Mumbai, India

Konsam Bidya Devi
Assistant Professor, Department of Periodontology, Dental College, JNIMS Porompat Imphal, Manipur, India

Thomas Varghese
Specialist Prosthodontist, Implantologist and Clinical Lecturer, Department of Prosthodontics, College of Dentistry, Gulf medical University, Ajman, United Arab Emirates

Abstract---Aim of the present study was to assess the changes in microflora in delayed and immediately placed implant. In this study, a total of 30 implant areas in 30 patients were analyzed. The study group consists 14 male and 16 female participants in the age range of 20-40 years. The patients were randomly divided into two groups (15 patients in each group). Group A: Immediate Implant Placement, Group B: Delayed Implant Placement. Implant placement done accordingly. The materials and media used for the study were sterilized. One day before, sample collection and implant placement,

2280

complete mouth scaling, and polishing were done. Sites to be sampled were isolated with sterile cotton rolls. Bacterial culture media used in the study include blood agar, Kanamycin blood agar, and Kanamycin-vancomycin blood agar. The samples were collected in the following stages- preoperative stage, After 24 hrs postoperative, After 7 days postoperative, on the day of prosthesis placement, 1st month follow-up, 2nd month follow-up. These following samples were tested to calculate the growth of the following pathogenic microorganisms: Aggregatibacter actinomycetemcomitans, Streptococcus, Porphyromonas gingivalis, Prevotella intermedia. On comparing mean counts of identified micro-organisms in the immediately placed implant a statistical significance was observed (Kruskal–Wallis = 44.836 and P < 0.001). On comparison of mean count of various micro-organisms in group 2 with the delayed placement of implants demonstrated statistical significance (Kruskal–Wallis = 48.136; P-value < 0.001). The present study concluded that, an immediate or delayed placement of implant does not alter the microflora of the oral cavity. Microorganisms' present preoperatively was consistently present during the entire phase of the treatment.

Keywords---delayed implant, immediately implant, microflora, peri-implant.

Introduction

A new era in restorative clinical dentistry began in 1950 with the introduction of dental implants as a restorative option. Subsequently dental implants came to the forefront in dentistry and became a standard of care for oral rehabilitation. Branemark's original protocol advocated placement of an implant after the bone had completely healed after tooth extraction (several months to 1 year). Although conventional dental implants have demonstrated long term success rates of around 88% after an observation time of 12.2 to 23.5 years, but this protocol of delaying the replacement of the missing tooth, associated function and aesthetics, resulted in severe compromise of hard and soft tissue architecture owing to rapid bone resorption after tooth loss.[1]

Modern dentistry has the goal to restore the patient to normal contour, function, comfort, esthetics, speech, and health by restoring caries tooth or replacing the missing tooth. Dental implant can fulfill most of the aforementioned goals. These implants can be loaded in three types. These are immediate loading (i.e., within 1 week), early loading (i.e., between 1 week and 2 months), and delayed or conventional loading (i.e., after 2 months). Studies show immediate loading of implant has higher failure rate.[2] But immediate or early loading protocols are practiced to reduce the interval between implant and prosthetic loading, which improves the patient comfort and also allows the patient to return to their socioeconomic lives earlier. Implant that is loaded after healing period (delayed loading) has high biologic stability, but it also has the disadvantage of prolonged treatment time.[3]

Since implant material is fundamentally a foreign material, the epithelium around the implant is thought to be more prone to invasion by foreign substances. Peri-implantitis is defined as a loss of the supporting bone caused by inflammation of the tissues surrounding the osseointegrated implant. A study by Cortelli *et al.*[4] tested the hypotheses that there is: (1) higher bacterial frequency in peri-implantitis/ periodontitis, followed by mucositis/gingivitis and peri-implant/periodontal health and (2) similar bacterial frequency between comparable peri-implant and periodontal clinical statuses. The result of the study was bacterial frequency increased from peri-implant/ periodontal health to peri-implantitis/periodontitis but not from mucositis/gingivitis to peri-implantitis/ periodontitis. There was a trend toward a higher bacterial frequency in teeth than implants. Hence the present study was conducted to assess the changes in microflora after placement of delayed and immediate implant.

Materials and Methods

The present study was conducted in the department of Periodontics, Kalinga institute of dental sciences, Bhubaneswar, India. In this study, a total of 30 implant areas in 30 patients were analyzed. The study group consists 14 male and 16 female participants in the age range of 20-40 years. These patients were selected from the outpatient department of Periodontics and oral implantology. Informed consent obtained from the each patient before the procedure.

Patient aged between 20-40 years and who had given written consent were included in the present study. Patients with the habit of alcohol, diabetes mellitus, smoking, immunosuppressive conditions, lactation, pregnancy, and systemic antibiotic therapy within 6 months before biofilm sampling or with an extensive fix or removable orthodontic or prosthetic appliance were excluded from the study.

