

Estimating Survival, Like Placing Implants, Must be Done Right

An important and commonly reported outcome measure in dental implant studies is survival. Estimating implant survival is neither as simple nor as complicated as it appears. A binary approach seems simple and intuitive, ie, did the implant survive—yes or no? Using a binary analysis, one estimates survival by taking the number of implants that survived and dividing it by the total number of implants inserted. For example, during the study interval, if 100 implants were inserted and 95 survived, the survival rate would be 95%.

The flaw with binary analysis is that the survival estimate weights an implant that has survived for 5 years the same as an implant that has been in function for 1 day. Most readers would appreciate that this approach is intuitively wrong. While computationally simple, the consequence of a binary analytic approach is that it overestimates survival rates because long-term failures are diluted by the presumed success of recently inserted implants.¹

Estimating implant survival falls under the domain of survival analysis. The Kaplan-Meier method should be used to produce statistically valid estimates of implant survival.² Kaplan-Meier analysis adjusts for differences between implants in situ for varying amounts of time, eg, 5 years versus 1 day. While difficult to compute manually, most statistical software programs include Kaplan-Meier analyses. If the investigator collects data including the date of implant insertion and the date of the last visit or implant removal, one can produce a statistically valid estimate of implant survival in a matter of seconds.

To illustrate the difference between binary and Kaplan-Meier survival estimates, consider a sample of 660 patients with 2,286 implants and 125 failures. The simple binary estimate of implant success is 94.5% (2,161/2,286). However, Chuang et al³ reported a traditional Kaplan-Meier 5-year survival estimate of 91.2%.

While useful (or perhaps “appealing”) to those who market implants, estimating survival using the binary approach is as wrong as it is simple. The more accurate method to estimate survival, ie, Kaplan-Meier survival analysis, is easy to do with currently available statistical software. For this reason, when reading articles reporting survival as a binary outcome, I stop. Life is too short to spend reading poor analyses.

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