On the Use of Complexity Methods in "Personalized Periodontology and Implant Dentistry"

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Personalized Periodontology and Implant Dentistry are about finding accurate diagnostic, prognostic, preventive and therapeutic strategies in treating periodontitis patients and in restoring mutilated dentitions by using dental implants. The studies comprising this thesis used complexity methods to (i) cluster periodontitis patients of four cohorts and train and test various classifiers in distinguishing aggressive (AgP) from chronic (CP) periodontitis and (ii) cluster implant-treated patients and create prediction models of the mean peri-implant bone level.

Leukocyte and lymphocyte counts as well as IgG, IgA, IgM and cytokine levels in peripheral blood were used to discriminate efficiently AgP from CP patients by recursive partition analysis and artificial neural networks. Unsupervised learning suggested two clusters of implant-treated patients, one with healthy patients or showing minimum peri-implant bone loss, and one showing pronounced peri-implant bone loss. By an implant-based unsupervised analysis two implant "phenotypes" were identified, one with susceptibility and another with resistance to peri-implantitis. Network analysis corroborated this finding by testing the resilience of a created peri-implantitis network. With supervised learning methods individual implant mean bone levels were predicted by using the parameters number of remaining teeth, age of the patient having the implants, full mouth plaque scores, implant surface type, periodontitis severity and diabetes.

A future generalization of such models can be anticipated that might provide accurate diagnosis of AgP and CP as well as accurate prediction of peri-implant bone level changes for functioning implants and in that way guide the treatment and maintenance of periodontitis and implant-treated patients in a "precision" manner.