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Comparative study on the efficacy of gingival retraction using Retraction cord and Expasyl paste in implant patients *In-vivo* study

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Abstract

Introduction: The precise reproduction of the abutment (implant) provides clinician with crucial clinical information of the relative position and orientation of the implant to other implants, teeth and soft tissue that allow them to fabricate exact- fitting, bio-integrated restoration. For that it is necessary to expose, access & isolate the implant region, especially when cement retained implant prosthesis are in consideration, where conventional crown and bridge impression and optical impression technique is used. Material and Method: Patient who accepted to participate were chosen for the study. Coincidentally all 15 patients were female. They were explained the purpose and methodology, agreed for periodic follow up at the interval of one month after placement of healing abutment and 7 days after using the retraction cord. Conclusion: The conclusions that were drawn from this study are: Both materials showed clinically and statistically significant amount of vertical soft tissue displacement. Among the both soft tissue displacement agents, non-impregnated retraction cord showed the more vertical soft tissue displacement than Expasyl Paste. But, the amount of retraction offered by this paste is limited with extremely subgingival margins. But the advantages with Expasyl paste over the retraction cord were its ease of application, painless, quick, and without agony to the patient.

Keywords: Expasyl, Retraction cord, Healing abutment, Impression post.

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INTRODUCTION

The patient's mouth is a challenging environment to make an accurate impression. An acceptable impression must be an exact record of all aspects of the implant. Procedures for fixed prosthodontics on natural teeth and implants require adequate and accurate duplication of the abutment and the corresponding finish lines. Finish lines are frequently placed at (or just below) the crest of the gingival margin, meaning that gingival retraction is usually necessary when impressions are made [1].

The precise reproduction of the abutment (implant) provides clinician with crucial clinical information of the relative position and orientation of the implant to other implants, teeth and soft tissue that allow them to fabricate exact- fitting, bio-integrated restoration. For that it is necessary to expose, access & isolate the implant region, especially when cement retained implant prosthesis are in consideration, where conventional crown and bridge impression and optical impression technique is used [1,2].

Several impression techniques are used in implant dentistry, and some require peri-implant mucosal displacement while making impressions. Others, such as the pickup impression technique, do not require any peri-implant mucosal retraction [2].

To ensure accuracy with elastomeric impression materials, Must maintain a minimum bulk of 0.2-millimeter thickness in the sulcus area, which can achieved by retracting the peri-implant tissue [1]. Below this thickness impression have higher incidences of voids, tearing of impression materials and less marginal accuracy [1,2]. Peri-implant tissue must be displaced laterally to allow access of material & vertically to provide adequate thickness of the impression material. In implant dentistry the retraction process should not only expose the abutment's margins atraumatically but should also not alter the implant surface [3].

In peri-dental tissue, the fiber-rich, highly organized periodontal complex surrounding natural teeth provides support for gingival tissues when they are retracted, mitigating the collapse of the tissues when the retraction agents are removed before making the impression. The peri-implant fiber structure, however, does not provide the same level of support and is not able to prevent the collapse of retracted tissues to the same extent, which complicates attempts to successfully make impressions. This is particularly true in situations in which the depth of sulcus is greater than average, such as when an implant has been placed deeply [2].

At the same time, clinicians need to ensure that the retraction forces are gentle since patient's peri-implant junctional epithelium is more fragile. Therefore, to create adequate space in the gingival sulcus for an accurate impression at the margins, the dentist must retract, displace or remove a portion of the gingival tissue [2].

Need for peri-implant mucosal displacement [1,4]

• To widen the peri-implant sulcus in order to provide access for impression material to reach the sub peri-implant mucosal margins and to record adequately the finish line.

• Helps in blending of the restoration with the finish line of abutment.

• During cementation it helps in easy removal of cement without tissue damage.

• It helps the dentist in visually assessing the marginal fit.

There are relative paucity of information on soft tissue retraction techniques used during making impression of implant restorations. So, most of the information which are applicable on natural tooth are considered as references.

