How to cite this article: Matsumoto W, Antunes RPA, Fernandes RM, Orsi IA, Hotta TH. Shell tray impression: a technique modification. J Dent Pub H. 2018;9(1):8-16.

Original article

Journals BAHIANA
SCHOOL OF MEDICINE AND PUBLIC HEALTH

Shell tray impression: a technique modification

Moldagem com casquete: uma variação na técnica

Wilson Matsumoto[1], Rossana Pereira de Almeida Antunes[2], Regina Maura Fernandes[3], Iara Augusta Orsi[4], Takami Hirono Hotta[5]

[1]Associate Professor, Dental School of Ribeirão Preto, Dental Materials and Prosthodontic Department. wmatsumoto@forp.usp.br
[2]Associate Professor, University of São Paulo, Dental School of Ribeirão Preto, Dental Materials and Prosthodontic Department. rpaa@forp.usp.br
[3]Associate Professor, University of São Paulo, Dental School of Ribeirão Preto, Dental Materials and Prosthodontic Department. refernandes@forp.usp.br
[4]Associate Professor, University of São Paulo, Dental School of Ribeirão Preto, Dental Materials and Prosthodontic Department. iaraorsi@forp.usp.br
[5]Corresponding Author - Associate Professor, University of São Paulo, Dental School of Ribeirão Preto, Dental Materials and Prosthodontic Department. takamihotta@forp.usp.br

Resumo | Introdução: A obtenção de um modelo de trabalho preciso em prótese parcial fixa é fundamental para se atingir o sucesso e está relacionada, principalmente, às técnicas e material de moldagem. Há várias técnicas para obtenção do modelo de trabalho e troquéis para confecção de prótese parcial fixa, dentre elas está a técnica do casquete. **Objetivo:** Este trabalho tem o objetivo de apresentar uma variação na técnica de reembasamento do casquete confeccionado previamente com resina acrílica convencional. **Material e Métodos:** Nesta técnica, o casquete é completamente preenchido com resina acrílica (Duralay) em uma única mistura, a qual é manuseada até a fase plástica e então, o conjunto casquete/resina duralay é inserido no dente preparado para copiar a linha de término do preparo. **Resultados:** A vantagem é que a fase plástica da resina acrílica possui baixa quantidade de monômero livre e adequada consistência para promover o afastamento gengival provocando desconforto mínimo ao paciente e possui adequada consistência para promover o afastamento gengival. Não é necessária a troquelização do modelo. **Conclusão:** Conclui-se que essa variação técnica tem aplicação clínica simples e eficaz e produz troquéis de gesso muito precisos.

Palavras-chave: Materiais para moldagem odontológica; prótese parcial fixa; técnica de moldagem odontológica

Abstract | Introduction: Obtaining an accurate working cast for a fixed partial denture is fundamental in achieving a successful restoration and is dependent on the impression materials and dental impression techniques. To fabricate a fixed partial denture, several impression techniques are used to obtain working casts or stone dies; one of them is the shell technique. **Objective:** The objective of the present study was to demonstrate a variation of the relining technique of the early-made acrylic resin shell. **Methods and materials:** In this technique, the shell was filled with a single mixture of acrylic resin (e.g., Duralay) that was manipulated until it reached a dough-like stage. The shell/resin set was then placed on the prepared tooth to copy the finish lines. **Results:** During the dough-like stage, the acrylic resin had a low quantity of free monomers, provoked minimal discomfort for the patient, and had adequate consistency for promoting gingival retraction. **Conclusion:** The results showed that clinical application of this technical variation is simple and effective and produces a highly precise stone die.

Keywords: Dental impression materials; fixed partial denture; dental impression technique.

