

IMPRESSION TECHNIQUE / TISSUE RETRACTION COMBINATIONS: EFFECT ON MARGINAL INTEGRITY OF FIXED PROSTHESIS

SAMAR ABDUL REHMAN AL-SALEH, BDS, MSc

ABSTRACT

The purpose of this study was to clinically assess the precision of margins reproduction using some impression techniques following application of different retraction materials.

A PVS impression material with different viscosities and an injectable tissue retraction material were chosen to make impression using two impression techniques. Traditional retraction cord was used as a control. A number of patients requiring fixed prostheses were selected and a total of twenty impressions were obtained following tissue retraction with special trays. Impressions were made using different combinations of two impression techniques and two retraction materials, which resulted in four groups of five each. Margin integrity was evaluated subjectively with naked eyes and X10 stereomicroscope by three clinicians, according to an ordinal scale from 1-3 depending on the presence of emergence profile on the circumference of the margins (COM) of the prepared teeth.

It was found, generally, that recorded margins did not differ significantly with variation. It can be concluded that using different combinations of tissue retraction materials and impression techniques show no significant clinical differences from each other.

Key words: *Tissue retraction materials, impression techniques, monophasic impression, Expasyl.*

INTRODUCTION

Full-coverage preparations often require subgingival margins because of caries, existing restorations, esthetics demands, or the need for additional retention.¹ The gingival tissues must be displaced to obtain adequate access to the prepared tooth to expose all necessary surfaces, both prepared and not prepared.^{1,2}

Recording the shape of the tooth surface below the margin will help the technician to create a normal emergence profiles which will help in preventing an over contoured restoration.^{3,4}

The tissue displacement should be sufficient to allow impression material to be injected into the expanded gingival crevice. For the elastomeric impression materials, the crevice needs to open to 0.2-0.3 mm to allow accurate detailed reproduction.^{3,5}

The different processes of gingival retraction fall into three categories, depending on the nature of the

action used to achieve the sulcular opening. Those are mechanical, chemico-mechanical and surgical techniques. The mechanical widening achieved by inserting a dry cord, or a copper tube, or a ring-collar between the cervical margins of the tooth and the free gingiva, or by using temporary prosthesis that is oversized at the cervical level to permit a lateral displacement of tissue. The chemico-mechanical widening can be achieved by using a combination of the mechanical effect obtained through the placement in situ of a cord, and the vasoconstrictor, hemostatic and astringent effect of a chemical agent in which the cord is dipped prior to insertion. While surgical widening obtained by removing a superficial layer of the crevicular epithelium by means of electrosurgery with a surgical knife or a rotary curettage, or a CO₂ laser.^{2,3 6-8}

Among the mentioned techniques, the chemo-mechanical technique of retraction using impregnated cord is the most widely used.⁹Injectable materials into gingival sulcus were introduced lately as an alternative

Lecturer, Department of Prosthetic Dental Science, College of Dentistry, King Saud University, Riyadh, Saudi Arabia

Correspondence: Dr. Samar Al-Saleh at: samar_nice@yahoo.com

method of the traditional chemo-mechanical technique. Expasyl is a representative of those new materials that can produce displacement of the sulcus, when applied before impression recording. It was initially described by P Lesage, a French dental surgeon, and it was launched in 1999 by the Pierre Rolland laboratory. The technique of Expasyl combines the mechanical effect of the paste placed in the sulcus with the astringent chemical effect of some compounds of its ingredients such as aluminum chloride.³ The physical and mechanical properties of the current available polyvinyl siloxane silicone impression materials have sufficient inherited accuracy and stability to produce high quality restoration.³ Impression technique is a much bigger factor in determining success or failure in indirect work than the material differences. One technique often used is the heavy /light System. In this one-step technique, the heavy tray material and the light syringe material are mixed simultaneously. The syringe material is injected around the prepared tooth, and then the tray loaded with the heavy body is inserted into the mouth.^{3,10,11}

To overcome problems associated with using two different viscosities such as using two mixing guns and any conflict between the viscosities, a monophasic impression technique with medium viscosity was suggested.^{3,11} Even though the medium body impression material can achieve the international standard for dental elastomeric impression materials of reproducing a line of 0.02 mm in width⁴, the flow of this material into the gingival crevice may be limited.³ Considering the fact that, the impression technique/ tissue retraction combinations affect the accurate reproduction of margins details; the purpose of this study was to clinically assess precision margins reproduction using two different impression techniques following the application of two different retraction materials.

