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Research Article

Evaluate Dental Implant Survival In Patients Undergoing Vascularized Maxillary Or Mandibular Reconstruction: A Systematic Review And Meta-Analysis

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Abstract

Background and aim: The aim of current systematic review and meta-analysis study was evaluate Dental Implant Survival in Patients Undergoing Vascularized Maxillary or Mandibular Reconstruction.

Methods: From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last five years between 2016 and September 2021. Effect size and Risk ratio with 95% confidence interval (CI), fixed effect model and Inverse-variance or Mantel-Haenszel method were calculated. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

Results: 1452 studies were selected to review the abstracts, the full text of 39 studies was reviewed. Finally, eight studies were selected. Implant Survival in 294 patients who underwent Dental Rehabilitation with 1138 total implants (Microvascular Flaps) was 94% (ES, 0.94 95 % CI 0.60, 1.29) and in the Preirradiation Implant Placement in 9 patients with 59 implants was 93% (ES, 0.93 95 % CI 0.36, 1.50). Statistically significant difference of survival outcomes between radiotherapy and no radiotherapy group observed (p=0.00); radiotherapy significantly increased the risk of implant failure.

Conclusions: in patients Undergoing Vascularized Maxillary or Mandibular Reconstruction, Osseointegrated dental implant placement is successful technique and improve their quality of life and oral function, and should be given special attention in these patients.

Keywords: Dental Implant, Implant Survival, Vascularized Maxillary, Mandibular Reconstruction, Osseointegrated dental implant,

Introduction

In people who have lost teeth, dental rehabilitation can improve patients' quality of life through osseointegrated implant placement, and restoring maxillofacial functions can improve mastication and speech in these people(1, 2). Over the past few years, osseointegrated dental implants have been recognized as a major factor in restoring tooth continuity(3, 4). Osseointegrated implant placement can be done immediately or delayed(5). Advantages of immediate implantation include better bone access, ease of interdental communication, and shorter time to complete dental rehabilitation(6, 7). In practice, most implants are performed as a secondary and delayed procedure to prevent damage to the bone flap(8). Reports indicate that different approaches have been observed for implant placement with variable outcomes, and the need to summarize the results and present a single outcome is of great importance.

Osseointegrated implant placement is a major concern in cancer patients treated with Radiotherapy because it is a complication of hot spot radiotherapy and osteoradionecrosis (9, 10). However, the effect of radiation on osseointegrated implant survival is unclear and should be studied in detail, although some surgeons recommend implant survival without change in native bone versus flaps in patients with head and neck cancer (11-13). Studies have reported lower implant survival rates (10, 14, 15). There is insufficient evidence for success in implant placement, before or after radiation therapy, in reconstructed maxilla and mandible, and it seems that a study in this regard is very important. Therefore the aim of current systematic review and meta-analysis study was evaluate Dental Implant Survival in Patients Undergoing Vascularized Maxillary or Mandibular Reconstruction.

Methods

Search strategy

From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last five years between 2016 and September 2021. The reason for choosing studies in the last five years is to be able to provide sufficient evidence in this area and use newer studies. Therefore, a software program (Endnote X8) has been utilized for managing the electronic titles.

Searches were performed with mesh terms:

("Reconstructive Surgical Procedures"[Mesh] OR "Mandibular Reconstruction"[Mesh]) OR "Maxilla"[Mesh]) OR "Mandible"[Mesh]) AND ("Dental Implant-Abutment Design"[Mesh] OR "Immediate Dental Implant Loading"[Mesh] OR "Dental Prosthesis, Implant-Supported"[Mesh] OR "Bone-Implant Interface"[Mesh] OR "Osseointegration"[Mesh] OR "Bone-Anchored Prosthesis"[Mesh] OR "Prostheses and Implants"[Mesh] OR "Dental Implants"[Mesh])) AND "Survival"[Mesh]) OR "Survival Rate"[Mesh]) AND "Vascularized Composite Allotransplantation"[Mesh]) AND "Mandibular Reconstruction"[Mesh].

