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Evaluating The Fluid Absorbency of Retraction Cords After Immersing It Into Two Gingival Retraction Medicaments (25 % Aluminium Chloride, 0.05% Oxymetazoline Hydrochloride) – An In-Vitro Short Study

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Abstract
There are numerous retraction agents used in chemico mechanical method of gingival retraction. Aluminium chloride which is more commonly used for gingival retraction produces efficient retraction but they have been also reported to cause collateral soft tissue damage due to its low pH whereas oxymetazoline, which were reported as safer vasoconstrictors and retraction agents in literature have very little scientific evidence regarding its efficacy.
Aim: - The purpose of the study was to know how much amount of retraction was achievable with safer retraction agents: Oxymetazoline and Aluminium chloride which is more commonly used and is more efficient in retraction, so that a retraction agent which is effective in retraction as well as safer to use can be known.
Materials and methods: - Gingival retraction cords 0, 00, 000, Retraction medicaments aluminium chloride, oxymetazoline, Blotting paper, Electronic analytical balance, Artificial saliva, human plasma. 30 samples of length 6cm are cut of size 0,00, 000. Divided into 3 groups of 10 samples each. Dry will be dipped directly in human plasma and saliva for 10 minutes. 10 were dipped in medicaments for 20 minutes, further these samples were divided into a grop of 5. 5 were dipped in plasma and 5 were dipped in saliva for 10 minutes.
Results: -When immersed in medicaments, there is a significant difference in absorption of fluids (artificial saliva and plasma) between the untreated dry cord and the cord treated with aluminium chloride and oxymetazoline chloride. The fluid absorbency was better in retraction cord 000, dipped in aluminium chloride and then dipped in human plasma.

Introduction

Gingival retraction can be explained as the procedure of deflecting the marginal gingiva away from a tooth. Accurate recording of finish line is a very important parameter for fabrication and successful prognosis of restorations. The position of finish lines, periodontal health, and sulcus hemorrhage during impression production all influence the quality of the impression. Exposure of sub- gingival finish line, with adequate moisture control to capture the finish line details in the impression, is the main goal of the gingival retraction procedure.(1) In fixed prosthodontics; the aim of gingival retraction is to allow the impression material to go beyond the abutment margins and to generate enough room for the impression material to be thick enough. (2)

A good and appropriate retraction of the gingival tissue is necessary for a better outcome of the fixed dental prosthesis in terms of periodontal health, aesthetics, and prosthesis longevity. (3. The value of biologic width is that it acts as a natural barrier or shield, preventing pathogens from penetrating the periodontium, ultimately determine the survival and longevity of the dental elements.(4)

The Retraction, Displacement, Collapse, And Relapsing Forces Are The Four Types Of Forces.

1. Retraction is the downward and outward pressure that is applied to the soft tissue by the retraction technique or the retraction material
2. Displacement is the downward force due to increased pressure exerted during retraction of the soft tissue
3. Relapse is the tendency of the gingival tissue to go back to its original position.
4. Collapse is when the gingival tissues is when the gingival tissues are far more pushed towards the tooth. (5)

APPLICATION OF GINGIVAL RETRACTION PROCEDURES

1. Isolation of the preparation field (6)
2. Diagnosis of subgingival caries and isolation of cavity prepared close to the gingival margin. (7)
3. Control of haemorrhage(8)
4. Recording subgingival margins during impression for indirect restorations
5. Better visualization of the preparation margins:
6. During crown lengthening procedures (6)

RETRACTION CORDS CLASSIFICATIONS
BASED ON SIZE :-

1. #000 (Black): Use as lower cord in the double-cord technique, anterior teeth and double packing
2. 00 (Yellow): Restorative procedures dealing with thin, friable tissues
3. #0 (Purple): Lower anteriors, when luting near gingival and subgingival veneers, Class III, IV, and V restorations and Second cord for double-cord technique
4. #1 (Blue): #1 and #2 sizes are particularly effective for tissue control and/or displacement prior to and/or after crown preparations
5. #2 (Green): Upper cord for double-cord technique and used as a protective prepreparation cord
6. #3 (Red): Areas that have fairly thick gingival tissues where a significant amount of force is required and as upper cord for use with the double-cord technique
7. Braided, knitted, twisted. (9)

