Development of an expert system for the simulation model for casting metal substructure of a metal-ceramic crown design

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HIGHLIGHTS

- Expert system for simulation model of metal substructure for metal-ceramic crowns design is proposed.
- Blackboard architecture and data model allowed the ES to improve the design and reduce processing time and lead-time.
- Integrated RE/CAD/CAE system has been designed for IC process in dentistry.
- Up to date, many design techniques and expert systems have been developed using artificial intelligence (AI) techniques to generate simulation model and casting process design. The expert engineering techniques, which enable the building of an interactive ES are: linear programming, non linear programming, simulated annealing, iterative redesign, parametric design template, gradient algorithm, branch and bound, heuristic rules, rule-base reasoning, case-based reasoning, meta-heuristic search, tabu search, genetic algorithm, space allocation, analogical reasoning and evolutionary design. Each technique has specific properties, which make them suitable only for particular problems. The main contribution of this paper is the development of the integrated expert system and its applications in the dentistry using blackboard architecture, rule-based reasoning and iterative redesign. The expert system is integrated with CREO Parametric (Pro/E), Zeiss Calypso, My VGL, MAGMAsoft, GOM Inspect and CAST CONTROL allows modeling and development of simulation model. The system is based on CAD/CAE/RE feature. The authors have made a significant step in the implementation of the test system in dentistry. The novel ES performs the following: CAD modeling of the simulation model for casting, modeling of gate subsystem, the CAD eligibility and cast ability check of the model, estimates and runs program code for casting machine, loading set of casting parameters, manufacturing time reduction of metal substructure. The ES allows obtaining castings derived roughness grade number N7.