Submitted 02/09/2017, Accepted 02/26/2018, Published 03/05/2018
J Dent Pub H, Salvador, 2018 March;9(1):8-16

Introduction

The success of prosthetic restorations depends on, among other factors, the fabrication of an accurate working cast. Hence, impression materials and techniques are among the relevant factors associated with the success of an oral rehabilitation, as evidenced by a number of scientific articles on the subject[1-5]. To make an impression, a space must be created between the prepared tooth and marginal gingiva to expose the preparation so as to allow the insertion of the impression material to copy the finish line of the preparation[2,4].

Generally, in dental practice, the choice of a technique or impression material is based on the ease of performing the procedure, cost/benefit/time factor, and final result of the technique.

The shell tray impression technique has advantages such as good reproduction of the preparation, less trauma to the gingival tissues[3], low requirement of materials, low cost, and ease of clinical work[1].

The objective of this study was to demonstrate a variation of the relining technique of the acrylic shell tray and propose isolated removal of this shell tray after impression with elastomeric material to obtain the stone die.

Methodology

This technique was performed in 5 steps: 1 - shell tray fabrication with acrylic resin using a stone cast, temporary crowns, or prepared tooth directly in the patient's mouth; 2 - relining the shell tray with an accurate acrylic resin (Duralay, Reliance Dental Manufacturing, Worth, IL, USA); 3 - elastomeric impression; 4 - impression removal; and 5 - die fabrication.

Acrylic resin shell tray fabrication

The self-cured acrylic resin (Jet Classic – Brazil) was manipulated in a dappen bowl using a number 7 spatula. A roll was made with this acrylic resin and applied on the prepared tooth, which had been previously moistened with water to prevent resin adhesion. The manipulated resin was made to cover the prepared tooth along its long axis to allow the operator to hold the shell tray. The resin was removed from the mouth and placed in a container with water until polymerization was complete.

External and internal shell tray preparation

The excess acrylic resin was removed, leaving the external surfaces straight, except for the buccal surface of the shell tray, which must have a depression to aid identification of the buccal surface to facilitate the adjustment and impression procedures. The shell tray was repositioned on the prepared tooth to verify its fit (Figure 1). The internal surface of the shell tray was relieved using a tungsten carbide bur in its long axis, and then the bur was tilted toward the margin, creating an adequate space for the relining with acrylic resin (Duralay). The shell tray fit was verified on the prepared tooth (Figure 2).

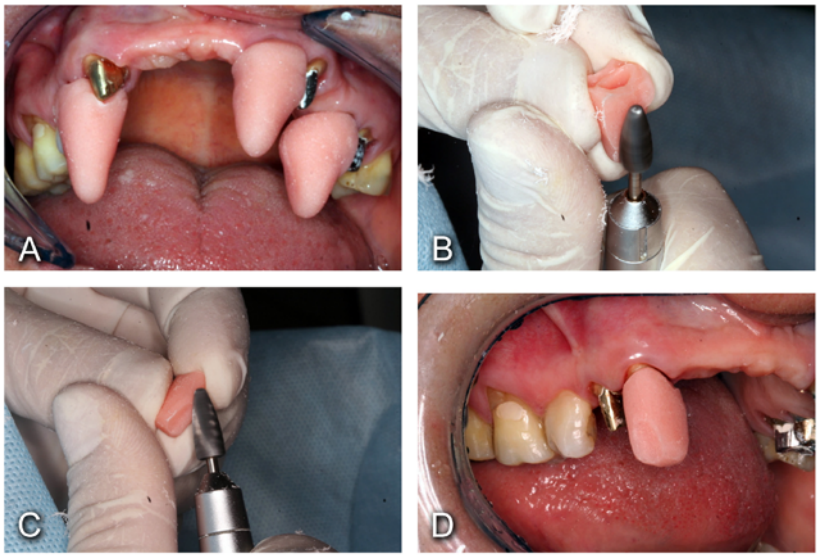

Figure 1. (A) Acrylic shell tray preparation, (B) external shell tray preparation in a tooth long axis, (C) marking on the buccal surface of the shell, (D) shell tray fit over the preparation.