MEDICAMENTS AVAILABLE: -

1) 0.1% and 8% racemic epinephrine; 2) 100% alum; 3) 5% and 25% aluminum chloride; 4) ferric sub-sulfate (Monsel's Solution); 5) 13.3% ferric sulfate and 15.5% ferric sulfate; 6) 8% and 40% zinc sulfate; 7) 20% and 100% tannic acid; 8) 45% negatol (condensation product of metacresol, sulfonic acid and formaldehyde). 9. Vasoconstrictors racemic epinephrine group, sympathomimetic amine group. (10)(17)

IDEAL REQUIREMENTS FOR CHEMICALS USED WITH RETRACTION CORD

1. Should produce effective gingival displacement.
2. Should produce hemostasis.
3. Should not produce any irreversible damage to the gingival tissue.
4. Should not have any systemic side effects.
5. The chemicals can be classified according to their mode of action. (10)

MATERIALS AND METHOD: -

MATERIALS: -

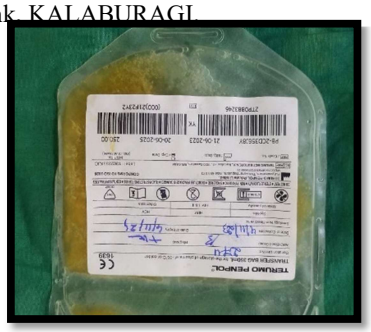
1. Gingival retraction cords 0, 00, 000 (CINCI RAK).

2. Retraction medicaments: - , 25% buffered Aluminium chloride (HEMOSTAL), 0.05% Oxymetazoline Hydrochloride (NASIVION).

3. Electronic analytical balance available at Al- Badar rural dental college and hospital.

4. Artificial saliva.

5. Human plasma from KBN, blood bank, KALABURAGI.



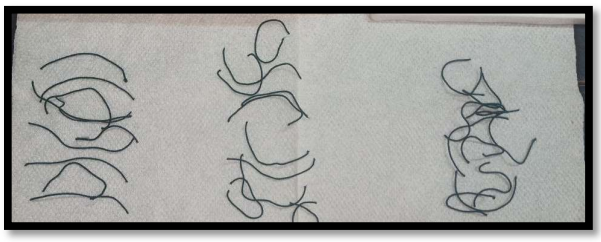
METHOD:

1. This in- vitro study was conducted in the Department of Prosthodontics, crown and bridge including Implantology, AL- Badar Rural Dental College and Hospital, Kalaburagi, Karnataka, India from 2021-2024.
2. The ethical clearance for this study has been obtained from the academic ethical clearance committee, AL- Badar Rural Dental College and Hospital, Kalaburagi, headed by the Principal of the institution.
    - Gingival retraction cords of 0, 00, 000 sizes were used

Retraction medicaments: -

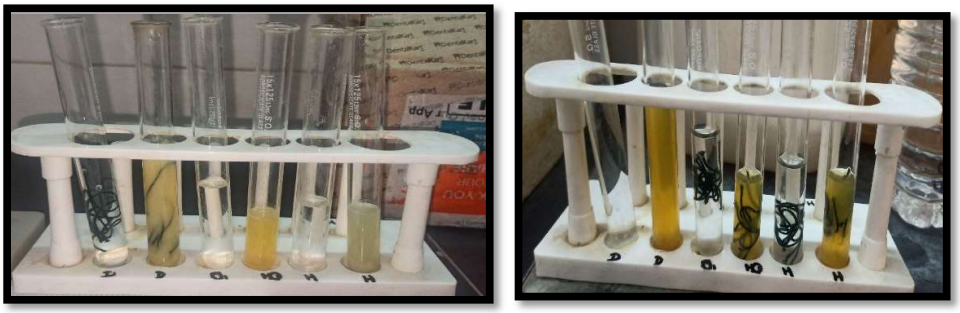
- Aluminium chloride, Oxymetazoline hydrochloride.
- Blotting paper
- Electronic analytical balance,
- Artificial saliva
- Human plasma