Aim

To access and compare the effectiveness of retraction cord and Expasyl paste in peri-implant tissue retraction.

Objectives

•To compare the pre-operative and post-operative peri-implant sulcus vertical depth by using the retraction cord.

•To compare the pre-operative and post-operative peri-implant sulcus vertical depth by using the Expasyl Paste.

•To compare post-operative peri-implant sulcus vertical depth by using the retraction cord and the Expasyl Paste.

MATERIALS AND METHOD

The clinical study was carried out in Implant Department on the patients visiting Jaipur Dental College, Jaipur, Rajasthan for implant prosthesis.

Patient who accepted to participate were chosen for the study. Coincidentally all 15 patients were female. They were explained the purpose and methodology, agreed for periodic follow up at the interval of one month after placement of healing abutment and 7 days after using the retraction cord.

Inclusion Criteria for patient selection

• Age 18-60 years.

• Mandibular posterior region was selected for Study.

• Partially edentulous and completely edentulous patients were selected for study.

• Patient with good oral hygiene and free from soft tissue inflammation and infection.

• Patients should be non-smokers/ tobacco chewers.

• All implants were flushing with the alveolar crest.

Exclusion Criteria for patient selection

• Presence of systemic diseases- metabolic disease, hematinic disease, osteoporosis or patients on bisphosphonates, chemotherapy, and radiotherapy were excluded.

• Presence of Parafunctional habits.

• Presence of Deleterious Habits- smoking/ tobacco chewing

• Those who refuse to take part in the study.

• Pregnancy or lactating women.

Methodology

A comparative study between two retraction materials was done to evaluate the amount of apical displacement of peri-implant mucosa. Neo-biotech implant system (Life care) (Korea) was chosen for study. 15 patients who got dental implant placement with good general health were selected for this study. They were randomly assigned to three equal groups.

Group A: represents before peri-implant mucosal retraction group, where no retraction procedures were carried out,

Group B: represents retraction cord group, where peri-implant mucosal retraction was carried out with retraction cord (Ultrapak # 00 knitted non-impregnated retraction cord)

Group C: represents Expasyl Paste Group, in which peri-implant mucosal retraction was carried out with Expasyl Paste (Pierre Rolland Acteon).

In these selected patients first retraction was done by using retraction cord (Fig. 1) and after 7 days retraction paste (Expasyl gel) (Fig. 2) was used because healing of the sulcus can take 7 to 10 days [2]. After 3 months of implant placement in posterior mandibular arch second stage surgery was carried out under local anaesthesia, 5 cover screws were removed and healing abutments were placed (Fig.3) with the help of hex driver (Neo-biotech system) (Fig. 4).

After one month of healing abutment placement patients recalled for clinical procedure for study purpose 6. The lower border of upper groove over the Hexed Pick-up Impression coping (Product code-ISIPH411) was used as a reference point to measure vertical depth of peri-implant mucosal sulcus. After removing healing abutment impression coping was screwed with the help of hex driver over implant and RVG was taken to check the proper fitting of impression coping over implant (Fig. 5).

Then clinical measurements were recorded immediately before retraction from sulcus depth till reference point over impression coping with the help of Hu-FriedyColorvue PCVUNC 12 Probe (Fig. 6) which had continuous marking from 1-12 mm. The probe was inserted gently into the sulcusmesiobuccal to the impression coping without any pressure and kept parallel to impression coping. If reference point of impression coping was coincided with probe's marking , the distance was measured from tip of probe to the marking over probe with digital vernier caliper (Fig. 7).

But if reference point of impression coping is coincided with probe in between these marking then the marking was done over probe with fine black colored marker (Fig. 8). Then it was measured by using vernier

caliper. The values which gave us the basic height of peri-implant tissues were recorded and tabulated.