Surgical procedure

The patient was prepared, draped and anesthetized under strict aseptic conditions with local anaesthesia preferably infiltration using 2% lignocaine hydrochloride with 1:200000 adrenaline given buccally and lingually/palatally to achieve anesthesia. The patients were randomly divided into two groups (15 patients in each group). Group A: Immediate Implant Placement, Group B: Delayed Implant Placement. Implant placement done accordingly. The materials and media used for the study were sterilized. One day before, sample collection and implant placement, complete mouth scaling, and polishing were done.

Collection of samples

Sites to be sampled were isolated with sterile cotton rolls. A supragingival plaque was registered and removed with sterile cotton pellets. The area was carefully dried, and the bacterial samples were collected by gently inserting fine sterilized paper points at gingival sulcus of teeth mesial and distal to the site of implant placement and the alveolar ridge of edentulous site for 30 s. In case of edentulous

ridge, paper points were placed in the vestibule and on the alveolar ridge. Paper points soaked with GCF were placed in sterile transport vials filled with 1 ml anaerobic medium and were sent to the laboratory. Bacterial culture media used in the study include blood agar, Kanamycin blood agar, and Kanamycin-vancomycin blood agar. The samples were collected in the following stages:

- Preoperative stage,
- After 24 hrs postoperative,
- After 7 days postoperative,
- on the day of prosthesis placement,
- 1st month follow-up,
- 2nd month follow-up.

These following samples were tested to calculate the growth of the following pathogenic microorganisms: Aggregatibacter actinomycetemcomitans, Streptococcus, Porphyromonas gingivalis, Prevotella intermedia.

Statistical analysis

The statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 17.0 for Windows). Kruskal–Wallis test was applied for comparison of two groups. And p value <0.05 considered as statistically significant.

Results

On comparing mean counts of identified micro-organisms in the immediately placed implant a statistical significance was observed (Kruskal–Wallis = 44.836 and P < 0.001). The presence of pathogenic micro-organisms, for example, P. gingivalis and P. intermedia which had pathogenic potential was of greater importance. [Table 1]

Table 1
Assessment of microbial counts in immediate placement of implant

Microorganism	Preoperative stage	After 24 hrs	After 7 days	prosthesis placement	1st month follow-up	2nd month follow-up
A. actinomycetemcomitans	0.13×10^4	0.10×10^4	Nil	Nil	Nil	Nil
Streptococcus	4.2×10^4	3.9×10^4	3.2×10^4	2.7×10^4	2.1×10^4	1.9×10^4
P. gingivalis	0.58×10^4	0.49×10^4	0.44×10^4	0.38×10^4	0.27×10^4	0.24×10^4
P. intermedia	0.08×10^4	0.07×10^4	0.07×10^4	Nil	Nil	Nil

Table 2 shows the comparison of mean count of various micro-organisms in group 2 with the delayed placement of implants demonstrated statistical significance (Kruskal–Wallis = 48.136; P-value < 0.001). Streptococcus microorganisms were consistently higher titers as compared to other microorganisms like A. actinomycetemcomitans, P. gingivalis, P. intermedia, and these microorganism shows relatively lower titers. However, there was no statistically significant result found on comparison of mean ranks of A. actinomycetemcomitans, Streptococcus, P. gingivalis, P. intermedia, in delayed as well as immediately placed implant groups.

Table 2
Assessment of microbial counts in delayed placement of implant

Microorganism	Preoperative stage	After 24 hrs	After 7 days	prosthesis placement	1st month follow-up	2nd month follow-up
A. actinomycetemcomitans	0.08×10^4	0.07×10^4	Nil	Nil	Nil	Nil
Streptococcus	3.9×10^4	3.7×10^4	2.9×10^4	2.4×10^4	2.6×10^4	2.1×10^4
P. gingivalis	0.60×10^4	0.58×10^4	0.47×10^4	0.42×10^4	0.38×10^4	0.29×10^4
P. intermedia	0.10×10^4	0.16×10^4	0.08×10^4	Nil	Nil	Nil

Discussion

Dental implants provide a unique opportunity for the observation of the initial bacterial colonization pattern and also for the estimation of time needed for the establishment of complex microbial flora since one is starting with bacteria-free surface.[5] The composition of peri-implant microflora is similar to pocket around the natural teeth that seems to be an obligate ecological niche for some oral microbiota. Long-term success with immediate implants is comparable to that of delayed implants. While many factors are considered important in determining the long-term success or failure of dental implants (for example, occlusal loading forces, implant materials, surgical placement, and host acceptance), little is known about the relative importance of the subgingival bacterial colonies around the implants and their effects on peri-implant tissues.[6]