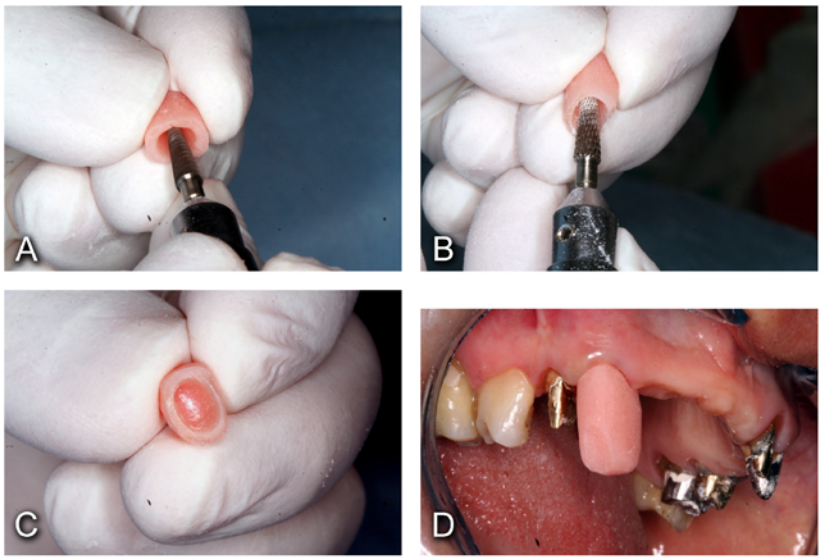

Figure 2. (A) Internal relief of shell tray, (B) relief of internal and lateral walls, (C) inner aspect of shell after internal relief, (D) shell tray fit on the preparation.

Acrylic resin manipulation and the variation of the shell tray relining technique

We ensured the acrylic resin was correctly manipulated according to the manufacturer instructions in order to obtain a resin with uniform consistency. At the beginning of the stringy stage, the resin, which had a brilliant surface, was placed inside the shell beyond the edges. Next, the shell tray-Duralay set was immersed in water, and the resin placed in the shell was manipulated until it reached the dough-like stage with no release of resin fibrils (Figure 3); then, it was applied to the prepared tooth. Shell tray insertion was performed in many steps with the compression of the excess resin against the gingival crevice. In the first step, the shell tray was positioned on the middle third of the prepared tooth by following the long axis, and the excess resin was manually compressed into the gingival crevice and proximal surfaces using a number 7 spatula. In the second step, the shell tray was pushed against the prepared tooth with rotational movements, and the excess resin was again compressed into the gingival crevice until it fitted in the preparation (Figure 4). After the resin had reached the rubbery stage, the shell tray was removed from the tooth and immersed in cold water. Further, we checked if there was penetration of the resin into the gingival crevice to

ensure the resin reached beyond the finish line of the preparation, forming a tapered margin. When the edge is round, the impression is inadequate. When performing this procedure, we took care to remove the gingival tissue on the edge of the preparation, using retraction cord or a scapel, to facilitate the penetration of resin in the gingival sulcus.