After that retraction cord (Ultrapak # 00 knitted non-impregnated retraction cord) was used to do soft tissue retraction. The area of retraction was dried and isolated. The retraction cord was drawn from the dispenser bottle and a piece approximately 5 cm (2 inches) long is cut off [7]. Then the retraction cord was dipped in normal saline and excess saline was squeezed out by using the gauze piece. Retraction cord was looped around the impression coping and started to pack from proximal area of implant with cord packer, which was having smooth, nonserrated heads to compress twisted cord with a sliding motion in to implant sulcus with minimal pressure. Excess cord was cut using curved scissor and left around 2-3 mm of displacement cord outside the sulcus for ease of removal (Fig. 9).

The retraction cord was left in place for 10 minutes. A large bulk of gauze was placed in the patient's mouth to make patient more comfortable by providing something to close on and at the same time, it was keeping area dry. Blanching of tissues, indicates adequate displacement of the gingival tissue. After 10 minutes the retraction cord was moistened with water spray and removed from the sulcus with tweezer and the measurements were done with probe in same manner. Then impression coping was removed and healing abutment was screwed over implant and patients recalled after 7 days.

After 7 days again healing abutment were removed and impression coping was screwed over implant and RVG taken to confirm its placement over implant. Then peri-implant tissue displacement was done with Expasyl paste (Pierre Rolland Acteon). Applicator tip of Expasyl Paste was placed in the cartridge and inserted into the gun. With the tip the paste was injected slowly in to the sulcus of peri-implant mucosa at approximately 2mm/second with minimal pressure about 0.1N/mm2 (Fig.10). The tip was placed almost horizontally then moved vertically when injecting the paste The Paste applied must have a dry and compact appearance, if not then second injection was performed. The working area was kept dry by placing the suction tip in the corner of the mouth opposite the quadrant being treated. Blanching of tissues, indicates adequate displacement of the gingival tissue. The paste was removed by gentle water and air spray after 2 minutes. Depending on the texture of the peri-implant tissue, retraction occurs between 30 seconds to 2 minutes [8]. After removal of paste measurements were done with probe then final impressions were made for fabrication of implant prosthesis. Value obtained were tabulated and subjected for statistically analysis.

RESULTS

A total 15 implant patient were included in this study. They were randomly assigned into 3 equal groups

Group A: represents control group, where no retraction procedures were carried out,

Group B: represents Retraction cord group, where soft tissueretraction was carried out with retraction cord

Group C: represents Expasyl Paste Group, in which soft tissue retraction was carried out with Expasyl Paste.

Paired T test were applied to analyze the result within these groups.

Table 2: On comparison of the mean values of before soft tissue Retraction and after retraction cord, the mean values of after retraction cord is higher with a difference of 0.4466667 is statistically significant with a p value of <0.001.

Table 3: On comparison of the mean values of before soft tissue retraction and after Expasyl Paste the mean values of after Expasyl Paste is higher with a difference of 0.1986667 is statistically significant with a p value of 0.001.

Table 4: On comparison of the mean values of after retraction cord and after Expasyl Paste the mean values of after retraction cord is higher with a difference of 0.248 is statistically significant with a p value of <0.001.

Graph 1 representing the comparison among Group A before soft tissue retraction, Group B after Retraction cord and Group C after Expasyl Paste in which mean value of Group B 9.58 is higher than Group A 9.13 and Group C 9.33. Graph 2 representing the comparison between Group B after Retraction cord and Group C after Expasyl Paste in which mean difference value of Group B 0.44 is higher than Group C 0.19.

Table 1: Baseline data

Patient Number	Before gingival Retraction (in mm)	After conventional retraction cord (in mm)	After Expasyl Paste (in mm)
1	10	10.45	10.35
2	8.26	8.75	8.59
3	8.12	8.46	8.36
4	8	8.37	8.27
5	10	10.5	10.19
6	8	8.52	8.22
7	9.3	10.06	9.67
8	10.6	10.27	10.16
9	9	9.28	9.18
10	9.96	10.21	10.14
11	9.08	9.45	9.26
12	8.2	8.94	8.36
13	9.22	9.75	9.45
14	9.14	9.82	9.46
15	10.17	10.92	10.37