This systematic review has been conducted on the basis of the key consideration of the PRISMA Statement–Perfumed Reporting Items for the Systematic Review and Meta-analysis(16), and PICO strategy (Table1).

Selection criteria

Inclusion criteria: Randomized controlled trials studies, controlled clinical trials, and prospective and retrospective cohort studies; in English. In vitro studies, case studies, case reports and reviews were excluded from the study.

Table 1. PICO OR PECO strategy.

PICO strategy	Description

P	Population/ Patient: Patients Undergoing Vascularized Maxillary or Mandibular Reconstruction
E	Intervention: bone flap, composite flaps, osteocutaneous, osteomyocutaneous, or osteoseptomyocutaneous
C	Comparison: No-Radiation Implant Placement
O	Outcome: survival rate

Data Extraction and analysis method

The data were extracted from the research included years, study design, sample size, mean/range of age, defect location.

Collaboration's tool(17). The scale scores for low risk was 1 and for High and unclear risk was 0. Scale scores range from 0 to 6. A higher score means higher quality

The quality of non-randomized studies included was assessed using Newcastle-Ottawa Scale (NOS) (18) used to assessed quality of the cohort studies and case-control studies, This scale measures three dimensions (selection, comparability of cohorts and outcome) with a total of 9 items. In the analysis, any studies with NOS scores of 1-3, 4-6 and 7-9 were defined as low, medium and high quality, respectively.

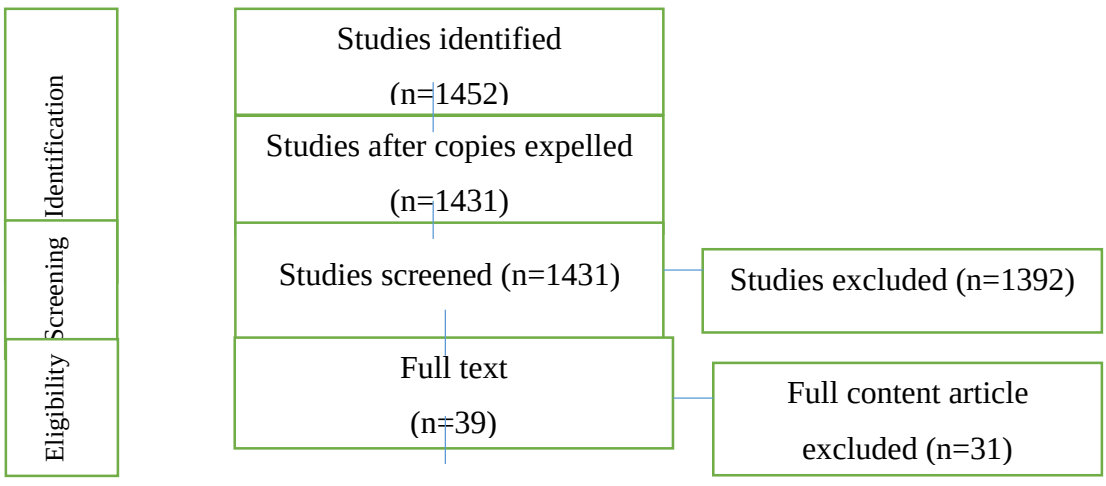
For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Prior to the screening, kappa statistics was carried out in order to verify the agreement level between the reviewers. The kappa values were higher than 0.80.

Effect size and Risk ratio with 95% confidence interval (CI), fixed effect model and Inverse-variance or Mantel-Haenszel method were calculated.

Random effects were used to deal with potential heterogeneity and I^2 showed heterogeneity. I^2 values above 50% signified moderate-to-high heterogeneity. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

Results

In the review of the existing literature using the studied keywords, 1452 studies were found. In the initial review, duplicate studies were eliminated and abstracts of 1431 studies were reviewed. At this stage, 1392 studies did not meet the inclusion criteria, so they were excluded, and in the second stage, the full text of 39 studies was reviewed by two authors. At this stage, 31 studies were excluded from the study due to incomplete data, inconsistency of results in a study, poor studies, lack of access to full text, inconsistent data with the purpose of the study. Finally, eight studies were selected (Figure1).