3. The three sizes of retraction cords being used in this study are cut into 30 samples of 5cm length each.



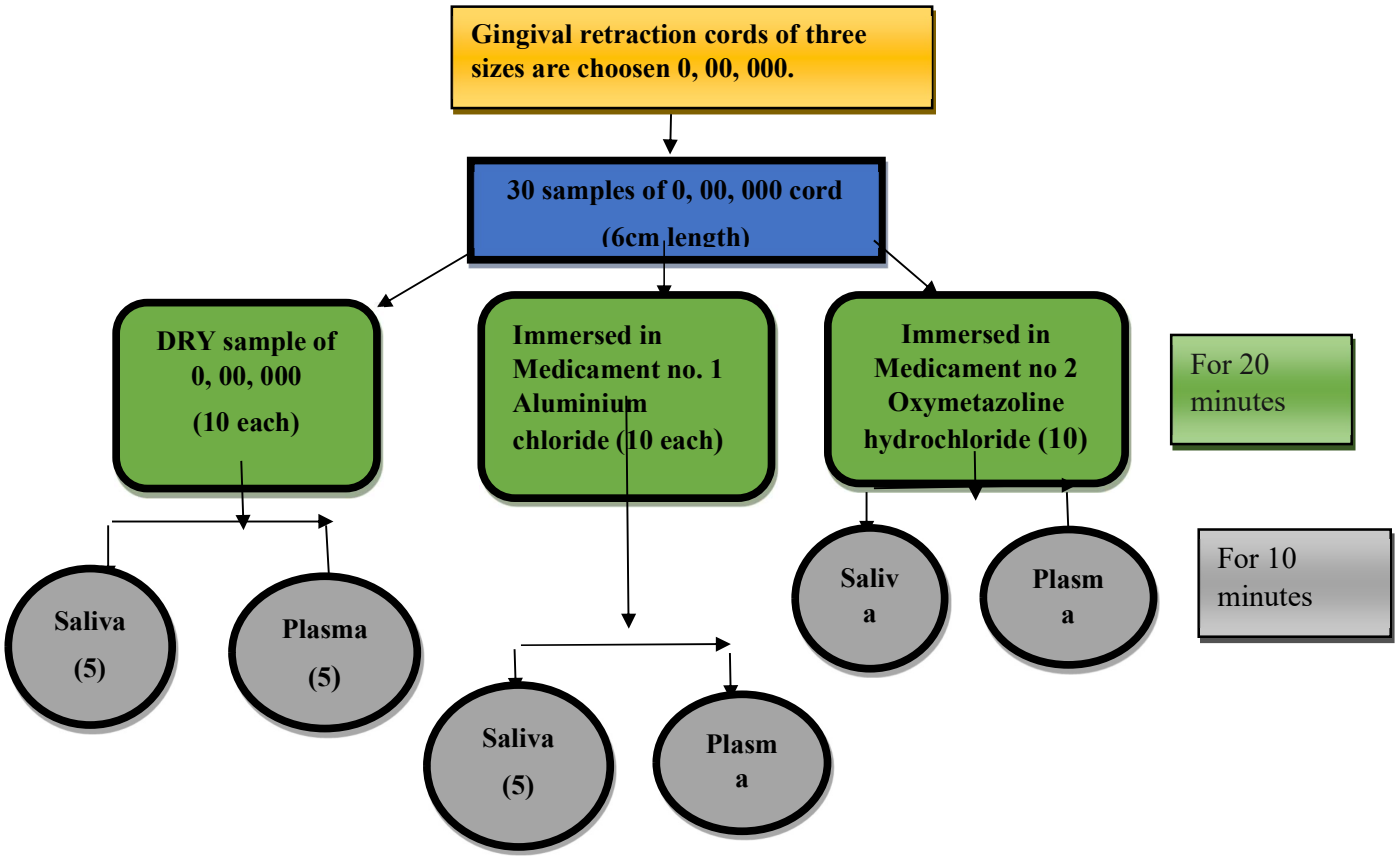
4. Out of 30 samples, 10 were kept dry, 10 were immersed in medicament no. 1 (25% Aluminium chloride), 10 were in medicament no. 2 (0.05 % Oxymetazoline hydrochloride).