MATERIALS AND METHODS

In this study, the patients were randomly selected from those attending King Saud University College of Dentistry, and screened for treatment with fixed prosthesis. Those patients needed complete coverage single crowns with subgingival margins for one or more posterior teeth due to different prosthetic reasons were chosen. Only teeth with good periodontal health were selected. The depths of gingival sulcuses were less than 3mm, no bleeding upon probing, no sign of inflammation and there were adequate width of attached gingiva. Twenty teeth with the above mentioned criteria were prepared to receive a full coverage crown with subgingival margin (0.5mm deep). A provisional crown with adequate margin was made for each tooth. The final impressions were taken for each prepared tooth with sectional custom try at least 3 days

after finalizing the preparation. The twenty prepared teeth were divided into two sets, each of ten teeth, according to the tissue retraction material used. The materials used in this study were listed in Table 1. In the 1st set the traditional double cord technique with astringent were used to achieve gingival retraction. In this technique two cords size 00 were used. The first one was introduced gently in the gingival sulcus around the prepared tooth. Then the second cord was impregnated with astringent and the cord is squeezed by gauze and applied gently in the gingival sulcus of the prepared tooth. After 7 min. the second cord were removed slowly and the final impression were made according to the protocol that will be discussed later. In the 2nd set of prepared teeth, Expasyl material was used to retract the gingival tissue. This material consists of a blend of kaolin (China clay) with astringent aluminum chloride; it is presented in cartridges with a dedicated syringe and disposable wide pore delivery tubes.

At the time of final impression making, the thick, putty-like material was injected into the gingival crevice. After 5 min. it was removed by water spray. The preparation was dried and impression material then flowed into the gingival crevice.

Each set was subdivided into two groups of 5 teeth, according to the impression technique applied which will form four tested groups (I, II, III, and IV). A flow chart summarizing the experimental protocol is shown in figure 1. One PVS impression material (Table 1) with different viscosities (monophasic and light body) was used for final impression making. One group of the impression, of each set, was made using the simultaneous technique (multiple viscosities /one-step). In this technique the medium body (monophasic) and the light body impression materials were mixed at the same time. The light body was injected around the prepared tooth in the gingival crevice after removal of the retraction material while the tray was loaded with the medium body and then inserted. After 6 min. the tray were removed and the impression were examined (group I & III). The other group of impression was made using the monophasic technique (single viscosity /one-step). The monophasic material was injected in the gingival crevice after removal of the retraction material while the same material was loaded in the tray, then it was inserted. After 6 min the tray was removed (group II & IV).

All impressions were washed, disinfected and assessed by three operators with different clinical experience. Subjective evaluation of the margin integrity was done with naked eyes and at a magnification of X10 with a stereomicroscope (Bausch and Lomb, scientific optical products Division, Rochester, N.Y). Margin

integrity was evaluated according to an ordinal scale from 1-3 as follows: Scale 1: presence of emergence profile, the replica of unprepared tooth surface beyond the finish line¹² (figure 2), on 100% of circumference of margins (COM), scale 2: presence of emergence profile on <100%- 75% of COM and scale 3: presence of emergence profile on <75%- 50% of COM.

The final scale was determined following the principle of majority. The presented scale in the results was selected by two examiners at least. Non para-metric analysis of variance, Mann-Whitney test was used for statistical comparison of results for significance at alpha level of <0.05.

RESULTS

The frequencies of the three scale categories for each tested group are presented in Table 2. The data showed no significant difference between the tested groups (Table 3). The presence of the emergence profile in tested group IV (Expasyl and monophasic impression) was less than other tested groups, but that difference was not statistically significant.

TABLE 1: TISSUE RETRACTION MATERIALS AND IMPRESSIONS USED IN THIS STUDY.

Materials	Manufacture
Tissue management kit: retraction cord & astringent (Ferric Sulfate)	Ultradent
Expasyl	Pierre Rolland lab, France
Virtual impression monophasic	Ivoclar, Vivadent, Inc. USA
Virtual impression light body	Ivoclar, Vivadent, Inc. USA

TABLE 2: THE FREQUENCIES OF THE THREE SCALE CATEGORIES FOR THE FOUR TESTED GROUPS

Ordinal scale	Scale 1	Scale 2	Scale 3
Tested Groups			
Group I	4 (80%)	1 (20%)	0
Group II	4 (80%)	1 (20%)	0

No statistical difference between the tested groups at alpha level of < 0.05 of significance.

