Influences of Statistical Analyses on Result Presentations of Oral Implant Treatment

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Abstract

Evaluation of oral implants involves at least three major components: statistical methods, study design and success criteria.

The aims of the current thesis were to investigate how different statistical methods affect the outcome of oral implant treatment and to statistically determine if any dependence among implants placed in the same jaw exists. If so - how would that affect the outcome and the type and amount of missing data (withdrawn patients)? Furthermore, the aims were to evaluate patient, implant and treatment characteristics to find possible prognostic factors for implant failure and to study the impact of variances with or without handling dependence using the Jackknife technique.

Four prospective multi-centre studies, involving 487 patients and 1738 implants, were pooled to create a database for these elaborations. The database was divided into subgroups based on significant different outcomes regarding implant failures. Four jaw-bone combinations (Combination I-IV) were established, and in study IV - Combinations I-III were pooled and compared with Combination IV. Statistical methods used were: life table analyses, confidence intervals, chi^2 tests, step by step multivariate analyses, post hoc analyses, log rank tests and the Jackknife technique.

The result of the current statistical investigations demonstrated that dependence among implants placed in the same jaw existed. The impact of missing data was shown to depend on, if the patients were selectively or randomly withdrawn. A random selection could reach at the most 50% without affecting the CSR. However, if the selection was based on e.g. treated jaw, the outcomes were significantly different. Patient characteristics such as jaw, jaw-bone quality, jaw-shape and combination of these factors, and also on implant length and treatment protocol, showed significant differences. Patients with jaw shape D or E and bone-quality 4 were e.g. identified with a significantly higher risk for implant failure than all of the other combinations. Both life table analyses, using CI and log rank tests, demonstrated after the variances were calculated via the Jackknife technique significantly lower success rates for Combination IV. The p-values were “inadequately” stronger, however, when using a log rank test and ignoring the established dependence.

Based on these results it was stated that, following established dependence among implants within the same jaw, this should never be ignored when evaluating oral implant outcomes. Two methods were found possible to use to handle this dependence, the “one implant per patient” or the Jackknife technique if variances are part of the evaluation. Missing data is inevitable and will affect the outcome, and therefore a description of the characteristics of withdrawn patients should be presented. Jaw-combination IV showed the lowest success rate and would therefore be the most appropriate population to use, when evaluating new improved oral implant systems in order to prove significantly different follow-up outcome.

Keywords: Statistical methods, oral implants dependence, prognostic risk factors, multivariate analysis, bone-combination, Jackknife, log rank test, variance.
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