5. Immersed for a time period of 20 minutes, after 20 minutes excess of medicament was removed using blotting paper.
6. Now the weight was recorded in the electronic analytical balance as initial weight
7. Five retraction cords from each group were now dipped in plasma and artificial saliva for 10 mins.



8. These were then taken out and the weight was remeasured.

9. The amount of the fluid absorbed was determined by subtracting the weight before fluid immersion from the weight after fluid immersion.
10. The amount of fluid absorbed in the dry retraction cord was obtained by subtracting the weight of dry cord from the weight of cord after fluid immersion (weight after immersion into test medicament)
11. The amount of fluid absorption after medicament treatment was obtained by subtracting the weight after medicament immersion from the final weight after fluid immersion (weight after immersion into plasma or artificial saliva



RESULTS: -

Table no. 1: Comparison of dry retraction cord weight of different cord sizes (0, 00, 000)

Cord types	N	Mean± SD	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	df	F	Sig.
				Lower Bound	Upper Bound					
0	10	0.0210±0.00316	0.00100	0.0187	0.0233	0.02	0.03	2	91	**0.000***
00	10	0.0150±0.00000	0.00000	0.0150	0.0150	0.02	0.02			
000	10	0.0100±0.00000	0.00000	0.0100	0.0100	0.01	0.01			
Total	30	0.0153±0.00490	0.00089	0.0135	0.0172	0.01	0.03			

*P value significant at 0.05.