TABLE 3 :NON PARA-METRIC ANALYSIS OF VARIANCE

Statistical Tests	Tested Groups			
	Group I	Group II	Group III	Group IV
Mann-Whitney U	12.5	12.5	12.5	10.5
Wilcoxon W	27.5	27.5	27.5	25.0
Asymp Sig	1.00	1.00	0.51	1.00

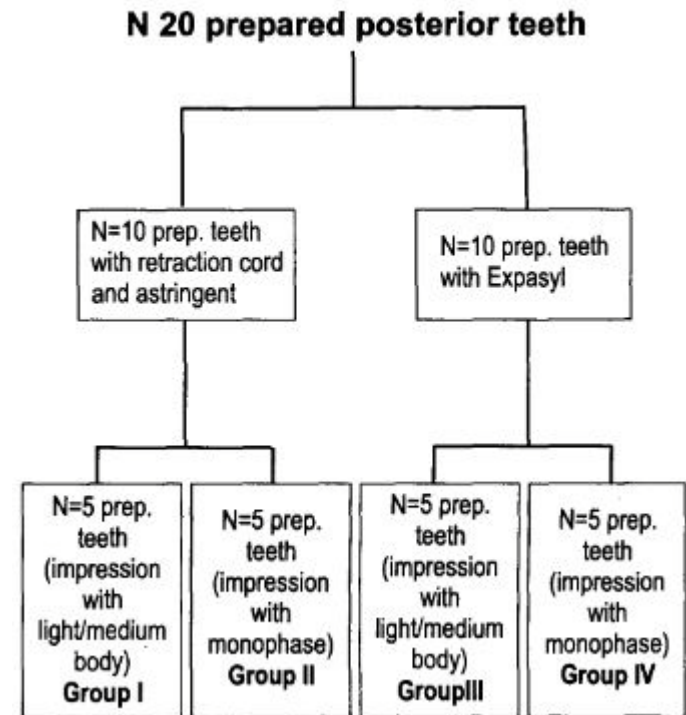


Fig 1. Design of the experiment

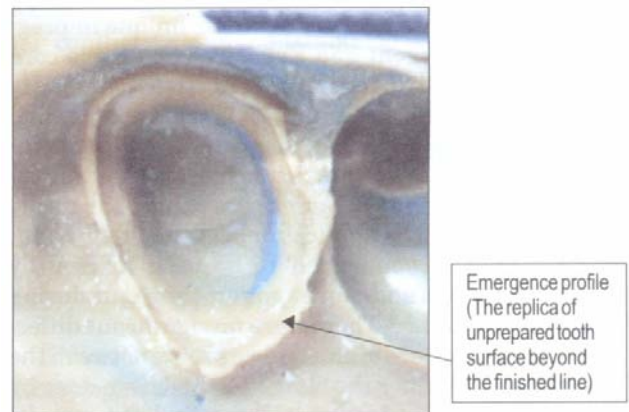


Fig 2. The emergence profile in the final impression of a prepared posterior tooth.

DISCUSSION

Polyvinyl siloxane impression materials are supplied in number of viscosities ranging from very low viscosity to very high viscosity putty materials. The viscosity of impression materials increases with the increase of fillers' amount and its distribution.^{4,11} Viscosity is also affected by the shear force placed on the material.¹¹ The optimum method of impression making is to use as little low-viscosity material as possible to capture the fine details of the prepared tooth and the bulk of the impression should be made with high-viscosity material.^{10,11,13} The usage of monophase (medium body) impression materials avoid the need for a double mix and gives the advantage of improved surface wetting.¹³