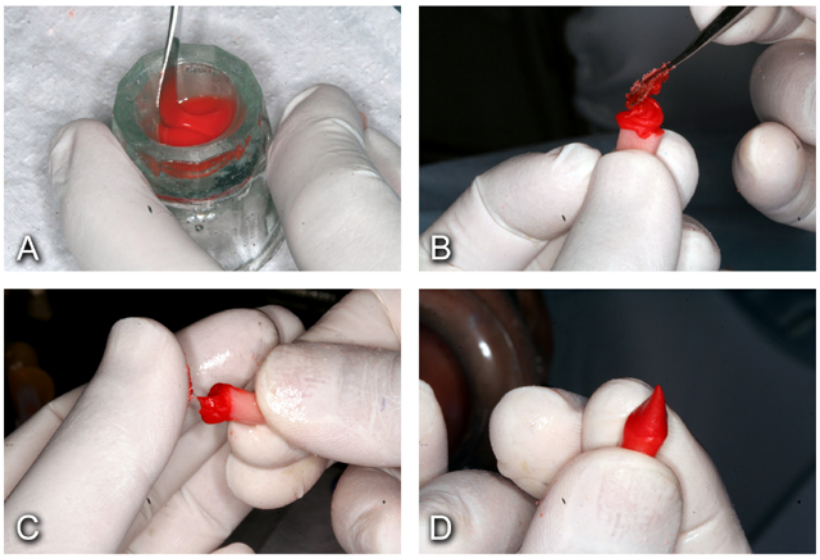

Figure 3. (A) Resin manipulation, (B) Inserting the resin inside the shell, (C) manual verification of the resin's dough-like stage, (D) Shell with the Duralay resin ready for relining.

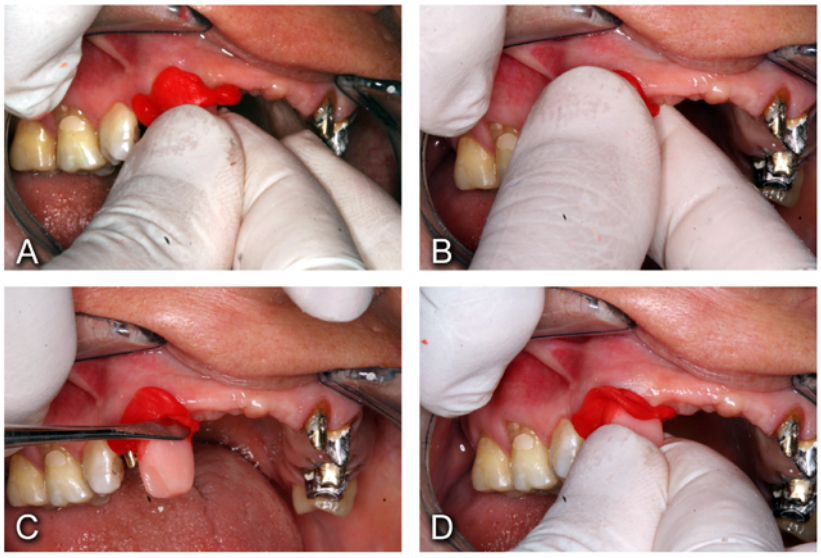

Figure 4. (A) Initial insertion of the shell-Duralay resin set on the preparation, (B) manual adaptation of the Duralay resin on the preparation finish line (C) resin adaptation on proximal surfaces, (D) final insertion with rotational movement.

Shell tray relief

The tungsten carbide bur was positioned on the external surface of the shell tray in the long axis of the preparation; any excess resin was removed leaving the sharp edge (Figure 5).