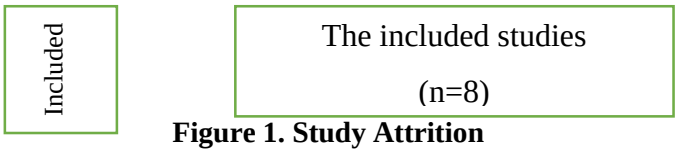


Figure 1. Study Attrition

Characteristics

Eight studies (seven retrospective cohort studies and one randomized clinical trials) have been included in present article. The number of patients a total was 585 with mean age of 53.48 years (male: 331; female: 254). Defect location in sic studies was both (Maxilla and Mandible) and in two studies was only Mandible (Table2).

Bias assessment

All studies had moderate quality or medium risk of bias.

Table 2. Studies were selected for systematic review and meta-analysis.

Studies. Years	Study design	Number of Patients		Mean/ Range of age (years)	Defect location	
		male	female		Maxilla	Mandible
Burgess et al., 2017 (19)	Retrospective	35	24	51.3	√	√
Kniha et al., 2017 (20)	Retrospective	15	13	58.3	√	√
Sozzi et al., 2017 (21)	Retrospective	12	10	54.6	√	√
Kumar et al., 2016 (22)	RCT	26	8	40.2	×	√
Wu et al., 2016 (23)	Retrospective	25	11	52.1	√	√
Jackson et al., 2016 (24)	Retrospective	31	15	62.6	×	√
Ch'ng et al., 2016 (25)	Retrospective	123	123	54	√	√
Barber et al., 2016 (26)	Retrospective	64	50	54.8	√	√

Implant Survival

Implant Survival in 294 patients who underwent Dental Rehabilitation with 1138 total implants (Microvascular Flaps) was 94% (ES, 0.94 95 % CI 0.60, 1.29) with low heterogeneity (I^2 = 0%; p=1.00) (Figure2).

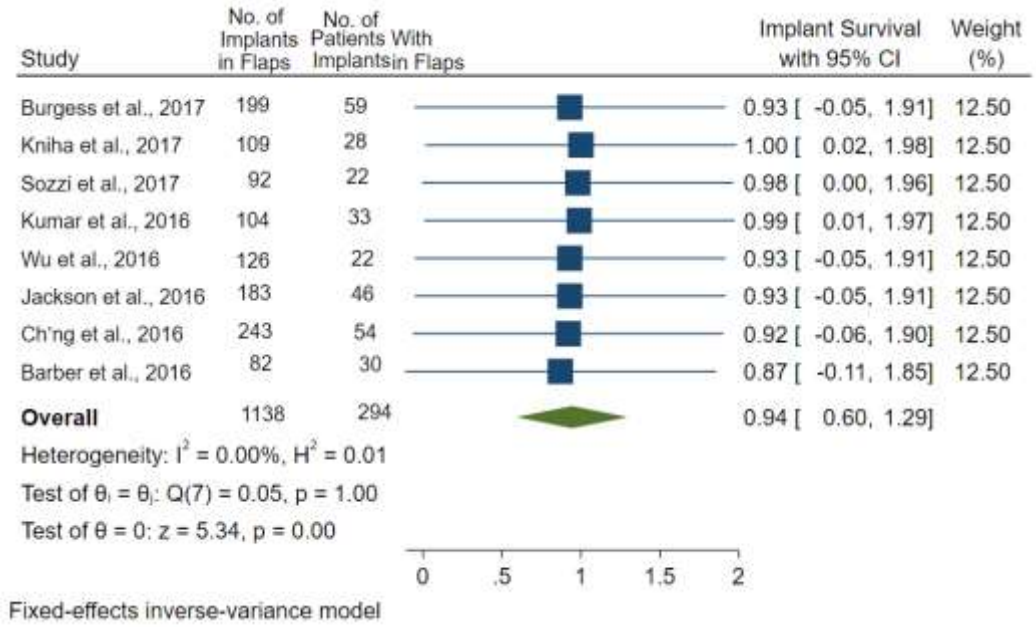


Figure2. The Forest plot showed Implant Survival in 294 patients who underwent Dental Rehabilitation with Microvascular Flaps