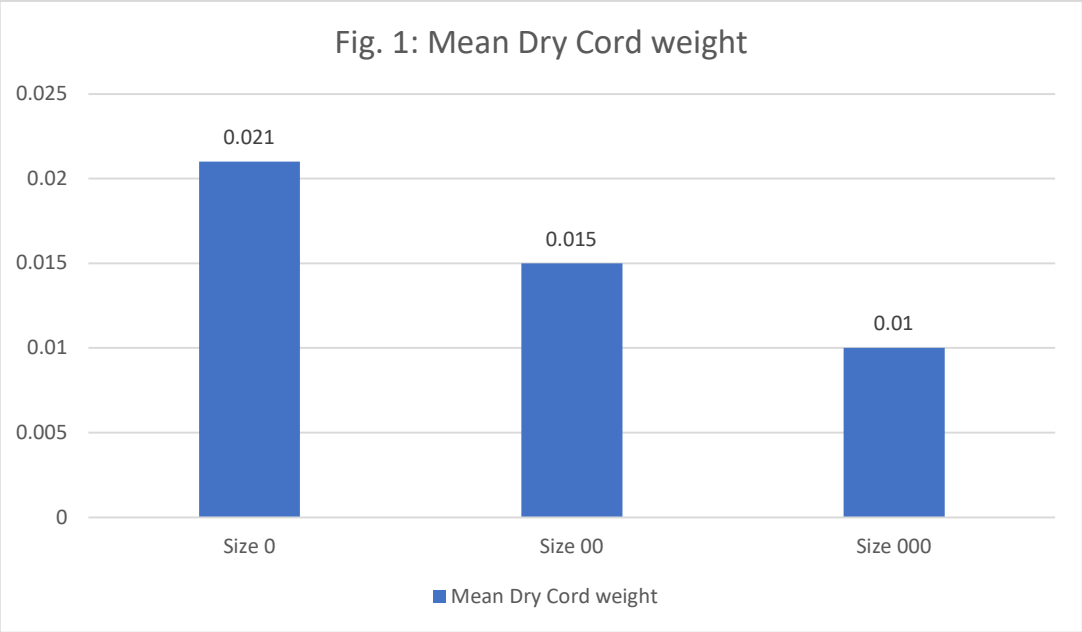


Table no. 2: Post-hoc Bonferroni Correction

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	00	**0.00600***	0.00082	0.000	0.0039	0.0081
	000	**0.01100***	0.00082	0.000	0.0089	0.0131
00	0	**-0.00600***	0.00082	0.000	-0.0081	-0.0039
	000	**0.00500***	0.00082	0.000	0.0029	0.0071
000	0	**-0.01100***	0.00082	0.000	-0.0131	-0.0089
	00	**-0.00500***	0.00082	0.000	-0.0071	-0.0029
*The mean difference is significant at the 0.05 level.						

Table no. 3: Comparison of different retraction cord weight after dipping in Medicament 1 & 2 (0, 00, 000)

		N	Mean± SD	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	df	F	Sig.
					Lower Bound	Upper Bound					
AlCl	0	10	0.0200± 0.00000	0.00000	0.0200	0.0200	0.02	0.02	2	114.3	**0.000***
	00	10	0.0460± 0.00516	0.00163	0.0423	0.0497	0.04	0.05			
	000	10	0.0320± 0.00422	0.00133	0.0290	0.0350	0.03	0.04			

	Total	30	0.0327±0.01143	0.00209	0.0284	0.0369	0.02	0.05			
OxyMet	0	10	0.0230±0.00483	0.00153	0.0195	0.0265	0.02	0.03	2	44.308	**0.000***
	00	10	0.0390±0.00316	0.00100	0.0367	0.0413	0.03	0.04			
	000	10	0.0310±0.00316	0.00100	0.0287	0.0333	0.03	0.04			
	Total	30	0.0310±0.00759	0.00139	0.0282	0.0338	0.02	0.04			

*P value significant at 0.05.

