

Radiotherapy associated with higher rates of dental implant loss

Abstracted from

Chambrone L, Mandia J Jr, Shibli JA, Romito GA, Abrahao M.

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Question: Does radiation therapy to the head, for treatment of cancer, decrease the survival rate of titanium dental implants placed in non-grafted mouths?

Data sources Cochrane Oral Health Group's Trials Register, CENTRAL, Medline via PubMed and EMBASE; no restrictions on language, published before February 1st 2013.

Study selection Observational studies reporting outcomes from irradiated and non-irradiated patients were eligible for inclusion as were randomised controlled trials (RCTs) and controlled clinical trials (CCTs) assessing irradiated patients submitted to different implant-based treatment protocols.

Data extraction and synthesis Screening of titles, abstracts and full texts was by two reviewers, with disagreements resolved through discussion, consensus, or failing this by consultation with a third reviewer. Data extraction was in duplicate and attempts were made to contact authors for missing data. Risk of bias was assessed using adapted versions of the Cochrane Collaboration's tool (for RCTs and CCTs) and the Newcastle-Ottawa scale for observational studies.

Results Fifteen trials with 10,150 implants were included with 1,689 (14.3%) placed in irradiated mouths. There were 13 case series and two RCTs. three of the studies were on hyperbaric oxygen (HBO) therapy. Neither of the RCTs was rated as low risk of bias. Mean survival rates ranged from 46.3% to 98% with pooled estimates showing that implant failure was statistically significantly higher in irradiated patients compared to patients who had not undergone radiotherapy (an increase of 174%) with a risk ratio of 2.74 (95% confidence interval {CI}: 1.86, 4.05; $p < 0.00001$). In maxillary sites, the risk ratio was 5.96 (95% CI: 2.71, 13.12; $p < 0.00001$) with the risk of loss increasing to 496%. Hyperbaric oxygen therapy did not reduce the risk of implant failure showing a risk ratio of 1.28 (95% CI: 0.19, 8.82).

Conclusions Irradiation of the head was linked to increased failure rate of implants compared to failure rates in patients who had not undergone radiotherapy. The failure rate was higher in the maxilla and HBO therapy did not improve implant survival.

Commentary

As head and neck cancer incidence continues to increase,¹ practitioners are potentially more likely to encounter patients who have undergone cancer resection and subsequent reconstruction. Many of these patients are treated with a combination of surgery and radiotherapy and may have lost teeth during their journey through to recovery. This highlights the restorative problem of replacement of missing teeth in this patient population.

Due to the advances in modern dental implant technology, implant retained prostheses are an increasingly utilised treatment option for replacement of missing teeth. An important consideration in this patient cohort is the quality of their remaining alveolar bone and whether a history of radiotherapy may affect the success of dental implants.

This systematic review investigated a multi-faceted question relating to the failure of dental implants in irradiated bone, the incidence of failure in the irradiated mandible compared to the non-irradiated maxilla and the effect hyperbaric oxygen on survival of implants placed in irradiated bone.

This review was carefully constructed and had a robust criterion for inclusion, which aimed to highlight only the most appropriate studies. The authors acknowledged the level of evidence included in their study was suboptimal, with neither of the RCTs included in their study being of low risk of bias, in addition to none of the observational studies being classified as of high methodological quality.

Another limitation of this study, in relation to its implications to general practice, is the predominant type of implant design utilised. Many of the articles included assessed machined implants, whereas surface textured implants are more commonly used in modern practice due to their superior survival rate.²

Chambrone et al. also noted the failure of selected studies to note the timing or dose of the radiotherapy, patient systemic factors, occlusal factors or follow-up and maintenance protocols of the prosthesis or peri-implant tissues, which may have consequences for the clinical survival of implants.

Additionally, the outcome measure for success defined in this systematic review was implant retention after a defined period of follow-up.

Other potential complications were not assessed, which may not immediately result in the loss of dental implants, but must also be considered by practitioners when assessing the success of dental implants, for example. the presence of peri-implantitis, success of

DENTAL IMPLANTS

prosthesis, patient satisfaction, etc.

The authors of this article concluded 'radiotherapy was associated with higher rates of implant loss in the majority of individual sites, especially for the maxilla'. This may have clinical implications as practitioners involved in the planning, placement, restoration and maintenance of dental implants in patients who have undergone radiotherapy are expected to be able to discuss the potential success rates of differing treatment options.

Additionally, the authors concluded that the available literature is insufficient to determine if hyperbaric oxygen has a meaningful effect on the survival of dental implants in irradiated bone. This concurs with the findings of the Cochrane review carried out in 2013 assessing the effectiveness of hyperbaric oxygen therapy for irradiated patients undergoing placement of dental implants.³ Additionally both reviews noted the presence of only one RCT asking this question.

This systematic review of dental implants installed in irradi-

ated bone provided low quality information with regards to the potential success of implants placed in the irradiated mandible or maxilla compared to non-irradiated bone. However, the limitations discussed by the authors highlight the need for more high quality evidence in order to effect changes in modern practice.

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1. Data were provided by ISD Scotland on request, April 2012. Similar data can be found here: <http://www.isdscotland.org/Health-Topics/Cancer/Publications/index.asp>
2. Le Guéhennec L, Soueidan A, Layrolle P, Amouriq Y. Surface treatments of titanium dental implants for rapid osseointegration. *Dent Mater* 2007; 23: 844-854.
3. Esposito M, Worthington HV. Interventions for replacing missing teeth: hyperbaric oxygen therapy for irradiated patients who require dental implants. *Cochrane Database Syst Rev* 2013; 9: CD003603.

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