Survival Outcome in the No-Radiation Implant Placement Group

The Survival rate in the No-Radiation Implant Placement in 48 patients with 406 implants was 95% (ES, 0.95 95 % CI 0.39, 1.59) with low heterogeneity (I^2 = 0%; p=1.00) (Figure3).

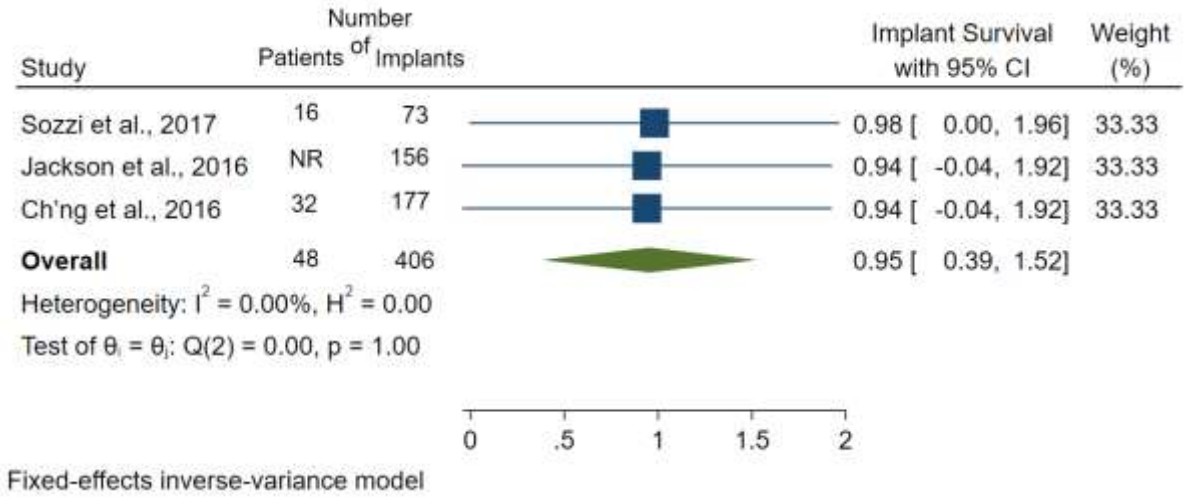


Figure3. The Forest plot showed Survival Outcome in the No-Radiation Implant Placement Group

Survival Outcome in the Preirradiation Implant Placement Group

The Survival rate in the Preirradiation Implant Placement in 9 patients with 59 implants was 93% (ES, 0.93 95 % CI 0.36, 1.50) with low heterogeneity (I^2 = 0%; p=0.98) (Figure4).