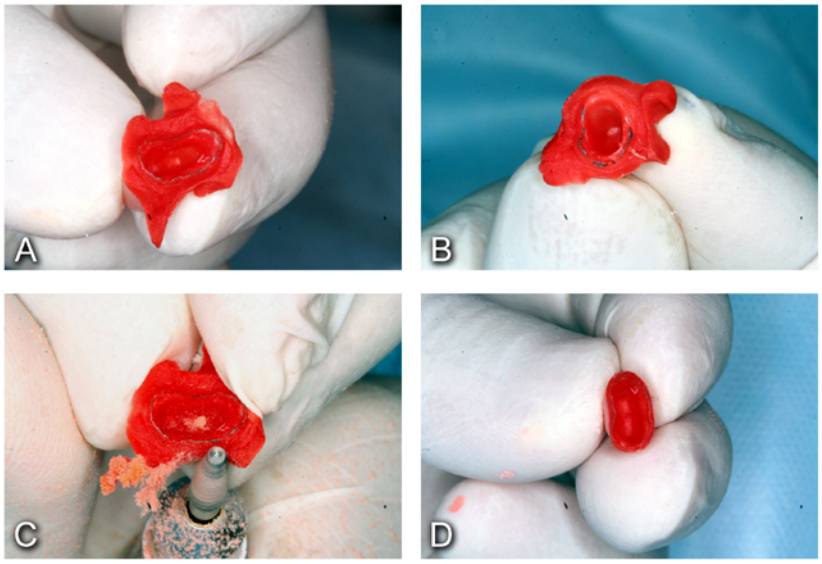

Figure 5. (A) Relined shell tray showing the continuity of the finish line, (B) relined shell tray showing the discontinuity of the finish line, (C) external wear of resin excess, (D) external edges after excess wear

The internal relief was created using a spherical bur #6 or #8; it was used the total diameter of the bur at the occlusal or incisal portion and half diameter of the bur at the lateral or axial walls, without interfering with the sharp edge of the shell tray. The final internal aspect of the shell tray was checked to ensure there was adequate space for the impression material (Figure 6).

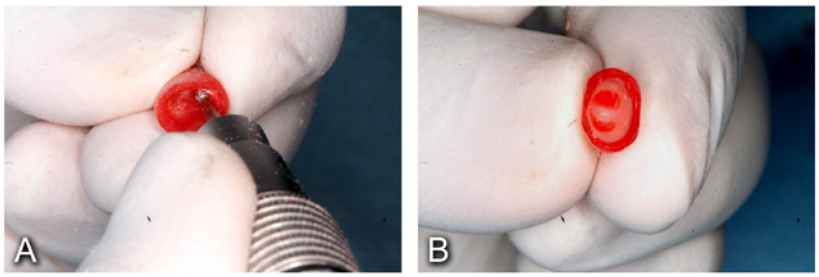

Figure 6. (A) Shell tray internal relief, (B) shell tray internal view with the space for the impression material

Verifying the shell tray fit is important; it should not lock on the prepared tooth. If the shell tray locks on the prepared tooth, this means that there is excessive resin at the sharp edge that must be removed internally or by shortening the edge.

Impression using polyether

A polyether adhesive was applied on the external edges and inside the shell tray, and the adhesive was allowed to dry. The base and catalyst pastes (Impregum, 3M Espe, MN, USA) were homogeneously mixed, and the impression material was inserted inside the shell tray gradually to prevent air bubble formation (Figure 7). The area where an impression is required was dried, and then the shell tray with the impression material was positioned on the prepared tooth, moved backward, and returned on the tooth. Then, it was sustained in position under light pressure, and the impression material was allowed to polymerize (Figure 8). After the time recommended by the manufacturer passed, the polymerized impression material was removed, and the quality of the impression was analyzed (Figure 9).

