FGP Friction Fit System used in Telescopic Technique of Removable Partial Dentures

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The objective of the study was to evaluate the FGP friction fit system as alternative to other procedures for double-crown systems. FGP is a resin material that has a coefficient of friction more favourable than the metal, so it provides minimal wear and long lifetime, high patient comfort, eliminates complicated adjustments tensions arising due to metal to metal framework friction at multiple items.

Keywords: FGP, resin, coefficient of friction

The retentive elements which can be used for the retention of removable partial dentures are very different. Almost all of these systems consist of two main parts used to connect teeth to removable dentures. The primary component is fixed on the tooth and the secondary component is integrated as part of the removable denture. The systems are different regarding material combination and the retentive mechanism used for denture retention [1- 3].

The loss of retention forces over the time and functional loads are the main problems of retention system. The change in time is caused by tribological processes affecting the surface structures of the components [1, 4, 5]. Methods to improve the retention of telescopic crowns are available. However, information about their efficiency is limited [6].

Regarding double crown systems as retentive elements, different techniques can be considered. Gold electro-forming systems are known as high cost procedures that can be accessed by few people. Other possibilities which contribute to improve the retention between the components are the friction of metal to metal, thermoforming system USIG and FGP resin friction fit system.

Because of the cleaning ability, denture retention, extensibility after abutment loss and patient satisfaction also show good results, the interest in the double crown system increases more and more. The technique using cast secondary parts shows the advantage of a long term experience as the system is well known concerning survival, maintenance and patient satisfaction. However, RPDs using the cone crown telescopic system require complicated laboratory processes and high accuracy, and it is difficult to control the retentive force [7]. Although the retentive force required making a denture sufficiently stable, functional, and satisfactory for the patient has not been elucidated. The retentive force of each individual tooth for the cone crown telescopic system has been suggested to be 5 to 9 N. Many factors influence the retentive force, including: tapered angle, height of conical crown, thickness of the outer crowns, inner crown form, alloy used for crowns, gap width in the occlusal region between inner and outer crowns, and surface roughness of cone crowns [7-9].

The parallelism or convergence of external surfaces may be from 0° to 6°. Cylindrical telescopic crowns are characterized by perfect parallelization of the exterior walls of the primary crown and retention of the RPD to the abutments by friction between the primary and secondary crown. Practice has shown that an absolute parallelism of the primary crowns can not be achieved.

This telescoping system has several disadvantages such as: requiring perfect fit of the secondary crowns to the primary crowns; at the fixing of the primary crowns, removing of the PD from the prosthetic field is almost impossible; difficulty at the insertion of the RPD (to eliminate this inconvenience primary crown can be beveled or tapered occlusal). If the friction force between the two components of the system is greater than the force required for disinsertion, periodontal lesions may occur in the abutments. Making this type of telescopic crowns require advanced technical facilities; it is difficult to achieve optimal friction and to obtain a set of the RPD. A good retention at the same time and the possibility to remove the denture from the prosthetic field is almost technically impossible. Due to the frictional principle of this type of telescope, more wear material than for other types of telescopic crowns should be considered.

Conical telescopic crowns appeared as a result of the multitude disadvantages presented by telescoping cylinder. The advantages of these are well-defined force retention, reduced wear the surfaces of the two telescopic parts and an insertion / disinsertion easy for the patient. Material wear is greatly reduced because of the conical shape removes the friction phenomenon between vertical walls of the crowns, which is reached only in the final position.

Currently electroforming is the technology that makes it possible to obtain precise prosthetic parts. The main advantage of electroformed retaining elements derives from the fact that the provided retention do not rely on friction. Physical substrate adhesion retention is occurring between the surfaces of the two crowns, mediated by the interposed salivary film. Such bonding is possible only when the adaptation of the primary and secondary element is very intimate and the space between the two components is very small, the thickness is uniform and on the order of microns. This can be achieved by electroforming of the secondary crowns, either directly on the primary or on a duplicate.

USIG thermoformed plastic friction generating coping out of special plastic for the telescope technique is another

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possibility to achieve friction between the components. The advantages are:

-provides an effective friction;

-introducing extremely comfortable and efficient use by the patient and technician;

-by simple processing the friction can be at any time optimized;

-low costs for materials;

-effective time management;

-the simplest thermoforming manufacturing technique using Erkoform device.

