Time interval after radiotherapy and dental implant failure: systematic review of observational studies and meta-analysis
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CRD summary
For patients who had been treated for a malignant tumour of the head, neck or both, the authors concluded that placing dental implants within 12 months after the end of radiotherapy could result in a higher risk of failure. This was based on studies with low methodological quality, and largely driven by one study. The authors' cautious conclusion seems reliable.

Authors' objectives
To compare the failure rate of dental implants placed between six and 12 months after the completion of radiotherapy to the bone, with the rate for those placed longer than 12 months after it ended.

Searching
MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL), LILACS, and Scopus were searched, without language restriction, for publications up to February 2013. A full search strategy was reported. The reference lists of included studies and relevant reviews were scanned. The authors of the included studies were contacted to identify further studies.

Study selection
Following an unsuccessful search for randomised controlled trials, the authors sought any observational study or case series focusing on patients who were receiving dental implants and had undergone radiotherapy to the head or neck region, or both, due to any malignant tumour. The exposed group must have received dental implants between six and 12 months after the end of radiotherapy; the control group must have received them at least 12 months after the end of radiotherapy. The outcome of interest was the failure (success or failure) of the dental implant measured by clinical examination or radiography. Follow-up had to be at least six months.

The included studies were conducted in Europe (none in the UK), or Japan and the USA. Dental implants were placed in mandibular or maxillary bone, or grafted bone. Most patients received radiotherapy of at least 50 Grays, and some patients received hyperbaric oxygen therapy. Two studies included patients with implants placed less than six months after radiotherapy, which conflicted with the inclusion criteria.

Two reviewers independently assessed the titles and abstracts to select studies for inclusion. Disagreements were resolved by discussion.

Assessment of study quality
Study quality was assessed using a checklist of six questions suitable for the appraisal of observational studies. It appears that two reviewers independently assessed study quality, and disagreements were resolved by discussion.

Data extraction
Data were extracted to calculate relative risks, risk differences, and 95% confidence intervals. Two reviewers independently extracted these data. Disagreements were resolved by discussion. Authors were contacted for further information, where necessary.

Methods of synthesis
Summary estimates were pooled in a fixed-effect meta-analysis. The number needed to harm was calculated. Statistical heterogeneity was assessed with $X^2$ and $I^2$. Publication bias was explored in a funnel plot, and assessed with Begg’s and Egger’s tests. Sensitivity analyses explored each study's influence on the overall effect.

Results of the review
Ten studies (at least 106 patients; 1,508 implants) were included in the review. The quality assessment was limited due
to poor reporting in the included studies; most appeared to be affected by selection bias and measurement bias. Follow-up ranged from over 10 to up to 170 months.

For dental implants placed less than 12 months after radiotherapy, the risk of failure was 34% more likely than for implants placed more than 12 months after radiotherapy (RR 1.34, 95% CI 1.01 to 1.79; 10 studies; I²=21.5%). The absolute risk difference was 3.6% (95% CI -0.0 to 7.3; 10 studies; I²=36.1%) and the number needed to harm was 28; indicating that 28 implants would need to be placed in the exposed group, for one additional failure to occur, compared with control.

There was no evidence of publication bias. When the only trial with a statistically significant relative risk was removed from the analysis, the overall effect was no longer statistically significant (RR 1.08, 95% CI 0.77 to 1.52).

**Authors' conclusions**
Placing dental implants within 12 months of the end of radiotherapy could result in a higher risk of failure, but the evidence was not strong.

**CRD commentary**
The review question was clear and the inclusion criteria were specified. Relevant data sources were searched. There was no search for unpublished material, but publication bias was assessed and no evidence of it was found. There may have been too few studies for this analysis to be informative. The review was conducted with attempts to minimise error and bias.

As acknowledged by the authors, the reliability of findings is limited by the low quality of the included observational studies, and by the fact that the overall finding was driven by one study. The discussion seems to include claims about the association between radiation, dose, and additional therapies and the risk of failure that were not substantiated by this review.

The authors' cautious conclusion reflects the evidence presented and seems to be reliable.

**Implications of the review for practice and research**
**Practice:** The authors stated that clinicians should use the best evidence available and if possible, wait longer than 12 months after the end of radiotherapy before installing dental implants in patients who were treated for a malignant tumour in the head or neck region.

**Research:** The authors stated that specific clinical trials were needed to assess the risk of dental implant failure after radiotherapy, for these patients.

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