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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF DIFFERENT METHODS OF SAND BLASTING ON IMPLANT STABILITY DETERMINED BY RESONANCE FREQUENCY ANALYSIS- A SYSTEMATIC REVIEW

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ABSTRACT

Background: Various methods of sand blasting are used to improve the implant stability which in turn improves the osseointegration and reduce the chance of implant failure. The most common method used to determine the stability is resonance frequency analysis. **Aim :** Dental implant is becoming common option for replacement of lost teeth. Various techniques are used to improve the stability of the implant after insertion. Most commonly used is modifying the surface of the dental implant that improves the wettability, resulting in improved osseointegration and implant stability. This systematic review evaluates the effect of different sandblasting techniques of the implant surface on implant stability. **Setting and Design:** The review is based on articles selected from PUBMED and google scholar and was completed in Dr. D. Y. Patil Dental College and Hospital, Pune, Pimpri. **Material and Method:** This review selected articles from PUBMED and Google Scholar. Additional studies were hand searched. Clinical trials, prospective and retrospective studies were included. FEM Studies and case reports were excluded in this study. These studies evaluate the effect on implant stability when the implant surface is treated with different methods of sand blasting. **Results:** A total of 140 articles were taken through the electronic search. Only 4 articles were included on the basis of inclusion and exclusion criteria. All the articles have shown good results when the implant surface was treated with different techniques of sand blasting. **Conclusion:** This review concludes that the treatment of the implant surface with different techniques of sand blasting improves the implant stability during insertion which improves the torque. The study also shows that the implant stability is improved as time progresses. **Limitations:** Total number of articles screened for full text are limited in number i.e., only 4 articles are screened in this systematic review

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INTRODUCTION

Dental implant is the most common line of treatment for edentulous areas and also for compromised bone sites. Modification of the implant surfaces directly influence the implant survival rates. bone quality and osseointegration is affected by the surface roughness of the implant (CarmoFilho, 2018). Implant stability is known as the absence of clinical mobility (Novellino, 2017).

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After implant placement, the macro-design of the implant provides the primary implant stability. This is slowly replaced by osseointegration which provides secondary or biological stability (Kim, 2017). Weeks after implant placement, primary stability decreases, but, secondary stability has not been achieved completely to compensate for this decline. This difference in the stability quotient results in a stability dip. Standard procedure of loading the implant after this stability dip is done. Many modification techniques of the implant surface have been introduced to alter the duration of this stability dip. Modifications of the surface characteristics, structure, chemistry, charge, and wettability can be done to increase the roughness of the surface which has a positive

effect on osseointegration and implant stability. The ultimate effect of this implant surface modification is to achieve a surface that attracts bone-forming cells (CarmoFilho, 2018).

FOCUSED QUESTION: To evaluate the effect on implant stability when the implant surface is treated with different techniques of sandblasting.

OBJECTIVES

- To evaluate the effect of conventional sand blasting with acid etching of the implant surface on implant stability.
- To evaluate the effect of modified sand blasting with acid etching of the implant surface on implant stability.

ELIGIBILITY CRITERIA

Inclusion criteria

- All the randomized control trials evaluating the effect on implant stability when the surface is treated with different techniques of sand blasting
- All the studies conducted between 2009 to 2019
- Full text article
- Articles in English language

Exclusion criteria

- All the narrative reviews.
- All the letter to editor.
- All the articles published in other languages.

PICO

P (population) – Surface Treated Dental implants

I (intervention) – Different Techniques of Sand Blasting

O (outcome) – Effect on Implant Stability

MATERIALS AND METHODS

Information source: Literature search strategy was developed using keywords related to Dental Implants, sand blasting, acid etching, Implant Stability and Resonance Frequency Analysis. Data was searched from PubMed and Google scholar from January 1st 2009 to December 31st 2018. Cross references were checked from relevant articles. Hand searching was done for the articles when the full text of the articles was not available through electronic databases.

Search: The search was done on PubMed and Google scholar. After search is completed, filters were put for the dates of publication from January 1st 2009 to December 31st 2018. Only English articles were chosen. Only full text articles were kept. The keywords were selected by the review of literature. The strategy used for searching articles in PubMed was Dental Implants AND sand blasting AND acid etching AND Implant Stability AND Resonance Frequency Analysis

Five search strategies were formed using keywords

- 1.Surface treatment AND dental implant AND implant stability
- 2.Sand blasting OR acid etching AND dental implants AND implant stability
- 3.Surface treatments AND dental implants AND resonance frequency analysis AND implant stability
- 4.Sand blasting AND dental implants AND implant stability AND resonance frequency analysis
- 5.acid etching AND dental implants AND implant stability AND resonance frequency analysis

Google search was carried out for the articles not published on PubMed. Searching on Google yielded 0 articles which were found to be relevant according to the eligibility criteria and not duplicate.

SEARCH ENGINES

Pub Med
Google Scholar
EMBASE
Institutional Library

DATA COLLECTION PROCESS

A standard data extraction sheet was made in Excel. The following criteria were predecided for extracting the data:-

- The main interest was to obtain the baseline and post treatment values of implant stability.
- Follow up period till 6 months onwards was considered.

