A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation. Part I: lateral approach

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CRD summary
This review concluded that insertion of dental implants in combination with maxillary sinus floor elevation was a predictable treatment method that showed high implant survival methods and low incidences of surgical complications. The best results were obtained using rough surface implants with membrane coverage of the lateral window. The reliability of these conclusions is unclear.

Authors' objectives
To assess the survival rate of grafts and implants placed with sinus floor elevation.

Searching
MEDLINE was searched from 1965 to November 2007. Search terms were reported. References of identified studies and related reviews were checked. No language restrictions were employed.

Study selection
Prospective and retrospective cohort studies of dental implant survival in combination with sinus floor elevation (mean residual bone height of up to 6mm) at the site of placement were included in the review. Studies were required to have a minimum of 10 patients and mean follow-up of at least one year. Clearly defined criteria for implant survival or success were required. Implant survival rates had to be reported. Other outcomes reported in the review were graft survival and surgical complications, which included infection. Studies that involved multiple interventions such as simultaneous ridge augmentations were excluded from the review. Studies on sinus augmentation via the transalveolar approach were excluded from the review. Studies on sinus augmentation were included in the review. Assessed procedures were first or second stage surgical interventions that used either the trap door or access hole surgical approach. Where reported, studies used antibiotic prophylaxis pre and/or post surgery. A variety of graft materials and implant types were used.

Included studies enrolled patients in the age range of 15 to 86 years. Most studies were conducted in institutional environments such as universities or specialist clinics. Assessed procedures were first or second stage surgical interventions that used either the trap door or access hole surgical approach. Where reported, studies used antibiotic prophylaxis pre and/or post surgery. A variety of graft materials and implant types were used.

Two reviewers independently assessed the studies for inclusion; disagreements were resolved through discussion.

Assessment of study quality
The authors did not state that they assessed validity, although they provided information on whether studies were prospective and the level of patient drop-out.

Data extraction
Information on complications and survival of the sinus grafts and implants on rates of outcome occurrence was independently extracted by two reviewers using a standardised form; disagreements were resolved through discussion.

Survival and failure event rates were calculated by dividing the total number of events by total implant exposure time in years. Survival was defined as implants remaining in situ at the follow-up, regardless of condition; failure was defined as implants that were lost, before or after functioning loading.

Methods of synthesis
Poisson regression was used to combine primary outcomes to give an estimated annual pooled rate of failure and estimated three-year survival rate with 95% confidence interval (CI) for implant level and patient level data. Random-effects Poisson regression was used if statistically significant heterogeneity was indicated, via Spearman's goodness of fit test. Multivariable Poisson regression was used to assess the effect of grafting material, surgical approach, implant
surfaces, membrane coverage of the lateral window, smoking status, bone availability and study design on event rates. Subgroup analyses were used to assess different implant types and patient characteristics. Mean outcome rates for secondary outcomes were calculated by dividing the numbers of failures by the total numbers of grafts; these results were presented in the context of a narrative synthesis.

Results of the review
Forty-eight studies with approximately 4,000 patients and more than 12,000 implants were included in the review. Twenty-six studies were prospective and 22 were retrospective. Seventeen studies reported levels of dropouts, which ranged from 0% to 20%. Mean follow-up was 2.8 years.

All 48 studies reported implant survival. Of 12,020 implants, 679 were lost. The pooled annual failure rate was 3.48% (95% CI 2.48% to 4.88%), which gave a three-year implant survival rate of 90.1% (95% CI 86.4% to 92.8%). Analysis at a patient level gave an annual failure rate of 6.04% (95% CI 3.87% to 9.43%) and a three-year rate of 16.6% (95% CI 10.9% to 24.6%). Results of subgroup analyses were reported.

Eighteen studies reported graft failure. Incidence ranged from 0% to 17.9%. There were 41 failures from 2,140 sinus grafts, which gave a mean failure rate of 1.9%.

The most frequent surgical complication, reported in 20 studies, was perforation of the sinus membrane. This had a prevalence range from 0% to 58.3% and a mean occurrence of 19.5%. Infection of grafted sinuses occurred rarely; 24 studies reported this with a mean incidence of 2.9% (range 0% to 7.4%). Other complications were reported to occur occasionally.

Authors' conclusions
The insertion of dental implants in combination with maxillary sinus floor elevation is a predictable treatment method showing high implant survival methods and low incidences of surgical complications. The best results were obtained using rough surface implants with membrane coverage of the lateral window.

CRD commentary
The review question and inclusion criteria were reasonably clear. The authors searched only one database, which significantly increased the chance that relevant studies were omitted from the review. The authors reported that they used methods designed to reduce reviewer bias and error in study selection and data extraction. No formal assessment of the validity of the included studies was reported, although two relevant aspects of study design and conduct were reported. The absence of a full validity assessment together with the uncontrolled design of the included studies made the reliability of the evidence unclear. The authors provided a reasonable level of detail about included studies. The method used to combine studies was generally clear. However, given the high level of heterogeneity between studies, pooling the implant results may not have been appropriate and the simple method used to pool results for graft failure and other complications did not take into account between-study variation and could be misleading.

The authors’ conclusions reflect the results of the review but their reliability is unclear.

Implications of the review for practice and research
The authors did not state any implications for practice or further research.

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