This simple system with telescopes provides an accurate and effective friction area with a firm fit. Also it allows insertions and a good biocompatibility without complications.

Friktions-Geschiebe-Passung - FGP offers the dentist and dental technician a completely new perspective, by solving the friction of all products of telescope metal prostheses. Long life and short time processing of FGP make a comfortable solution for a patient that provides safety and quality. The FGP Bredent provides optimum and individualized friction by new manufacturing of metallic frameworks on telescopes.

The advantages include:

-saves time by a quick and easy manufacturing;

-a reasonable resolution of individual friction;

-secondary parties do not require attention;

-long life;

-comfortable to wear;

-the possibility of one piece casting at a reasonable price;

-the work can be carried in the mouth;

-almost no wear.

The principle of the material FGP is that the metal joints used up to now in the telescopic system have been replaced by heterogem joints of metal and plastic. The advantage of the joints between the metal and plastic is much lower coefficient of friction than for metal ones. The results are greater wearing comfort and a longer life.

Experimental part

Materials and methods

A maxillary cast with a Kennedy class II with one modification was used as experimental model (fig. 1). The teeth 1.6, 1.3, 2.3 and 2.4 were prepared to receive double crowns in order to retain the removable partial denture. The prepared teeth were used to achieve different types of friction systems on each tooth: with FGP, electroplating, USIG and classical.

Classical laboratory procedures to obtain the primary crowns were used: surveyor analysis – defining the path of insertion, modeling using Adapta system (fig. 2) and special milling wax. The wax milling of the primary crowns were made with the milling machine Orthoflex – Pi Dental (fig. 3). The wax-ups were sprued and prepared for investing (fig. 4) with BellaStar XL and Begosol K.

The other laboratory steps were: preheating, melting-casting, blasting the investment material. The obtained cast crowns were milled from coarse to ultra-fine and finished. The primary crowns were fixed to a transfer key using Pattern Resin LS (fig. 4).

One secondary crown was kept as such, one was achieved with galvanoforming using GAMMAT® free (fig. 5), another by thermoforming - USIG system, the FGP resin was inserted in one secondary crown after the secondary part is finished.

The sheet for carrying out the secondary component using USIG method is a standard sheet with a thickness of 0.5 mm which is heated to a temperature of 160°C by

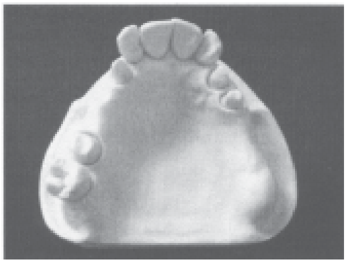

Fig.1. Maxillary working cast with die preparations

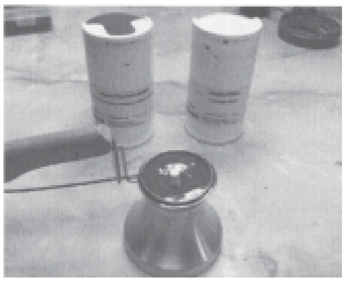

Fig. 2. Achieving of the wax-up using Adapta system

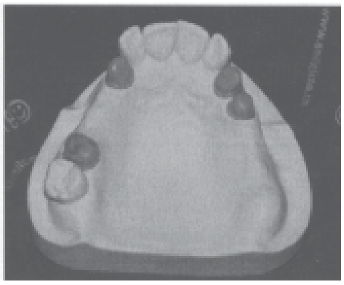

Fig. 3.Wax-up of the milled primary crowns

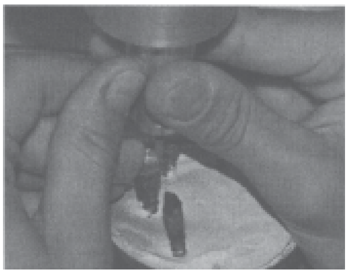

Fig. 4. Milling of the cast primary crowns

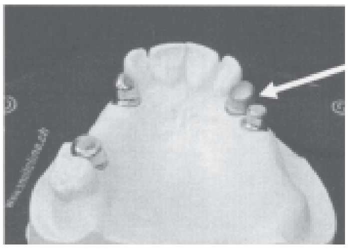

Fig. 5. Galvanoformed secondary crown

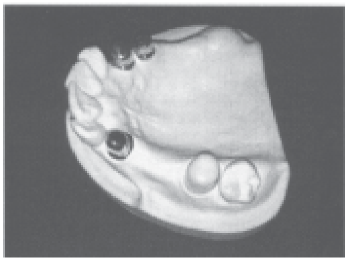

Fig. 6. Usig thermoformed plastic sheet on the die

means of the device 3D Erkoform and adapted to the die (fig. 6).