The present study results showed that in both groups, Streptococci were seen in the higher titer as compared to A. actinomycetemcomitans, P. gingivalis, P. intermedia, which shows comparatively low titer. This can be attributed to the fact that *Streptococcus* is the normal commensal of the mouth, while other microorganisms are found in the pathologic state. Therefore, the titers of these cocci counts are more. The study also shows that microorganisms remain the same in healthy patients throughout the treatment process. Our results were in accordance with Quirynen *et al.*[7] who reported 65.3% cocci compared to other bacteria. *P. gingivalis* (21.4%–24%) was another predominant bacteria that were observed and are associated with periodontitis. Similar results were obtained by Mombelli *et al.*[8] in their study in healthy patients with implants. Cortelli *et al.*[4] in

his research, found that *P. gingivalis* to be 12% and *P. intermedia* to be 22% in a healthy patient with implants that contradict our results as the value of *P. intermedia* in our study was very less range in Group 1 and Group 2. However in the same study, the number of *P. gingivalis* increased in mucositis and periimplantitis condition. This could be explained that the microflora around the implant keeps on changing, and the same microorganism responsible for periodontitis causes peri-implantitis. Therefore, the periodontium around implant must be continuously monitored after implant placement.[9]

Implant failures due to the infection are characterized by a complex peri-implant microbiota, resembling that of adult periodontitis. In edentulous subjects, *A. actinomycetemcomitans* and *P. gingivalis* are not as frequently associated with peri-implant infection as in dentate subjects. Danser *et al.*[10] reported that after total extraction in patients with severe periodontitis, *P. gingivalis* could no longer be detected on the mucosal surface of edentulous patients. Furthermore, *A. actinomycetemcomitans* and *P. gingivalis* could not be isolated at the peri-implant pockets in these patients after the insertion of implants.

In the present study, it was found that placement of implants either delayed or when they are immediately placed do not cause alteration in the microflora of the oral cavity. Thus, one must understand that maintaining periodontal tissue health is important for preventing peri-implantitis. Although, it is important for identifying these micro-organisms for understanding their level of pathogenicity as well as monitoring the patients for good clinical outcomes.

Conclusion

The present study concluded that, an immediate or delayed placement of implant does not alter the microflora of the oral cavity. Microrganisms present preoperatively were consistently present during the entire phase of the treatment. The peri-implant disease develops many years after placement of implants hence, a regular follow-up for monitoring coupled with assessing peri-implant micro-flora was important for a good prognosis.

References

1. Jaspreet Kaur, Gurparkash Singh Chahal, Vishakha Grover, Dipika Bansal and Ashish Jain. Immediate implant placement in periodontally infected sites- A systematic review and meta-analysis. Journal of the International Academy of Periodontology 2021;23(2):115–137.
2. Muthukumar B, Gopichander N, Katare U. Clinical and radiographic evaluation of single unit implant-retained prosthesis with immediate and delayed loading. SRM J Dent Sci 2010;1:48-50.
3. Simunek A, Kopecka D, Brazda T. Development of implant stability during early healing of immediately loaded implants. Int J Maxillofac Implants 2012;27:619-27.
4. Cortelli SC, Cortelli JR, Romeiro RL, Costa FO, Aquino DR, Orzechowski PR, *et al.* Frequency of periodontal pathogens in equivalent peri-implant and periodontal clinical statuses. Arch Oral Biol 2013;58:67-74.

5. Brånemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A. Intra‑osseous anchorage of dental prostheses. I. Experimental studies. Scand J Plast Reconstr Surg1969;3:81‑100.
6. Hiremath KG, Patil VN, Ruttonji Z, Kusugal P, Sushma KM, Astagi P. A comparative evaluation of changes in microbial flora in delayed and immediate placed implants: An *in vivo* study. J Dent Implant 2020;10:16-21.
7. Quirynen M, Listgarten MA. Distribution of bacterial morphotypes around natural teeth and titanium implants ad modum Brånemark. Clin Oral Implants Res. 1990;1:8–12.
8. Mombelli A, van Oosten MA, Schurch E, Jr, Land NP. The microbiota associated with successful or failing osseointegrated titanium implants. Oral Microbiol Immunol. 1987;2:145–51.
9. Canullo L, Penarrocha-Oltra D, Soldini C, Mazzocco F, Penarrocha M, Covani U. Microbiological assessment of the implant-abutment interface in different connections: Cross-sectional study after 5 years of functional loading. Clin Oral Implants Res. 2015;26:426–34.
10. Danser MM, van Winkelhoff AJ, van der Velden U. Periodontal bacteria colonizing oral mucous membranes in edentulous patients wearing dental implants. J Periodontol 1997;68:209‑16.