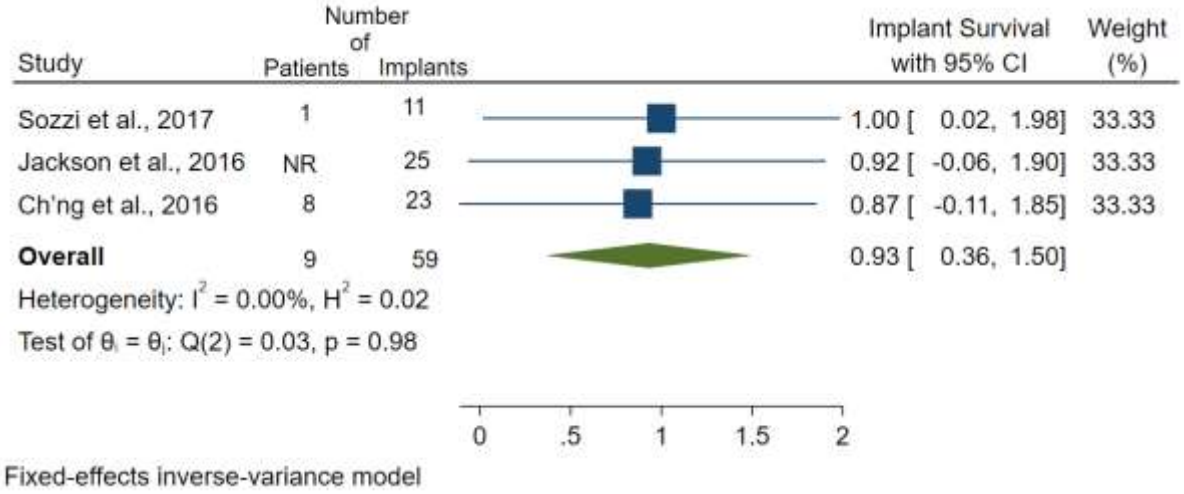


Figure4. The Forest plot showed Survival Outcomes in the Postirradiation Implant Placement Group

Survival Outcomes in the Postirradiation Implant Placement Group

The Survival rate in the Postirradiation Implant Placement in 54 patients with 227 implants was 86% (ES, 0.86 95 % CI 0.43, 1.30) with low heterogeneity (I^2 = 0%; p=1.00) (Figure5).

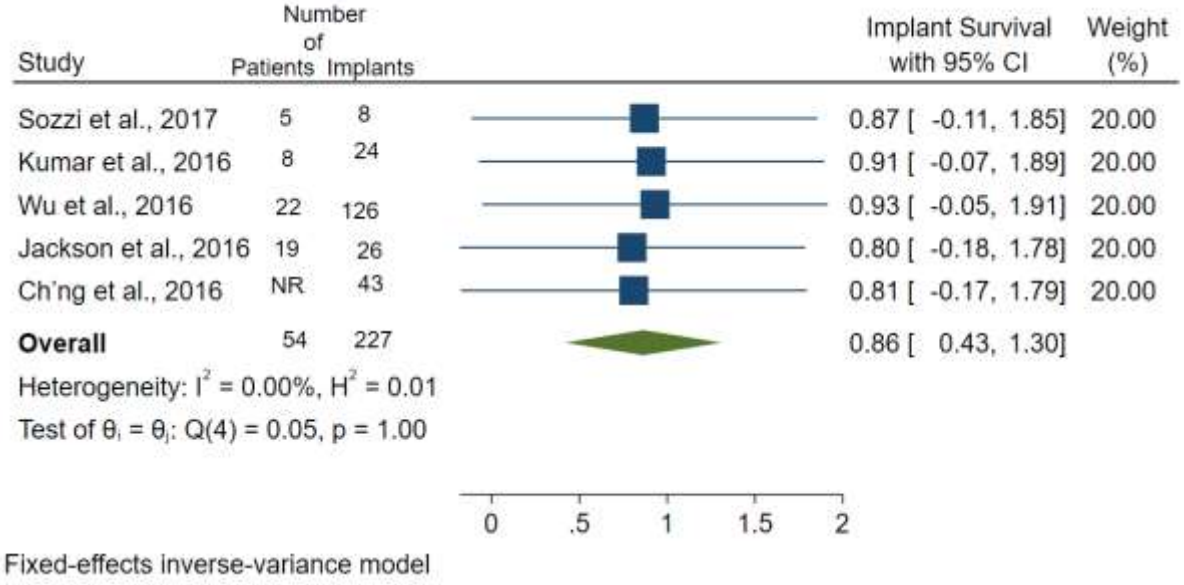


Figure5. The Forest plot showed Survival Outcomes in the Postirradiation Implant Placement Group

Survival Outcomes before or after radiotherapy vs control group

The risk ratio of implant failure (total: 23) in patients with implant placement (total: 147) before and after radiotherapy between radiotherapy and no radiotherapy was -0.13 (RR, -0.13 95 % CI -0.20, -0.05; p=0.00) with low heterogeneity (I^2 <0%; p=0.63) (Figure6). This result shows statistically significant difference of survival outcomes between radiotherapy and no radiotherapy group; radiotherapy significantly increased the risk of implant failure (Figure6).