The following step is block-out of the model with special wax Biotec Blocking Out Wax – Bredent, underlining the saddle with preparation wax and preparing for duplicating.

The galvanoformed sheet, USIG sheet were isolated and a space of 1mm was created on the die where the resin FGP will be introduced in order to make an intimate contact with the framework (fig. 7). The model was duplicated using Interduplicast – Interdent silicone (fig. 8).

The duplicating model was achieved using Wirofine – Bego (fig. 9) and prepared for wax-up of the secondary

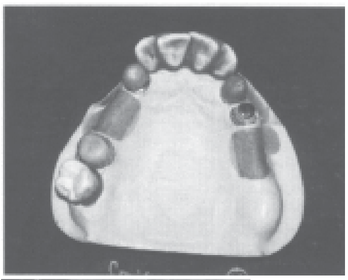

Fig. 7. Model prepared for duplicating

Fig. 8. Casting the duplicating silicone

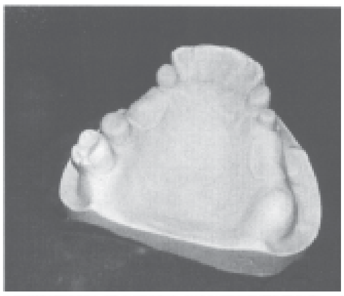

Fig. 9. Duplicating model

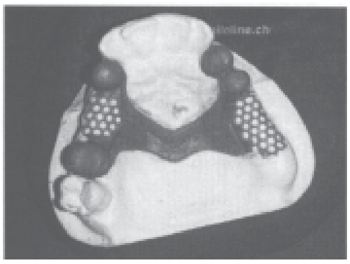

Fig. 10. Wax-up of the secondary framework.

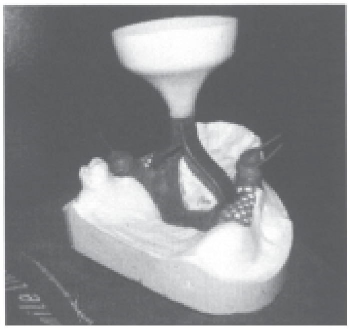

Fig. 11. Wax-up sprued for investing.

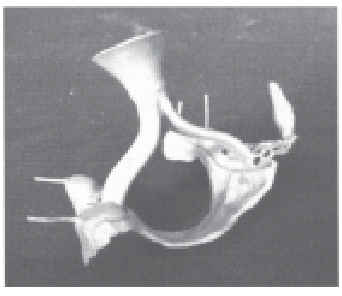

Fig. 12. Secondary framework after sandblasting.

framework (fig. 10).The wax-up was sprued for investing (fig. 11), invested and the framework was casted (fig. 12) and finished (fig. 13).

Results and discussions

Telescopic crowns are subject to natural wear due to the frequent insertion and removal during time. As friction declines, the removable denture loses her retention. The

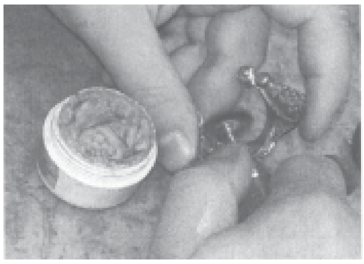

Fig. 13. Finishing of the secondary framework

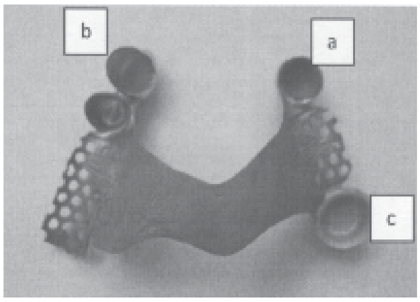

Fig. 14. 4 types of telescopic systems: a. classic, b. galvanoforming, c. FGP.

adjustment of the friction is often very complicated. The FGP friction fit system is a viable option.