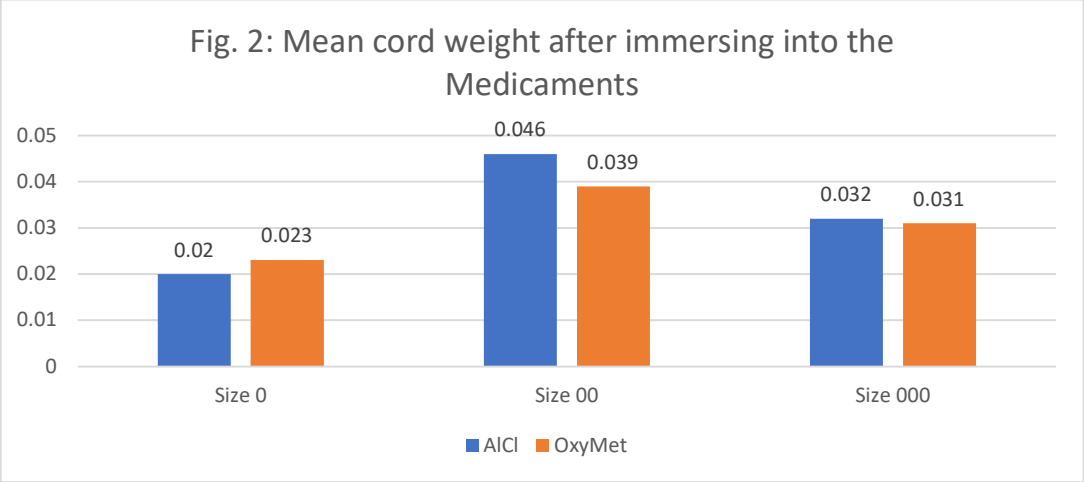


Table no. 4: Post-hoc Bonferroni Correction

	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
AlCl	0	00	**-0.02600***	0.00172	0.000	-0.0304	-0.0216
		000	**-0.01200***	0.00172	0.000	-0.0164	-0.0076
	00	0	**0.02600***	0.00172	0.000	0.0216	0.0304
		000	**0.01400***	0.00172	0.000	0.0096	0.0184
	000	0	**0.01200***	0.00172	0.000	0.0076	0.0164
		00	**-0.01400***	0.00172	0.000	-0.0184	-0.0096
OxyMet	0	00	**-0.01600***	0.00170	0.000	-0.0203	-0.0117
		000	**-0.00800***	0.00170	0.000	-0.0123	-0.0037
	00	0	**0.01600***	0.00170	0.000	0.0117	0.0203
		000	**0.00800***	0.00170	0.000	0.0037	0.0123
	000	0	**0.00800***	0.00170	0.000	0.0037	0.0123
		00	**-0.00800***	0.00170	0.000	-0.0123	-0.0037

*The mean difference is significant at the 0.05 level.

Table. No 5: Comparison of cord weights no. 0, 00, 000 dry and dipped in different solutions

		N	**Mean ± SD**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**	**df**	**F**	**Sig.**
					Lower Bound	**Upper Bound**					
0	*Dry*	10	0.0210 ± 0.00316	0.00100	0.0187	0.0233	0.02	0.03	2	2.1	0.142**
	AlCl	10	0.0200 ± 0.00000	0.00000	0.0200	0.0200	0.02	0.02			
	OxyMet	10	0.0230 ± 0.00483	0.00153	0.0195	0.0265	0.02	0.03			
	Total	30	0.0213 ± 0.00346	0.00063	0.0200	0.0226	0.02	0.03			
00	*Dry*	10	0.0150 ± 0.00000	0.00000	0.0150	0.0150	0.02	0.02	2	216.273	**0.000***
	AlCl	10	0.0460 ± 0.00516	0.00163	0.0423	0.0497	0.04	0.05			
	OxyMet	10	0.0390 ± 0.00316	0.00100	0.0367	0.0413	0.03	0.04			
	Total	30	0.0333 ± 0.01392	0.00254	0.0281	0.0385	0.02	0.05			
000	*Dry*	10	0.0100 ±	0.00000	0.0100	0.0100	0.01	0.01	2	166.680	**0.000***

			0.00000								
	AlCl	10	0.0320 ± 0.00422	0.00133	0.0290	0.0350	0.03	0.04			
	OxyMet	10	0.0310 ± 0.00316	0.00100	0.0287	0.0333	0.03	0.04			
	Total	30	0.0243 ± 0.01073	0.00196	0.0203	0.0283	0.01	0.04			

*P value significant at 0.05. **P value not significant. Hence, No post hoc done.