Table 2: Comparison of the mean values of before soft tissue retraction (group a) and after retraction cord (group b)

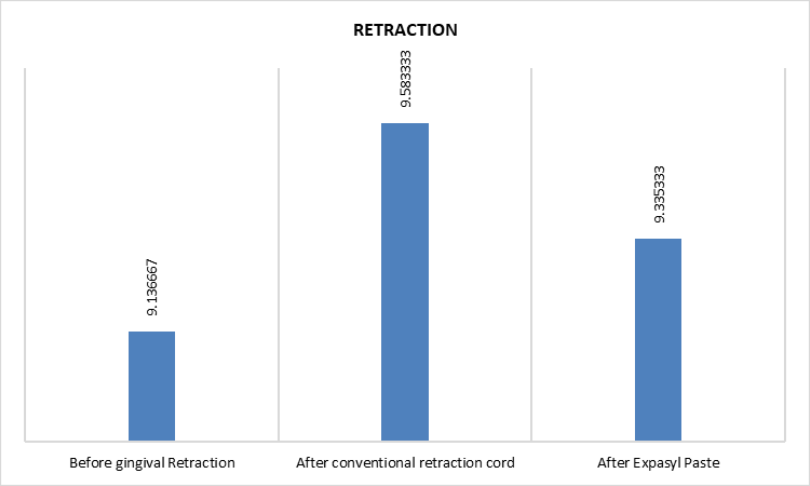
		Mean	N	Std. Deviation	Paired Differences		T	df	*p* Value
					Mean Difference	Std. Deviation			
Pair 1	Before soft tissue Retraction	9.136667	15	0.874101	-0.44667	0.272624	-6.345	14	<0.001
	After retraction cord	9.583333	15	0.829636					

Table 3: Comparison of the mean values of before soft tissue retraction (group a) and after expasyl paste (group c)

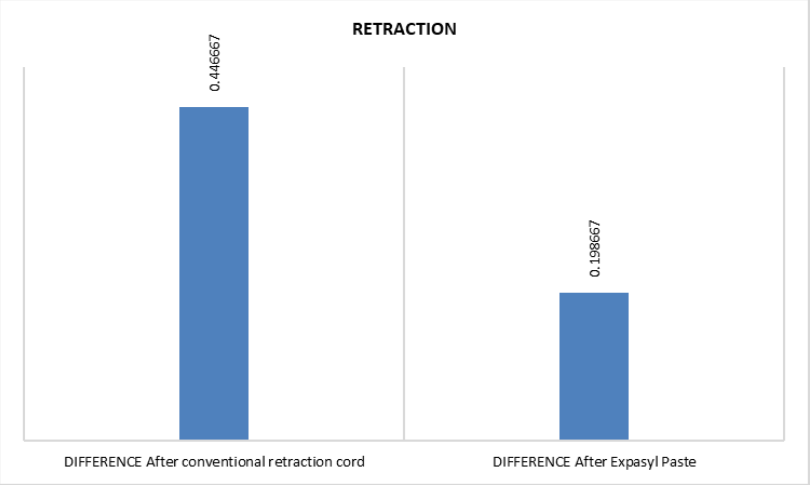
		Mean	N	Std. Deviation	Paired Differences		T	df	*p* Value
					Mean Difference	Std. Deviation			
Pair 2	Before soft tissue Retraction	9.136667	15	0.874101	-0.19867	0.189543	-4.059	14	0.001
	After Expasyl Paste	9.335333	15	0.809125					

Table 4: Comparison between the mean value of retraction cord (group b) and expasyl paste (group c). This is also significantly higher in the conventional retraction cord (group b).

