

# On CAD/CAM generated fixed dental prostheses, fit and effect of ceramic veneering

Akademisk avhandling

Som för avläggande av odontologie doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligens försvaras i F-sal 3, Medicinaregatan 12 A-G, den 16/12, klockan 9.00.

av Per Svanborg

Fakultetsopponent:

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Umeå universitet, Sverige

## Avhandlingen baseras på följande delarbeten

- I. Svanborg P, Längström L, Lundh R, Bjerkestig G, Örtorp A. (2013) A 5-year retrospective study of cobalt-chromium-based fixed dental prostheses. *Int J Prosthodont* 26:343-349
- II. Svanborg P, Skjerven H, Carlsson P, Eliasson A, Karlsson S, Örtorp A. (2014) Marginal and internal fit of cobalt-chromium fixed dental prostheses generated from digital and conventional impressions. *Int J Dent* *doi*: 10.1155/2014/534382.
- III. Svanborg P, Stenport V, Eliasson A. (2015) Fit of cobalt-chromium implant frameworks before and after ceramic veneering in comparison with CNC-milled titanium frameworks. *Clinical and Experimental Dental Research*, *doi*: 10.1002/cre2.9
- IV. Svanborg P, Eliasson A, Stenport V. (2016) Additively manufactured titanium and cobalt-chromium implant frameworks: fit and effect of ceramic veneering. *Manuscript Submitted*

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## **Abstract**

Cobalt-chromium (CoCr) is extensively used as a material in fixed dental prostheses (FDPs) today, even though there are only a few clinical studies published. The manufacturing process of CoCr has changed in the last five years, from the lost wax technique to CNC-milling to additive manufacturing. Using a digital workflow from clinic to laboratory involves intraoral digital impressions. CoCr FDPs are usually not made as full-contour or full-anatomic reconstructions. They are instead designed using a cut back technique and then covered with a ceramic surface for a tooth-like appearance.

The general aims of this thesis were to study CAD/CAM production processes, material aspects on CoCr, clinical performance, and fit of tooth-, and implant-supported FDPs. A retrospective study of ceramic veneered CoCr FDPs was conducted to evaluate the performance of restorations made with the lost wax technique. One hundred forty-nine patients with 201 FDPs were followed for five years using patient records. To study CAD/CAM-techniques, the fit of CNC-milled CoCr three-unit FDPs on teeth, made using conventional and digital impression techniques, was compared. Also, the fit of CNC-milled and additively manufactured CoCr and titanium implant-supported FDPs were evaluated before and after ceramic veneering.

CoCr FDPs are a promising prosthodontic alternative to other dental alloys, presenting a low level of ceramic fractures, cement failure, caries, and other complications during the first five years in function. To evaluate their longer-term success and possible biologic adverse effects, further long-term randomized controlled studies are necessary. The digital impression technique produced FDPs with a significantly more accurate fit than conventional impressions using VPS impression material. Implant-supported frameworks can be produced in either titanium or CoCr using either CNC-milling or additive manufacturing with a fit well within the range of what is regarded as clinically acceptable. The fit of frameworks of both materials and production techniques are affected by the ceramic veneering procedure to a small extent, most likely of no clinical significance.

**Keywords:** Metal ceramic alloys, Titanium, Cobalt, Chromium, Dental Marginal Adaptation, Dental Prosthesis, CAD, CAM, Tooth-Supported, Implant-Supported, Additive Manufacturing

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