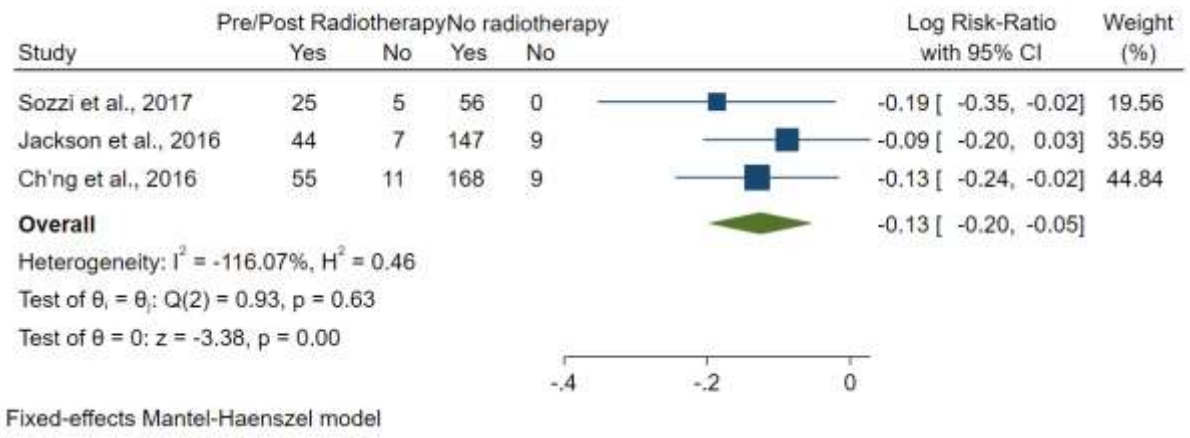


Figure6. The Forest plot showed implant failure in patients with implant placement before or after radiotherapy vs control group (no radiotherapy)

Survival Outcomes before radiotherapy vs after radiotherapy

The risk ratio of implant failure (total: 5) in patients with implant placement (total: 54) before radiotherapy and implant failure (total: 14) in patients with implant placement (total: 77) after radiotherapy was 0.10 (RR, 0.10 95 % CI -0.04, 0.24; p=0.14) with low heterogeneity (I2 <0%; p=0.89) (Figure7). This result shows no statistically significant difference of survival outcomes between before and after radiotherapy; Implants before radiotherapy had a reduced risk of failure.