		Mean	N	Std. Deviation	Paired Differences		T	df	*p* Value
					Mean Difference	Std. Deviation			
Pair 3	After retraction cord	9.583333	15	0.829636	0.248	0.167511	5.734	14	<0.001
	After Expasyl Paste	9.335333	15	0.809125					



Graph 1: Comparison among Group A before soft tissue retraction, Group B after Retraction cord and Group C after Expasyl Paste



Graph 2: Comparison between Group B after Retraction cord and Group C after Expasyl Paste

Fig 1: Retraction cord

Fig 2: Expasyl paste

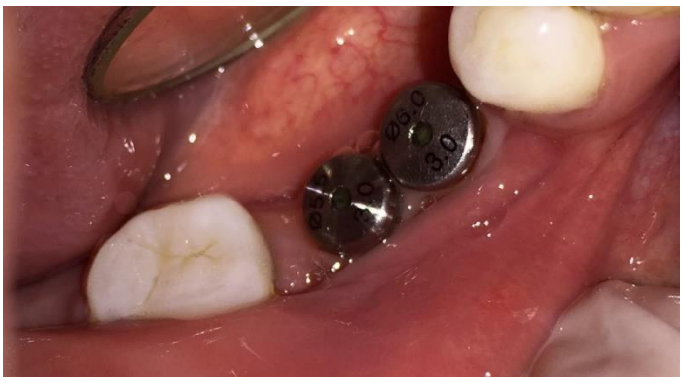


Fig 3: Placement of healing abutments

Fig 4: Hex driver

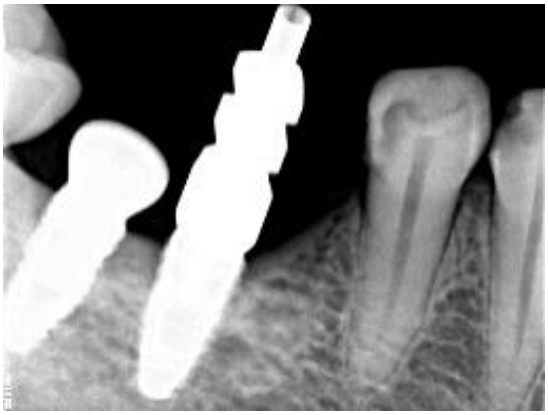


Fig 5: RVG to check the proper fitting of impression coping over implant

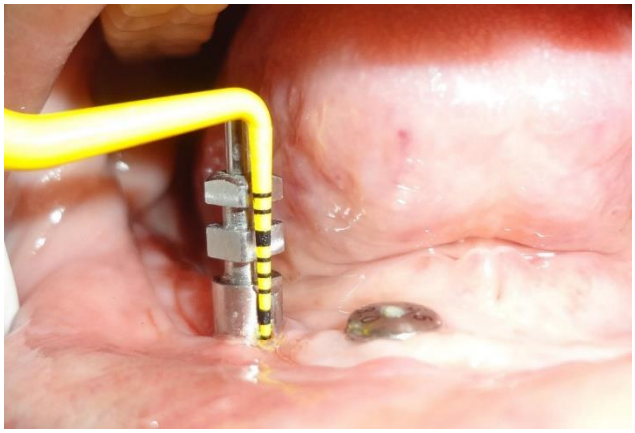


Fig 6: Recording Clinical measurements from sulcus depth till reference point over impression coping with the help of Hu-FriedyColorvue PCVUNC 12 Probe

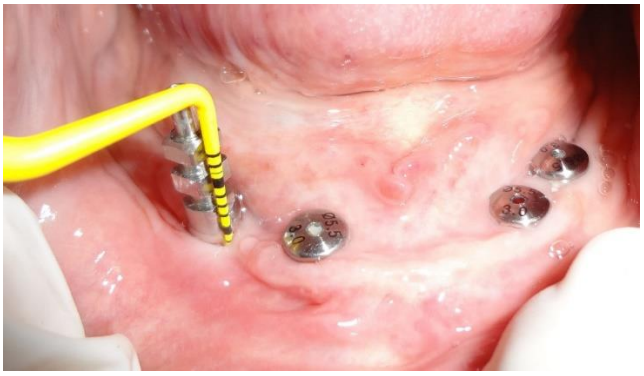


Fig 7: Marking over probe with fine black colored marker

Fig 8: Measuring distance from tip of probe to the marking over probe with digital vernier caliper

