Evaluation of Marginal Adaptation of Fix Partial Prosthesis to Polymeric Abutments

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The present study evaluates the marginal adaptation of fixed partial prosthesis made from resin composite. The main goal is to obtain restorations with excellent aesthetics and extremely high quality which increase the lifetime of the prosthesis system - dental structures. The method allowed the observation of defects that might occur during the technological processing, as well as their correction. It was used the 3D Shape software with which have been achieved scans for the virtual presentation the marginal adaptation. Following the investigation it was showed, that the cementation is extremely important, the errors occurring in this phase are influencing of the final results and behaviour. Composite resin fixed partial prosthesis are restorations which through a correct technology can compete with the ceramic fixed partial dentures.

Keywords: aesthetic restoration, marginal adaptation, defects, 3D Shape software

Fixed polymeric prosthetic restorations must satisfy a number of objectives, namely: to protect the dental pulp, to ensure dimensional measure and the stability of the inferior floor, to ensure smooth occlusal function, to allow the correct hygiene, it should not irritate the marginal periodontium, sufficient strength, retention and good aesthetics.

When it is desired to obtain a prosthetic restoration of the highest quality, not only the stability and the aesthetic restructuring matter, but also the long-term success of a prosthetic restoration depends on the influence of materials on biological tissues of the dental system.

Among the effects on the dental tissues restored is included the formation of secondary caries at the level of the subgingival crown as well as the periodontal damage in the region [1]. Only after understanding the importance of the marginal adaptation, it can be assured the superior quality of the prosthetic restoration. A final ideal marginal adaptation is when there is no visible empty or palpable space on the edge of the crown.

As an accepted limit for marginal adaptation of metal crowns and bridges, are specified certain values of the individual authors, for example 20μm or 50μm, 100μm is a gap [2]. These marginal inaccuracies can not be perceived only with the visual inspection but with the tip of the probe [3]. The numerous studies have shown that such a gap, can be easily achieved by the molded golden crowns, therefore, the polymer systems, should measure this value [4]. The sense of touch of the examiner and the probes used are responsible for the differences in the evaluation of marginal compatibility.

Holmes classifies different possible forms of the marginal adaptation, and concludes that they have lot of versions until the deadline, so that the marginal gap exists. He holds up an opinion based on the marginal sealing "the absolute marginal discrepancy meaning the removal of the margin of the crown". Margin of a crown is represented by a niche of retention, with a width of discrepancy of the cement from 0 to an over contouring, from clinical point of view acceptable [5].

In conducting the study appeared problems related to the choice of the points and the measurement methods in order to achieve the compatibility with the other studies.

The layer of the cement which is placed on the restoration is also very important, forming a thermal isolation layer destined to protect the pulp. The layer of the cement is, however, supported by a minimum thickness of 20μm, a certain thickness of space, so that the marginal gap of an perfect covering crown will enjoy an ideal increase. There must be measured the film thickness of the cement, to avoid being useless expanded (fig.1). Not at least, the crucial for the success of a prosthetic restoration is the permanent sealing of the marginal difference by the the cement [6].

For example, the glass ionomer cements have a much lower solubility than the zinc phosphate, the cement that already existed for 100 years.

They also act by releasing the fluoride from the microorganisms. There are cements that allow the adhesive cementation of crowns and bridges. Bonding the cement to the dentin can be achieved by offering a fraction of the power of obligations compared to fusion. The plaque formation on the composite surfaces is a disadvantage of the cements [7].

Fig.1. Horizontal section: Visualizing the cement layer

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Experimental part

Material and methods

For the study were realized a number of 14 all polymeric prosthetic restorations. After introducing the model into the *3Shape D700 Scanner* (fig.5) and fixing it on the existing table, it was carried on with the model scanning. The program requires the patient data and information about the restoration that is desired to be realized. With the help of the scanning software 3 Shape dental Manager, it was realized an initial scan of the whole model. On this initial scan is selected the area of interest, where follows to achieve the future fix partial denture.

After scanning the model was carried on to the design of the future prosthetic parts. In the software of the *3Shape Dental Manager design* were loaded from the hard disk the images of the virtual model. The software allows us to choose the modality to mark the limit of the cervical area. If the software does not limit or underline the correct line of the cervical area, it allows us its manual correction then establishing the necessary space for the fixing cement. The software detects if the connectors do not have a suitable size and draws our attention to the areas where there is increased risk fracture. At the end the fixed partial denture design is saved on the hard disk. With the help of the software, there were achieved measurements related tot the virtual abutment and the virtual prosthetic restoration. The realized prosthetic restorations were sectioned to validate the obtained measurements on the model.

