OCCLUSAL ADAPTATION BY CAD-CAM

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INTRODUCTION

The Harmonious intergration of occlusal surface of a restoration with the opposing dentition has been the object of continuous research in dentistry . As in all other techniques of prosthodontic reconstruction, the computer [1-2-3-4-5] and specially Dental CAD-CAM [6-7-8-9] must effectively contribute to establishing a functionally correct occlusion.

The purpose of this study is to analyze the possibility of the Sopha dental- CAD-CAM system to create a static and dynamic occlusal surface.

MATERIALS AND METHODS

1 -Complete thirty different crown preparations on premolar and molar have been made using maxillary and mandibular typodont models. Preparation design was follow typical clinical preparation proced

2 -Each crown , on the stone model , have been made by the Sopha dental CAD-CAD system , and the version 3.0 softwar. We take arround ten pictures of the preparation and the opposit teeth in centric position of Gnathologic occlusion , modeling the model in a imaging proceesing system, disign the crown on the CAD station , according to a specific shedule , and milling the crown in aristee and plexy-glass with the CAM .

3 -durring the process of conception , it have been made:

-pictures of the occlusal view during the optical impression.

-hard copies of the CAD sceen before and after the static occlusion adaptation in the occulsal plan

-sections with the software at the level of the centric point and along the groove.

-three values of the direction of the lateral mouvement and of the cusp angle have been test on each dsign to see the possibility of the occlusal CAD-CAM software to respect the dynamic occlusion

4 -Crown have been cimented on the preparation according the manufactured instruction , adjusted in occlusion on the opposit teeth with the bit wax and sectioned faciolingfually close to the centric points or along the groove.

RESULT

During all the the process , to have a good information of the preparation , the adjacent and the opposit teeth it has been necessary to take around 10 optical views for each crown. That mean ,for a regular process, 20 mn was used for each crown during the imaging modeling (first step).

The supperposition that we see on the imaging and the CAD view in the occlusal plan indicated that the CAD softwar respect the centric and the groove position from the interactive work of the dentist. In general case , the design of the occlusal crown is directly fonction of the position of each determinant

of the gnathologic occlusion.

The section and the mesure on the CAD sceen indicate that the space between the occlusal surface of the crown and the opposit teeth is 0 to 90 µm on the level of the centric points and 100 to 300 µm between to top of the cusp and the groove. 5 mn on the CAD station are necessary to obtain a complet and correct crown design.For each new occlusal indication (direction of the groove or cusp angle) the softwar respect exactly the infornation of the operator. It is possible to transform the ligne of the groove in 3D from the indication of the access articulator (sopha bio-concept).

With the Access Articulator, one of the most sophisticated articulator , we have propelled 10 000 points on 20 seconds . This allows us to come close to a precision of 20 µm for the traject of the cusp angle and the traject of the lateral mouvement.

DISCUSSION

the design of the crown surface respect the general occlusal concept in static position. It is possible to find a good position of the centric points , according the gnatologic view and have an usuel space between the opposite teeth and the crown.

Using the Access Articulator , the information give anough information to have the cusp angle and a good direction of the lateral groove. That mean that it is possible , with CAD CAM to obtain a respectable static and dynamique occlusal surface for general crown.

This experience has shown that , after twenty years of research and two years of experimental process in USC, the the dental CAD-CAM represents one of the first alternative in many years for our profession.But , now , It is very important for evry one to prove that in a general practice.

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Introduction

The harmonious integration of the occlusal surface of a restoration with the opposing dentition has been the object of continuous research in dentistry. As in all other techniques of prosthodontic reconstruction, the computer[1-5] and especially dental CAD-CAM[6-8] must effectively contribute to establishing a functionally correct occlusion.

The purpose of this study was to analyze the possibility of the Sopha dental CAD-CAM system to create a static and dynamic occlusal surface.

Materials and Method

Thirty complete crown preparations having different margin configurations were made on maxillary and mandibular typodont models. All preparations opposed intact teeth and followed typical clinical designs. Crown preparations were reproduced in stone models and images were made using the Sopha CAD-CAM imaging system, version 3.0 software. Approximately 10 pictures were made of the preparation and a wax occlusal registration of the opposing teeth in centric occlusion. The images were made on the image processing system and the crown designed on the CAD station according to a specific schedule. Theoretical dynamic data (horizontal condylar inclination and laterotrusive angle) were provided to simulate occlusal movements. A gnathologic occlusal design was used. The crown was milled using Aristée composite resin material or Plexiglas using the CAM station.

During the conception process pictures of the occlusal view using the optical impression were made. Hard copies were printed of the CAD screen

before and after the static occlusion modification of the occlusal view. Sections were made with the software at the level of the centric point along the occlusal groove. Three values of the direction of the lateral movement and cusp angle were tested on each design to evaluate the ability of the occlusal CAD-CAM software to respect the information for dynamic occlusion. Crowns were luted to stone models of the preparations using polycarboxylate cement following manufacturer's instructions. The crowns were positioned in occlusion to the opposing teeth using the wax registration and sectioned faciolingually close to the centric contact points or along the groove.

Results

The superimposition on the imaging and CAD view of the occlusal surface indicated that the CAD software conformed to the dentists interactive instructions concerning the centric position and the position of the occlusal grooves for the tripodized cusp placement.

The section and measurement on the CAD screen indicated that the space between the occlusal surface of the crown and the opposite teeth ranged between 0 and 90 μm at the level of the centric points and 100 - 300 μm between the tip of the cusp and the opposing fossa. The software followed the instructions of the operator, three dimensionally transforming the line of the groove from the dynamic information provided.

Discussion

Ten optical views of the adjacent and opposing teeth for each crown required approximately 20 minutes for the first step, imaging. A complete and correct occlusal design consumed approximately five

minutes.

The design of the coronal surface respected the general occlusal concept in the static position. It is possible to develop a good position of the centric contacts, according to the gnathologic view of tripodized occlusion, for the placement the of the cusp, and using data for dynamic movement, to develop a cusp angle and groove direction that are in harmony with lateral mandibular movement.

Dynamic data for mandibular movement can be provided by the Access articulator mandibular motion recording system (Sopha Bioconcept). The Access recording system can develop 10,000 points of mandibular motion in 20 seconds. A precision of 20 μm for determination of the cusp angle and trajectory of lateral movement can be determined. The Access articulator provides sufficient information to develop the cusp angle and ridge and groove direction for development of a harmonious dynamic occlusion. This gives the possibility of obtaining not only static occlusal accuracy, such as was determined in this study, as well as dynamic accuracy.

The information gained from this study has shown that after 20 years of research and 2 years of experimental process in USC, the dental CAD-CAM represents one of the first alternatives in many years for our profession. Now it is very important for everyone to prove this in general practice.

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