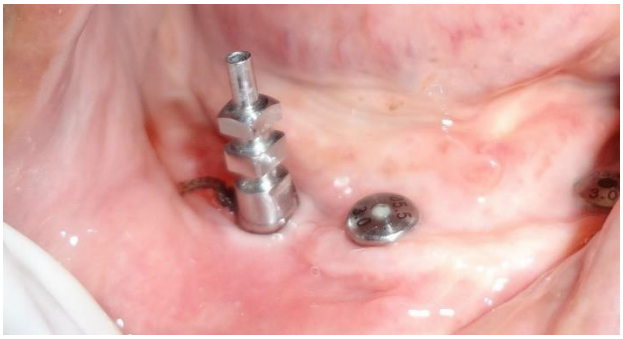


Fig 9: Packed retraction cord in to the sulcus of peri- implant mucosa

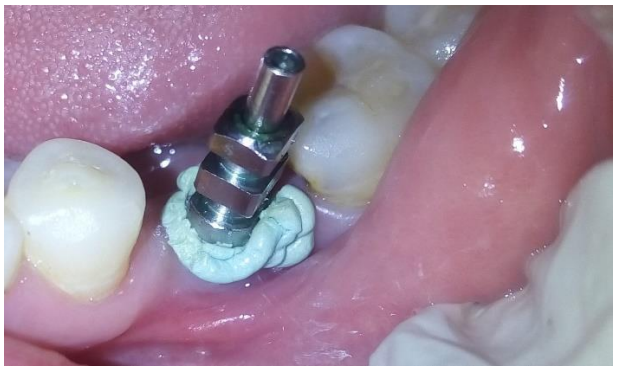


Fig 10: Injected Expasyl paste in to the sulcus of peri-implant mucosa

DISCUSSION

The mechanical retraction of gingival tissues by using cords around implant restorations can lead to ulceration of the junctional epithelium. It is indicated in situations in which patients' sulcus depths are shallow, their mucosal health is impeccable and a robust, thick periodontal biotype is present [2].

Only 18% of respondents used retraction around implants. This may be because most clinicians take fixture head impressions, rather than abutment-level impressions. Azza Al-Ani et al also investigated that dentists experience of gingival bleeding before and after gingival retraction around both natural teeth and implants [1]. The findings on gingival retraction around natural teeth are consistent with those reported by Al Hamad et al, who compared the periodontal effects of two cordless techniques (Expasyl™ and Magic Foam Cord™) with conventional cords. They showed that these cordless techniques did not induce bleeding during or after retraction, while the conventional retraction cord Ultrapak™ induced bleeding in 28% and 27% during and after retraction, respectively [9].

Using an injectable matrix for gingival retraction offers clinicians the opportunity to perform an atraumatic procedure. There is no risk of laceration when clinicians introduce materials such as 15 percent aluminum chloride in a kaolin matrix into the sulcus surrounding natural teeth. With no damage to the junctional epithelium at the base of the sulcus or to the sulcus walls, the risk of inflammation caused by chemicals delivered in the matrix is reduced significantly [2]. Phataleet al. showed a higher percentage of intact junctional epithelium histologically with Expasyl in comparison to the use of a retraction cord [10]. The force of retraction offered is limited due to the elevated viscosity of the injectable matrix, and, while this protects the implant sulcus from the trauma of over packing, it may not offer sufficient retraction for situations that are unique to implant dentistry [11].

The addition of chemical adjuncts to retraction cords further complicates the situation and may lead to increased inflammation of the subsulcular tissues. If the delicate junctional epithelium around the implant restoration becomes damaged during cord placement, the lacerated sulcus provides reduced protection against the penetration of chemicals into deeper subepithelial cell layers and against systemic dissemination when the vascular bed is exposed. All chemical agents used for gingival retraction are irritants.