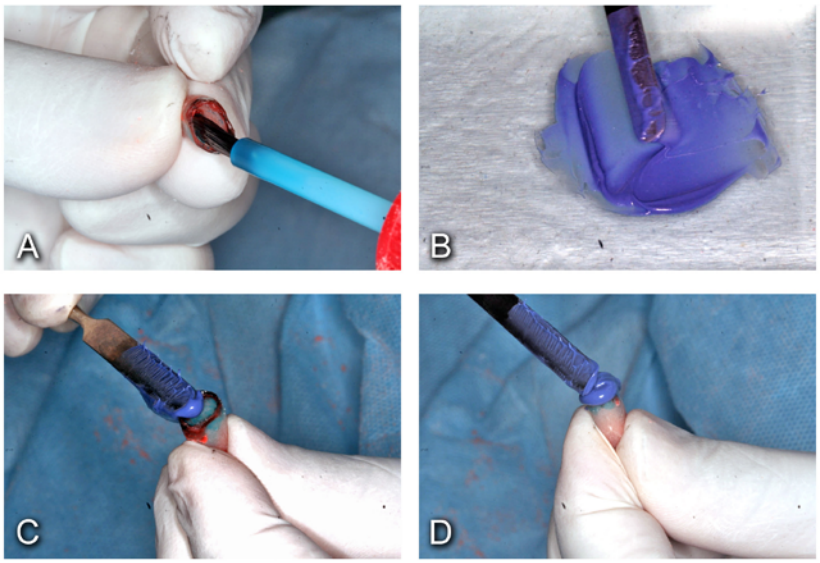

Figure 7. (A) Adhesive application at internal and external surfaces, (B) impression material manipulation, (C) start of careful insertion of impression material in order to avoid air bubbles, (D) completed filling of the shell tray.

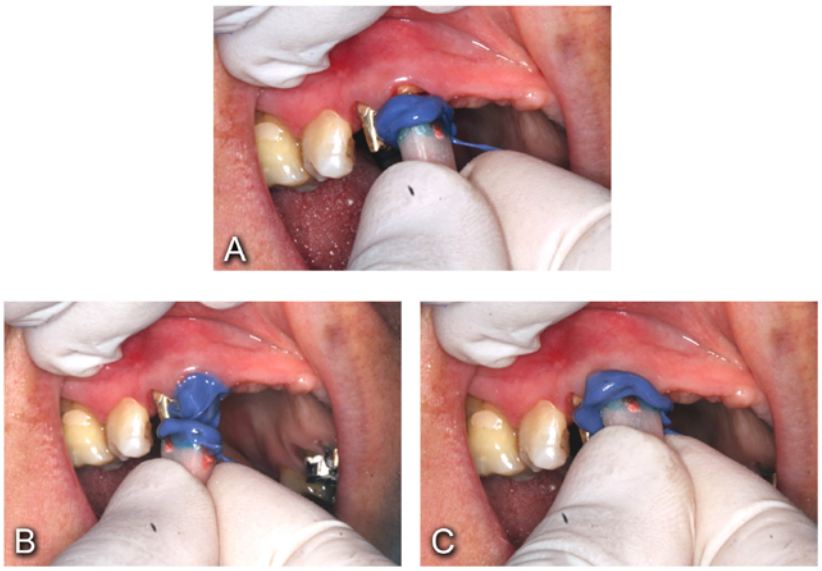

Figure 8. (A) Partial insertion of the shell tray/impression material set on the preparation, (B) displacement of the shell tray/impression material set of the preparation, (C) final and complete insertion of the shell tray/impression material set.

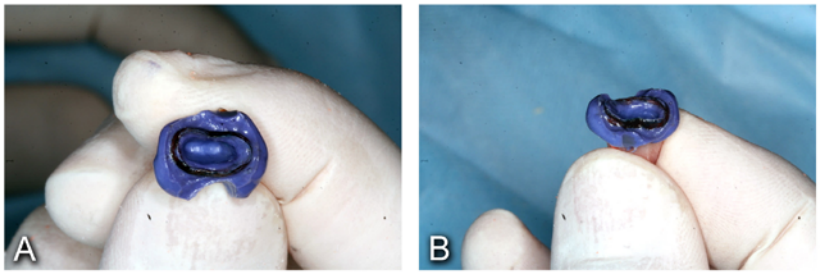

Figura 9. (A) Inside view of the impression, (B) lateral view of the impression

Stone die fabrication

The shell tray and the impression material were wrapped using a number 7 wax before filling with type 4 stone (Durone, Dentsply, PA, USA) (Figure 10).