In this study achieving of telescopic crowns using FGP system was made comparative with the classical method, obtaining friction metal to metal, the Gold electroforming and USIG thermoforming (fig. 14).

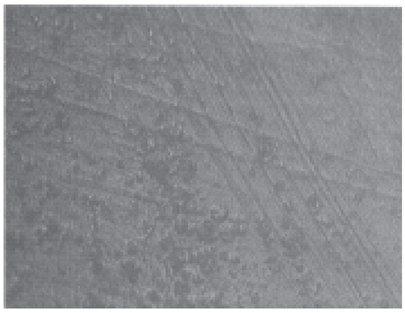

Fig. 15. Metallographic microscopic image of the cast crown surface

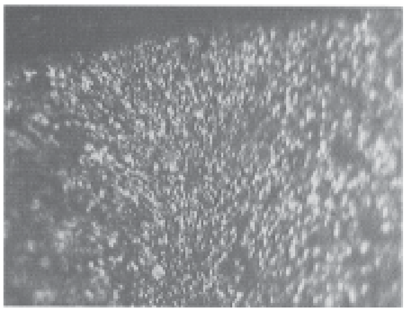

Fig. 16. Metallographic microscopic image of the galvanoformed crown surface.

The surfaces were analyzed metallographic (fig. 15-18).

Processing of metal surfaces are always uneven, with small geodes occurred after blasting, which do not disappear even after polishing. At galvanoformed systems an increase of the roughness is observable, which makes the surfaces in contact to become more retentive. Compared to these, FGP provides matching smooth surfaces. This “low cost” telescopic system seems to impose in practice because of the ease of handling, processing and especially because of the optimization possibility of the denture retention through a new application. The resin confers such a degree of resilience favourable for telescopic systems. In time, smooth or rough surfaces seem to be not of major importance because the retention decreases anyway. As such, systems that can restore retention, fast and cheap seem to impose.

Double-crown-retained removable dental prosthesis might be a viable treatment option for patients with a reduced dentition [10]. Different studies evaluated FGP friction varnish (FGP Friction-Fit-System), SD friction

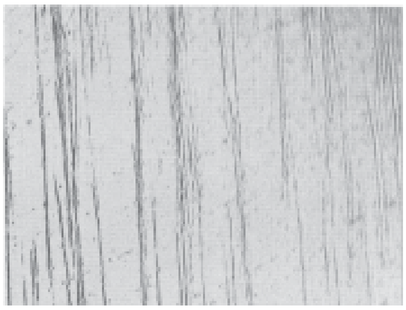

Fig. 17. Metallographic microscopic image of the FGP surface

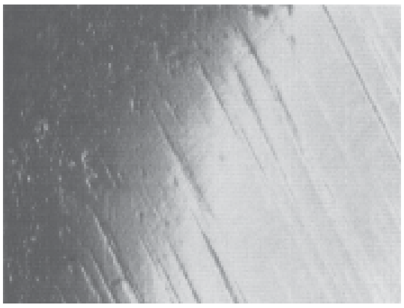

Fig. 18. Metallographic microscopic image of the FGP/metal joint surface

varnish (Servo-dental), and an electroforming method (GES\Gold Electroforming System) applied to the specimens. Group FGP showed the maximum retention values. Group EF showed higher retention values than group SD [6].

The magnitude of static and slide friction forces depends on the strain within the contact area and properties of materials employed. Friction force value between telescope elements declines in the first phase of wearing period and, subsequently, maintains particular constant value of 8 to 10 N. In the telescopic technique, homo and heterogenic joints are used [12]. Different studies indicate that an exclusive analysis of the force is not sufficient as the integral is not equivalent to the force although it describes the retentive property of the system in a better way than the force over a distance is described. The electroplated system showed a higher level of retention force than the cast specimens. Both systems seem to be suitable in clinical practice [1]. Other studies showed that survival differences between the two study groups did not reach statistical significance [11].

Conclusions

Within the limitations of this study it can be stated that all the double crown systems are suitable in clinical practice. Regarding the FGP system it can be easy used, can be associated with different materials, resulting heterogenic joints, and therefore can be even considered a social solution for the improvement of the retention between the primary and secondary crown.

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