Clinicians often choose to perform surgical procedures because they are able to, the procedure can be performed rapidly and hemostasis is achievable. Surgical retraction procedures, however, are destructive and involve excision of tissue. This may be acceptable around natural teeth, as the results of studies have supported using electrosurgery, lasers and rotary curettage [2]. Evidence does not support the use of such destructive procedures in the implant situation as it will reduce the amount of attached keratinised tissue [1]. Moreover, evidence has shown that peri-implant mucosa does not have the same capacity for regeneration as peridental mucosa. Rotary curettage has a high risk of the bur damaging the implant surface as well as the risk of tissue retraction exposing implant threads. Electrosurgery is contraindicated with implant as there is a risk of arcing. Lasers expose the implant margins by creating a trough by excision rather than by displacing soft tissue. Therefore, large defect would result if they are used around deeply placed implants [11].

So, according to these study it is decided to use conventional retraction cord without chemical and Expasyl paste for this comparative study.

All the measurements in the study were made by single operator to avoid inter-operator variability. The results of this study indicate that there is a significant difference between cord gingival displacement and Expasyl paste gingival displacement. The above mentioned results can be attributed to the following factors; Conventional cord is a ''mechanical method'' of the gingival displacement. The mechanical method involves physical displacement of the gingival tissue by placement of materials within the sulcus to obtain maximal gingival retraction. Whereas, expasyl is a non-cord ''mechanico- chemical'' method of gingival displacement where the material is placed into the gingival sulcus with no pressure. Hence the amount of retraction observed may be less.

Vincent Bennani et al [12] found that Expasyl generates 37.7 times less pressure than a cord system during placement and 10 times less pressure after placement. The lower pressure generated by Expasyl compared to the KnitTrax cord makes Expasyl a safer option. While the reduced pressure does protect the tissue, further research is needed to investigate the effectiveness in retracting deeper sulcus where relapsing and collapsing forces increase. The collected data were analysed using paired sample t-test to test the characteristics of the data. P value <0.05 indicates significant difference between the variables.

In this study, both groups (retraction cord group and Expasyl group) showed a mean of Soft tissue vertical displacement greater than 0.19 mm. The mean value of vertical depth of the displaced sulcus in the retraction cord group (9.58 ± 0.82) was higher than Expasyl group (9.33 ± 0.80). On comparison of the mean values of before soft tissue retraction and after retraction cord, the mean value of after retraction cord was higher with a difference of 0.4466667, which was statistically significant with a p value of <0.001.

On comparison of the mean values of before soft tissue retraction and after Expasyl Paste the mean value of after Expasyl Paste was higher with a difference of 0.1986667, which was statistically significant with a p value of 0.001. On comparison of the mean values of after conventional retraction cord and After Expasyl Paste the mean value of after conventional retraction cord was higher with a difference of 0.248, which was statistically significant with a p value of <0.001.

The mean difference vertical depth of the displaced sulcus in the Retraction cord group (0.44 ±0.27 mm) was greater than that of the

Expasyl paste group (0.19 ±0.18 mm). When retraction cord group compared with the Expasyl group the't' value was 5.73 which was statistically significant with a p value of <0.001. This study agrees with the study by Ankitguptaet al [13] which found that the amount of vertical gingival retraction attained by using stay-put and magic foam cord retraction systems was significantly (P<0.05) higher than Expasyl. This study is also similar to the study by Rubina Gupta et al [14] in which the cord provided greater sulcular depth than the Expasyl paste system. And disagree with the study by D. Bheemalingeswara Rao et al [15], where more vertical gingival displacement of 0.72mm was observed with Expasyl retraction system than Medicated retraction cords showed displacement of 0.49mm. But as this study on implant, so the comparison with these study is inappropriate because these study are on natural teeth and soft tissue biotype is different in natural tooth and implant and there is no any literature for comparison on peri-implant mucosal retraction.