DATA ITEMS

Data items included for the data extraction were :-

- **Study ID** :- Number given to the study for identification.
- **Author's name** :- Name of the author
- **Year of publication** :- Year in which the study was published.
- **Location** :- place where the study was done.
- **Duration** :- For how much duration the study was conducted
- **Intervention** :- Different techniques of sand blasting.
- **Results** :- value obtained at baseline till 6 months post implantation
- **Remarks** :- Results of the individual study.

RESULTS

STUDY SELECTION

One review author independently screened the titles and abstracts obtained by search strategy and included them if they met the inclusion criteria. Later full texts of all the included studies were obtained. After obtaining the full texts of the articles they were screened by reading the whole article and then decided if they met the inclusion criteria. Whenever there was uncertainty regarding any study to be eligible for inclusion, the problem was resolved by discussing it with the second author. Finally, the search yielded 4 studies to be included in systematic review. All the excluded studies were recorded with reason for exclusion for each study. None of the authors were blinded to the journal titles, study authors or the institutions where the studies were conducted.

Search Strategy	Articles obtained	Selected articles	Reasons for exclusion
Surface treatment AND dental implant AND implant stability	8	4	case report/not relevant to this study
Sand blasting OR acid etching AND dental implants AND implant stability	6	0	case report/not relevant to this study/duplicate
Surface treatments AND dental implants AND resonance frequency analysis AND implant stability	6	0	case report/not relevant to this study/duplicate
Sand blasting AND dental implants AND implant stability AND resonance frequency analysis	1	0	case report/not relevant to this study/duplicate
acid etching AND dental implants AND implant stability AND resonance frequency analysis	4	0	case report/not relevant to this study/duplicate

Depicts the process of selecting the articles and excluding them at each step. 140 Records were identified through the data search using search strategy in PubMed. Through Google scholar 0 articles were selected based on titles. Total articles number arrived to be 140. Second step was screening through the titles and after screening 115 articles were excluded because they were not related to the objectives of the systematic review. Some articles mentioned study done on animals whereas, some mentioned techniques other than sand blasting and acid etching. 15 articles were excluded by title. Out of 10 articles, 5 articles were chosen based on abstract. Out of 5 articles, 4 were chosen based on full text. At the end 4 studies remained which underwent qualitative synthesis.

DISCUSSION

Summary of evidence: If there is no clinical mobility, then the implant is said to have primary stability. Osseointegration is also defined by the same. The adjacent bone quality, quantity, the type of implant & placement technique used determines the initial implant stability. Secondary implant stability is determined by bone formation and by the remodel at the implant interface. Numerous ways are present to determine the implant stability, like measurement of resistance during placement, reverse torque test, the perio-test and by RFA.

Hyun-Joo Kim et al in 2017 performed a study in which he included 20 participants. 35 implants were placed in these 20 participants. Appropriate periodontal treatments was done which included maintenance of hygiene, scaling and root planning. Surgical intervention was done if required. A magnetic peg was attached to the implant and the Osstell Machine was used to measure the ISQ in the buccal and lingual sides. Average value was concluded. Initial implant stability was measured at the time of implant placement and at one, two, three, four, six, and ten weeks. The modified sand blasted treatment group showed an increased ISQ than the SLA group immediately after implant placement (week 0), while the SLA group showed an increased ISQ than the modified sand blasted group at week 10. However the difference was not statistically significant. Stability dip was seen at week one for the SLA group and at week two for the modified sand blasted group. Later, both groups showed a uniform increase in the ISQ, and in weeks four and six, the ISQ of the SLA group was significantly higher. The time at which the ISQ recovered to a level higher than week zero was at week two for the SLA group and week ten for the RBM group. Marcelo M. Novellino et al in 2017 placed a total of 64 implants. He evaluated the implant stability at different time periods. The lowest and highest RFA values during the study were 42 and 81 for the SAE group and 32.5 and 82.5 for the MSAE group, respectively.

The MSAE implants showed increased values than the SAE implants from week five to sixteen. The MSAE group and the SAE group's ISQ measurements resulted in statistically significant differences. He concluded that the SAE group had better delayed implant stability as compared to the MSAE group. Luiz Carlos et al in 2018 placed 80 implants in 19 patients to evaluate the implant stability. All implant showed similar behaviour until the 28th day. After 35 days, MSAE implants showed noticeably lower ISQ values than SAE implants ($p < 0.001$), and this difference was observed until 56 days. After 91 days, the values for all implant types were noticeably higher than the primary ISQ value ($p < 0.001$).

He also concluded that the implant stability increases as healing continues. Implant stability is more for the SAE group in the later stages as compared to the MSAE group. Beena Kumary et al in 2019 evaluated the implant stability in 210 patients. The maximum RFA value of 86.2 and minimum of 44.6 in SAE dental implants was measured. The maximum mean RFA value in MSAE was 89.4 and minimum was 32.5. The difference was statistically significant ($P < 0.05$). She observed that the MSAE group showed higher implant stability in both the initial and delayed stages than the SAE group.

Limitations

Total number of articles screened for full text are limited in number i.e, only 4 articles are screened in this systematic review.

Conclusions

Sand blasted acid etched group showed increase RFA values in both the initial and delayed stages than the modified sand blasted acid etched.

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