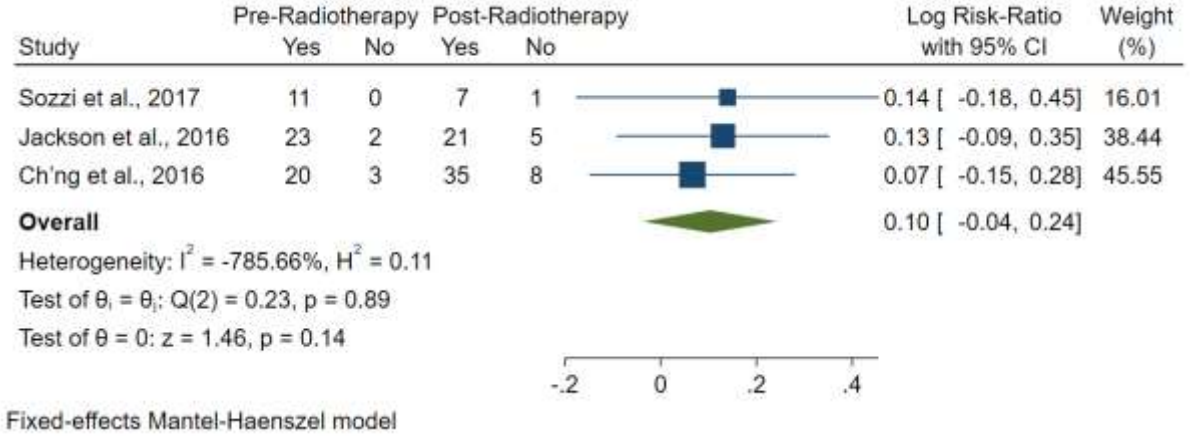


Figure6. The Forest plot showed implant failure in patients who underwent pre-radiotherapy implant placement versus post-radiotherapy implant placement

Discussion

Evidence suggests that even if vascularized bone flaps begin the restoration of orofacial form and function, regeneration remains incomplete until healthy teeth are restored (27, 28). The aim of current systematic review and meta-analysis study was evaluate Dental Implant Survival in patients Undergoing Vascularized Maxillary or Mandibular Reconstruction.

The meta-analysis of the present study showed, Implant Survival in patients who underwent Dental Rehabilitation with Microvascular Flaps was 94%, Survival rate in the No-Radiation Implant Placement was 95%, Survival rate in the Preirradiation Implant Placement was 93% and Survival rate in the

Postirradiation Implant Placement was 86%. Also there was statistically significant difference of survival outcomes between radiotherapy and no radiotherapy group; radiotherapy significantly increased the risk of implant failure and Implants before radiotherapy had a reduced risk of failure; although statistical analysis was not significant between before and after radiotherapy.

If implants are not placed during flap reconstruction, many oncology patients may not be able to have their teeth repaired in the future, regardless of the need for radiation therapy. Finally, in terms of cost, paying for implant placement may be associated with the initial reconstruction and reduce the overall cost compared to the delayed method, which is often done out of pocket. In general, immediate placement of dental implants is a possible technique that can lead to better results and may be more cost-effective. Given the challenges of subsequent removal, reconstruction, and treatment, this systematic review provides the basis for the literature on the immediate placement of dental implants during initial reconstruction, with virtual scheduling and protocols for initial tooth restoration even under radiotherapy(29).

Radiation may cause inflammation of the soft tissue around the implant, potentially disrupting the ossification of the implants, or directly endangering the bony arteries, or indirectly creating quasi-heat pockets around the implant due to being placed on the back. , All of which prevent bone softening(29-32). Not surprisingly, implant survival in non-irradiated flaps is superior to that in irradiated flaps(33, 34). Studies have suggested that the implant be inserted 12 months after radiation therapy, which may improve bone perfusion and implant survival(35). One of the limitations of the present study was that the difference in follow-up time between radiotherapy groups should be considered in order to provide stronger results and evidence. Patients' quality of life and function should also be evaluated. Proper evaluation of oral functions after rehabilitation, which play an important role in health-related quality of life, is very important. It is recommended that these two variables be discussed in future studies. Prolonged follow-up leads to an increase in implant failure rate, the results of which may be affected by survival bias. Given that prostheses need more than one implant for support, and the fact that implant loss can make the entire structure unusable, the concept of implant interaction is crucial. Better Analysis Cluster analysis may be more robust using statistical techniques, although current data do not allow this to be done. And mandibular implantation. Prospective studies should be performed to further investigate these aspects of implant placement and prosthesis design after oral and facial reconstruction, especially in patients undergoing head and neck cancer surgery.

Conclusion

The current systematic review and meta-analysis study showed in patients Undergoing Vascularized Maxillary or Mandibular Reconstruction, Osseointegrated dental implant placement is successful technique and improve their quality of life and oral function, and should be given special attention in these patients. In cancer patients receiving radiotherapy, implant survival was higher before radiation therapy.

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