There are substantial differences between the connective tissue structures surrounding teeth and implants that affect the robustness of gingival tissues. Peri-implant mucosa lacks keratinized epithelium at the base of the sulcus, which forms the junctional epithelium and has a hemidesmosomal attachment and internal basal lamina in the lower regions of the interface. It adheres poorly to implant surfaces, is more permeable and has a lower capacity for proliferation and regeneration than does the junctional epithelium around teeth [2].

Peri-implant mucosa consists of circumferentially running fiber bundles and fibers that run longitudinally to the implant surface. Most connective tissue fibers that surround smooth implants run parallel to the implant surface. The use of rougher implant surfaces encourages the attachment of fibrils to the implant surface, affecting the orientation of fibers adjacent to implants at varying angles.

The junctional epithelium associated with natural teeth has a high rate of cell turnover, which occurs rapidly during the wound healing that takes place after penetration by a dental probe or while recovering from infection. When the junctional epithelium that surrounds implants is exposed to trauma (such as during gingival retraction procedures), it is at greater risk of experiencing penetration damage than is the more robust sulcus of natural teeth.

Another consideration that has a bearing on the ability of epithelial tissues to withstand chemo-mechanical manipulative procedures is the influence of the natural soft tissue biotype. Clinicians associate a thin periodontal biotype with fragility that requires delicate management to avoid recession owing to tissue damage. Thick fibrotic biotypes are more resilient, and they have a tendency to form pockets rather than recede. Thus, a thick biotype is more conducive for implant placement [2].

Limitations

There are some limitations in this study;

• The influence of distendability of peri-implant mucosa, peri-implant mucosal thickness, varied sulcus depth, and the visibility and accessibility on the peri-implant mucosal retraction and retraction forces are not considered.

• Further, UNC 12 plastic probe and vernier caliper are used to measure sulcus depth (soft tissue), which may lead to some variations in the measured values.

• Different methods were not used in this study.

• Both male and female patients were considered to compare the effectiveness of both the procedure for the study but coincidentally all were female patients.

• Only single implant system was used for the study.

• The sample size was small hence results cannot be conclusive.

• This study was done only in lower posterior region and bone texture and tissue thickness are different in upper and lower arch. So this study is not applicable in all teeth regions.

• The measurements was done only on single point around the Implant.

Summary

A comparative study between two retraction materials was done on 15 patients to evaluate the amount of apical displacement of peri-implant mucosa. In these selected patient first retraction was done by using the conventional retraction cord and after 7 days retraction paste (Expasyl gel) was used.

In this study impression post was used for reference point. After removing healing cap, impression post was screwed over implant and clinical measurements were recorded immediately before retraction from sulcus depth till reference point over impression post with the help of Hu-Friedy Colorvue PCVUNC. If reference point of impression post is coincided with probe's marking, the distance was measured between tip of probe and marking over probe with digital vernier caliper but if reference point of impression post was coincided with probe in between these marking then marking was done over probe with marker.

After that retraction was done with conventional retraction cord which was packed with cord packer in to the sulcus with minimal pressure. Excess cord was removed leaving around 2-3 mm of displacement cord outside the sulcus for ease of removal. After removal of cord with tweezer the measurements were done with probe in same manner. After 7 days peri-implant tissue displacement done with Expasyl paste which was slowly dispensed into the sulcus without exerting any pressure with the tip on peri-implant tissue. After removal of paste measurement was done with probe.

The most important rationale of soft tissue retraction is to widen the peri-implant sulcus in order to provide access for impression material to reach the sub peri-implant mucosal margins and to record adequately the finish line.

CONCLUSION

The conclusions that were drawn from this study are: Both materials showed clinically and statistically significant amount of vertical soft tissue displacement. Among the both soft tissue displacement agents, non-impregnated retraction cord showed the more vertical soft tissue displacement than Expasyl Paste. But, the amount of retraction offered by this paste is limited with extremely subgingival margins. But the advantages with Expasyl paste over the retraction cord were its ease of application, painless, quick, and without agony to the patient. Finally, the choice of retraction material depends on various clinical conditions, ease of packing and clinician's preference.

Conflict of Interest

None declared.

Financial Support

None declared.

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