Dental implants installed in irradiated jaws: a systematic review
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CRD summary
The authors concluded that radiotherapy was associated with higher rates of implant loss, especially in the maxilla. Hyperbaric oxygen therapy did not improve implant survival. The authors concluded that inclusion of retrospective case series and differences between the studies (type of implant, timing and radiotherapy dose) mean the results need to be interpreted with caution. This conclusion seems appropriate.

Authors' objectives
To assess the survival rate of titanium implants placed in irradiated jaws.

Searching
MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials (CENTRAL) were searched up to February 2013. No language restrictions were applied. Search terms were reported. The search included unpublished studies. Four relevant journals and their databases were searched. Reference lists of articles were examined.

Study selection
Observational studies that reported the outcomes of irradiated versus non-irradiated patients and randomised and non-randomised trials that assessed irradiated patients submitted to different implant-based treatment protocols were eligible for inclusion. Irradiated patients had to have a titanium implant and have undergone radiation therapy to the head to treat cancer. Studies with irradiated patients who underwent bone grafting procedures were included only if they reported the outcomes from the non-grafted area separately. Studies that reported on implants placed only in grafted areas were excluded.

Studies were conducted in Europe, USA and Japan. The outcome of interest was the number and/or percentage of implants lost. Most studies used Branemark-type implants.

Two reviewers were involved in study selection. Any disagreements were resolved through discussion or involvement with the third reviewer.

Assessment of study quality
The authors assessed study quality using the Cochrane risk of bias tool (for clinical trials) and an adapted Newcastle-Ottawa Scale (for observational studies) to award a maximum possible score of 14 points. Studies with 11 to 14 points were considered high quality, 8 to 10 points were of medium quality and fewer than 8 points were considered low quality.

The authors did not state how many reviewers were involved in quality assessment.

Data extraction
Data were extracted to calculate overall percentages and risk ratios with their 95% confidence intervals. The authors did not state how many reviewers were involved in data extraction. Study authors were contacted for additional information.

Methods of synthesis
Pooled risk ratios and 95% confidence intervals were calculated using a random-effects model. Heterogeneity was assessed using the $I^2$ statistic

Results of the review
Fifteen studies were included in the review: 13 case series and two randomised controlled trials (RCTs). There were 10,150 implants including 1,689 installed in irradiated jaws. Three observational studies were considered to be medium quality and 10 were considered low quality. The two RCTs had unclear risk of bias in randomisation, allocation concealment and blinding. Follow-up ranged from 14.4 months to 15 years.
Overall mean survival rate of implant in the studies ranged from 46.3% to 98.0%. The meta-analysis showed a significant increase in the risk of implant failure in irradiated patients (RR 2.74, 95% CI 1.86 to 4.05; Ι²=0%; seven studies) and in maxillary compared to mandible sites (RR 5.96, 95% CI 2.71 to 13.12; Ι²=33%; seven studies). There was no significant difference between the two groups in the risk of implant failure rate for patients who received hyperbaric oxygen therapy (three studies).

**Authors’ conclusions**
Radiotherapy was associated with higher rates of implant loss in most individual studies, especially for implants placed in the maxilla. Hyperbaric oxygen therapy did not improve implant survival. Implant therapy appeared to be a viable treatment option for reestablishing adequate occlusion and masticatory conditions in irradiated patients.

**CRD commentary**
The review question and inclusion criteria were clear. Efforts were made to find published and unpublished studies and no language restrictions were applied, which minimised risk of publication and language biases. Attempts were made to minimise reviewer errors and bias during study selection; it was unclear whether the same applied for quality assessment and data extraction. Relevant quality assessment tools were applied; it appeared that the reliability of most studies was low or unclear. Appropriate methods were used to pool data and assess heterogeneity. The authors’ conclusions were based on heterogeneous case series studies published over a 20-year period.

The authors concluded that inclusion of retrospective case series and differences between the included studies (such as type of implant used, timing and dose of radiotherapy) mean the results need to be interpreted with caution. This conclusion seems appropriate.

**Implications of the review for practice and research**
**Practice:** The authors stated that implant therapy appeared to be a viable treatment option for re-establishing adequate masticatory conditions and a better quality of life for patients.

**Research:** The authors stated a need for prospective cohort studies and RCTs of different implant surfaces to confirm the present findings.

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