Results and discussions

For the marginal area has been obtained acceptable average value. The higher values than in other studies are because the measurements were made on bridges. The slight expanses in the interdental area show in this case a negative result in the column area (fig.2). Beside this, the bridges were not made by the dental technician in the laboratory but of producers which do not have a routine with these devices. For technical reasons there has not been analyzed circular the marginal area, only the proximal area. A large part of information has been lost because of the destructive grinding. Some of the works that are concerned with the research of single crowns measures the marginal adaptation directly under the electronic microscope. An advantage of this method is the possibility of having sampling points the whole marginal surface of the crown. It has to be analyzed the proximal area of the body of the bridge. The cemented bridge on the abutment should be cut into the area of the bridge of the body. This maneuver might detach the abutments.

Fig.2. Horizontal section: Visualizing the adaptation of the cement on the abutment A, B.

Fig.3. Horizontal section: Observation the minuses of the cement and the wall thickness of the polymeric restoration A

The advantage of this method is the possibility to be able to measure the area of the cement inside. This gives a differentiated picture of the adaptation of the crown. As disadvantage we have the difficulty to achieve the limited measurement points in the marginal area. Ideally, would be a combination of the two methods through which vestibular and lateral areas of the bridge are checked in the marginal are of the preparation . Based on the internal adaptation, the width and the uniformity gap of the internal cement between the tooth root and the restoration are subject to examination. The gap from the continuous and uniform cement layer is necessary to ensure a sufficient mechanical strength [8]. The bridge maintenance on the crowns prepared at the same time is beneficial to obtain a good release of cement. Using a paint Hub to adjust the gap of the cement would be necessary in order to bring to a volume of the cement secure insured.

An improvement of the software so that the PR machines are suitable exactly according to the rules of preparation for the optimum system processing, can be particularly made in vivo, an exact observance of the ideal form of preparation, is not always accessible.

It has been observed the adaptation of the integrated polymeric infrastructure at the dental abutment. The infrastructures were sectioned horizontally and vertically by using an abrasive paper. All of them had the role to visualize the adaptation of the crowns on the abutment: the thickness of the cement, highlighting the minuses of the cement layer (fig.3).

The real images of the models analyzed were different from the virtual images achieved by using the *3D Shape scanner program*, because the program perfectly sectioned horizontally at the same level, while in reality they could not achieve the cutting area at the same level because of the abutment height and it was necessary to cut the abutments.

In the scanning by sections with the help of the *3D Shape program* the scanned model presented abutments much more than the real model.

The sectioning line of the real models has a flatter trajectory to distal provided that at the virtual models the sectioning line is perfectly straight. In this case the reality differs from the virtual, the thickness of the layer of the cement varying from one section to another (fig.4). Because of areas free of cement there can occur

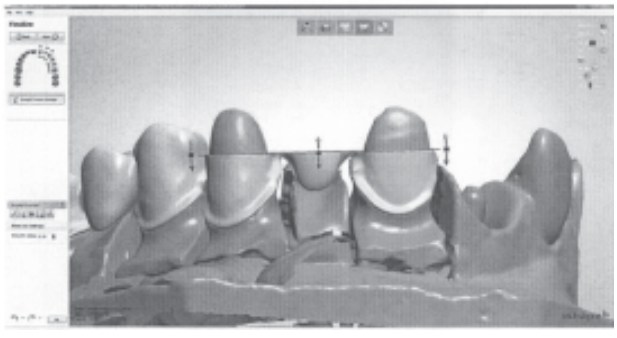

Fig.4. The virtual horizontally section of the frontal norm

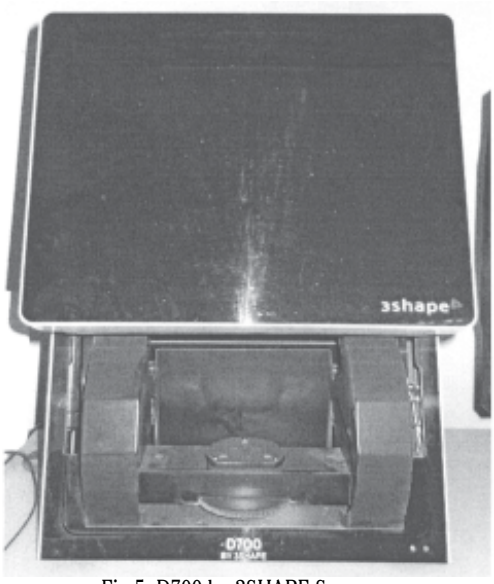

Fig 5. D700 by 3SHAPE Scanner

differences of the marginal adaptation due to unfinished proximal area of the wax layout.

Conclusions

For long-term success of prosthetic restorations it is very important, that beside the stability, contacts on the occlusal and proximal areas to exist also in the marginal area. An ideal edge of the preparation can not be held because of the passage between the tooth and the preparation. Therefore, an area of 50-100μm cement is acceptable. Numerous studies are dealing with the adaptation of the single crown preparations, while the bridges adaptation have been neglected. The bridges adaptation compared to that of the single-tooth preparation is more complex and extremely important.

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