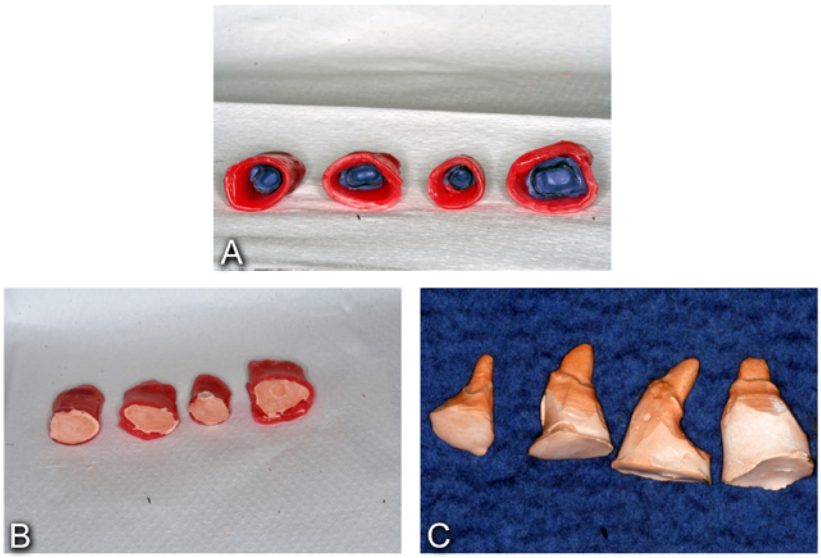

Figure 10. (A) Preparation for acquisition of stone die using wax #7, (B) modeling with type 4 gypsum, (C) direct acquisition of individual stone dies

Impression of the complete arch with alginate or elastomeric impression material

The impression of the complete arch with tooth preparations was performed to obtain a solid cast with the correct relationship between the prepared teeth and the adjacent and opposing teeth.

Discussion

The choice of gingival displacement technique that is minimally harmful to the periodontium should be considered as a crucial step in the process of obtaining a working cast; this is because injuries of the sulcus epithelium can induce gingival retraction and compromise the esthetics. Different materials and techniques have been shown to have different advantages and disadvantages in studies on gingival displacement[2,5,6,10-12]; the shell tray technique is considered to be more effective and less traumatic than others[13,14] because the acrylic resin is applied to the prepared tooth in a stage when its consistence does not damage the gingival tissues.

This work detailed the procedures in shell tray fabrication, relining, impression, and stone die fabrication with the objective of emphasizing the care and variations necessary to produce accurate clinical and laboratory results.

The shell tray was made directly in the mouth on the prepared tooth; this is a simple and fast approach that can be executed in the waiting periods i.e. during extra buccal polymerization of the resin added as relining the temporary restorations. In addition, this approach is better than the two other techniques because it does not require a stone cast and immediately produces an adequate shell tray size that is not limited to the size of temporary crown.

The internal relief produced by using rounded burs #6 or #8 at the occlusal (full-diameter bur) and side walls (half-diameter bur) of the shell tray creates a sufficient homogeneous space for the impression material to maintain its properties and volume necessary to allow for pressing of the soft tissues and penetration into the gingival crevice. In addition to preventing an increase in pressure within the gingival sulcus, an excessive relief can make it difficult to maintain the shell tray position during the

impression procedures. The excessive relief may also allow different amounts of impression material inside the shell tray, which can interfere with the accuracy of the stone die.

Relining by adding the Duralay resin with the brush technique uses the resin at different consistencies and polymerization stages, and this can interfere with the decision of the ideal time for the application of the resin in the mouth. In addition, it can make gingival displacement difficult. Notably, the addition of the resin by using this technique provides different amounts of free monomers that may harm the soft tissues[15,16] and the tooth. This does not occur in the newly proposed technique because care must be taken to manipulate a single portion of the Duralay resin, insert it inside the shell tray, wait for it to reach the dough-like stage, and then apply it on the prepared tooth to copy the finish line of the preparation.

When using this technique variation, the amount and the dough-like stage of the Duralay resin produce the optimal volume and consistency for gingival displacement with less damage to the gingival tissue due to minimal amount of free residual monomer, in addition to facilitating the positional stability of the shell tray during the relining procedures, confidence to determine the correct moment to insert the shell tray and resin to the prepared tooth, manual compression of the resin excess at the preparation finish line and differentiated relining based on the homogeneity provided by the insertion of resin at a single stage. After the relining procedure, the shell tray must be removed from the mouth prior to the final polymerization of the acrylic resin to avoid the consequences of its exothermic reaction and the possibility of the shell tray to adhere to the prepared tooth.