To avoid the undesirable effect of the try space on the accuracy of monophase impression material, a special custom try was used in this study.¹⁴ The effect of the increased viscosity of the medium body on the ability of the material to flow into gingival crevice was controversial.^{3,4,13,15} In clinical situation, after impression making, the final step is the visual inspection of the impression. In the present study, the presence of emergence profile was assessed visually and under the microscope. The presence of emergence profile in the impressions with monophase impression material was not statistically differing from those with light / medium body impression material. This agrees with the articles reported that, the flow of the medium body impression material in the gingival crevice is suitable⁴ and the actual differences in accuracy between the medium body and the two viscosity impression techniques are likely not clinically significant." The condition of the gingival tissue of the selected teeth in this study, were healthy and the margins were placed 0.5 mm apical to the gingival margin. These factors may provide good environment for the impression materials to flow in the enlarged sulcuses." The gingival retraction, in the present study, was done using chemomechanical technique, double cord technique impregnated with astringent and Expasyl. The double cord technique with astringent is very effective technique to obtain enough retraction but, it is time consuming. Introducing of alternative chemo-mechanical methods, ex. Expasyl, to retract the tissue, give the advantages of decreasing the trauma, the pain to the tissue and less time for the application. On the other hand, this material recommended to be used in healthy gingival condition and cannot protect the tissue during teeth preparation.^{3,12} There were no significant differences in the presence of emergence profile between the tested groups (with the retraction had been done by the double cord or Expasyl). These findings may be explained on the basis of the good tissue status of the prepared teeth and the relatively shallow depth of the

margins. In addition, the impressions were made for single prepared teeth, were the results maybe affected if the impressions made for multiple teeth preparations.

Within the limitations of this study, it can be concluded that using different combination of two different materials of tissue retraction (double cord with astringent and Expasyl) and two impression techniques (monophase and light /medium body) showed no significant clinical differences from each other.

ACKNOWLEDGMENT

The author would like to express special thanks to Professor Salaw Khier for her valuable advice, support and encouragement . I also express my appreciation to Dr. Nazeer Khan for his valuable help with the statistical analysis.

REFERENCES

- 1 Weir D, Williams B. Clinical effectiveness of mechanical - chemical tissue displacement methods. *J Prosthet Dent* 1984; 51 : 326 — 329
- 2 Rosenstiel S, Land M, Fujimoto J. Contemporary fixed prosthodontics. 2nd edition 1995 by Mosby — year book. Missouri.
- 3 Stewardson D. Trends in indirect dentistry: 5. Impression Material and Techniques. *Dental updates* 2005; Sept : 374 — 393.
- 4 Mandikos M . Polyvinyl Siloxane impression materials. An update on clinical use. *Aust Dent J* 1998; 43: 428 — 434.
- 5 Laufer B, Baharav H, Cardash H. The linear accuracy of impression and stone dies as affected by the thickness of the impression margin. *Int J Prosthodont* 1994;7: 247-252.
- 6 Nemetz H, Donovan T, Landesman H. Exposing the gingival margin: A systematic approach for the control of hemorrhage. *J Prosthet Dent* 1984; 51: 647 — 651.
- 7 Shillinburg H, Hoho S, whitsett L, Jacobi R, Brackett S. Fundamentals of Fixed prosthodontics, 3rd edition 1997 by Quintessence Publishing Co. Inc.
- 8 Benson B, Bomberg T, Hatch R, Hoffman w. Tissue displacement methods in fixed prosthodontics. *J Prosthet Dent* 1986; 55:175-181.
- 9 Bowles W, Tardy S, Vahadi A: Evaluation of new gingival retraction agents. *J Dent Res* 1991; 70:1447 — 1449
- 10 Chee W, Donovan T. Polyvinyl Siloxane impression materials: A review of properties and techniques. *J Prosthet Dent* 1992; 68 : 728 — 732.
- 11 Donovan T, Chee W. A review of contemporary impression materials and techniques. *Dent Clin N Am* 2004; 48: 445-470.
- 12 Cranham J. Tips from the lab: Predictable impressioning. *Dental Equipment & Materials* 2003; May/June: 46-48. (URL: www.kerrdental.com).
- 13 Millar B, Dunne S, Robinson P. In vitro study of the number of surface defects in monophase and two-phase addition silicone impressions. *J Prosthet Dent* 1998; 80:32-35.
- 14 Emes W, Sieweke J, Wallace, Rogers L. Elastomeric impression materials; effect of bulk on accuracy. *J Prosthet Dent* 1979; 41:304-302.
- 15 Council on dental materials, instruments, and equipment: Vinyl polysiloxane impression materials: a status report. *JADA* 1990; 120:595-596.