Another factor incorporated into the newly proposed technique is the use of an individual die that is associated with a rigid complete-arch stone cast without the use of removable die-cast, which is more difficult to manufacture. In addition performing an impression by arresting the shell tray does not allow the verification of the accuracy of the shell tray impression, returning the shell tray impression on the complete-arch impression can cause distortion and the die adaptation in the cast is not always precise due sawing.

For both the die-cast model and individual die, the technician makes the prosthesis in parts, that is, not in one-piece, which would be desirable. Fabrication in parts requires an extra appointment for soldering the parts. However, because obtaining the die-cast model is more complex (requiring use of a die pin, parallel placement, pin fixing, etc.), the individual die technique is an attractive option; it also allows impressions to be performed in different appointments, which is not possible with the die-cast model.

Conclusion

This technique variation can facilitate shell tray relining by using a resin in a homogeneous phase with an adequate consistency which promotes mechanical gingival displacement. In addition, this technique provides an impression that maintains the gingival position, preserves periodontal health, and facilitates complete reproduction of the preparation finish line.

Conflict of interest

Authors of this manuscript do not have any financial interest or affiliations with institutions, organizations, or companies relevant to the manuscript.

References

1. de Sá ATG, de Freitas CA, de Sá FC, Ursi WJS, Simões TC, de Freitas MFA. Effect of cervical relining of acrylic resin copings on the accuracy of stone dies obtained using a polyether impression material. J Appl Oral Sci. 2008;16(1):7-11.

2. Ribeiro JGR, Costa AMM, Junqueira Neto JFA, Segalla JCM, Perez F. Alternative technique for gingival displacement and impression with individual custom tray. Rev Odontol UNESP. 2005; 34(4):179-183.

3. Alves MC, Soares CR, Zani IM. Estabilidade dimensional dos moldes de poliéter e polissulfeto obtidos com a técnica do casquete de acrílico, vazados em gesso pedra especial tipo IV e V. Revista Odonto Ciência. 2005; 20(48): 120-125.

4. Pegoraro LF, Valle AL, Araújo CRP, Bonfante G, Conti PCR, Bonachela V. Prótese Fixa. São Paulo: Artes Médicas: EAP-APCD, 2004. (Série EAP-APCD; Vol.7)

5. Hoffman JM. Nontraumatic final impressions for fixed partial dentures. J Prosthodont. 1992;1(1):61-64.

6. Nishioka RS, Duarte CA, Carvalho YR, Nakae K, Bottino MA. Afastamento gengival: estudo histológico comparativo em cães, entre a eletrocirurgia e o uso do fio de algodão embebido em cloreto de zinco e em cloreto de alumínio. Rev Odontol UNESP. 1999;28(2):239-250.

7. Cannistraci GJ. A new approach to impression taking for crown and bridge. Dent Clin North Am. 1965;29:33-42.

8. Dimashkieh MR, Morgano SM. A procedure for making fixed prosthodontics impressions with the use of preformed crown shells. J Prosthet Dent. 1995;73(1):95-6.

9. Spyrides GM, Spyrides SMM, Ferreira ABC, Ferreira EC. Moldagem com casquete de resina/elastômero: método alternativo e simplificado para obtenção do casquete acrílico. Rev Bras Odontol. 1998;55(3):160-164.

10. Stungis TE, Fink JN. Hypersensitivity to acrylic resin. J Prosthet Dent. 1969;22(4):425-428.

11. Hochman N, Zalkind M. Hypersensitivity to methyl methacrylate: mode of treatment. J Prosthet Dent. 1997;77(1):93-96.