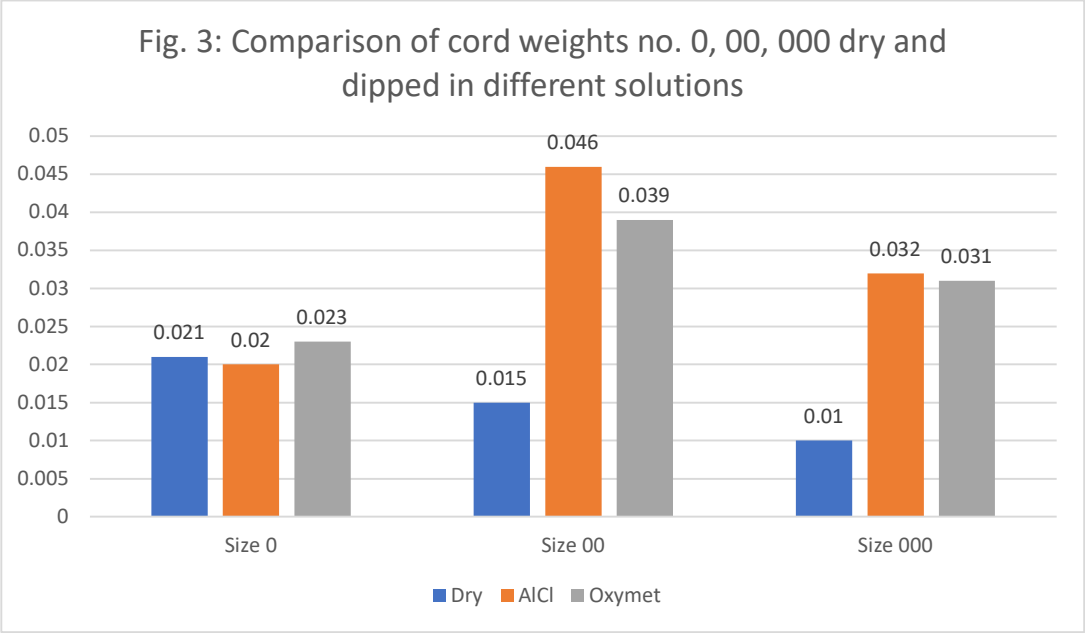


Table. No 6: Post-hoc Bonferroni Correction

Dependent Variable	**(I)**	**(J)**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
						Lower Bound	**Upper Bound**
00	Dry	AlCl	**-0.03100***	0.00156	0.000	-0.0350	-0.0270
		OxyMet	**-0.02400***	0.00156	0.000	-0.0280	-0.0200
	AlCl	Dry	**0.03100***	0.00156	0.000	0.0270	0.0350
		OxyMet	**0.00700***	0.00156	0.000	0.0030	0.0110
	OxyMet	Dry	**0.02400***	0.00156	0.000	0.0200	0.0280

		AlCl	**-0.00700***	0.00156	0.000	-0.0110	-0.0030
000	Dry	AlCl	**-0.02200***	0.00136	0.000	-0.0255	-0.0185
		OxyMet	**-0.02100***	0.00136	0.000	-0.0245	-0.0175
	AlCl	Dry	**0.02200***	0.00136	0.000	0.0185	0.0255
		OxyMet	0.00100	0.00136	1.000	-0.0025	0.0045
	OxyMet	Dry	**0.02100***	0.00136	0.000	0.0175	0.0245
		AlCl	-0.00100	0.00136	1.000	-0.0045	0.0025
*The mean difference is significant at the 0.05 level.							

Table no. 7: Comparison of cord (0, 00, 000) weights in dry as well as dipped in Medicament 1 & 2 and after dipping it in Saliva and Human Plasma

Group			**N**	**Mean± SD**	**Std. Error**	**95% Confidence Interval for Mean**		**Min**	**Max**	**df**	**F**	**Sig.**
						Lower Bound	**Upper Bound**					
Dry	**Saliva**	**0**	5	0.0220±0.00447	0.00200	0.0164	0.0276	0.02	0.03	2	3.500	0.063**
		00	5	0.0320±0.00447	0.00200	0.0264	0.0376	0.03	0.04			
		000	5	0.0240±0.00894	0.00400	0.0129	0.0351	0.02	0.04			
		Total	15	0.0260±0.00737	0.00190	0.0219	0.0301	0.02	0.04			
	Human Plasma	**0**	5	0.0200±0.00000	0.00000	0.0200	0.0200	0.02	0.02	2	21.714	**0.000***
		00	5	0.0400±0.00707	0.00316	0.0312	0.0488	0.03	0.05			
		000	5	0.0280±0.00447	0.00200	0.0224	0.0336	0.02	0.03			
		Total	15	0.0293±0.00961	0.00248	0.0240	0.0347	0.02	0.05			
AlCl	**Saliva**	**0**	5	0.0280±0.00447	0.00200	0.0224	0.0336	0.02	0.03	2	31.000	**0.000***
		00	5	0.0400±0.00000	0.00000	0.0400	0.0400	0.04	0.04			
		000	5	0.0300±0.00000	0.00000	0.0300	0.0300	0.03	0.03			

		Total	15	0.0327±0.00594	0.00153	0.0294	0.03060	0.02	0.04			
	Human Plasma	**0**	5	0.0280±0.00447	0.00200	0.0224	0.03036	0.02	0.03	2	23.565	**0.000***
		00	5	0.0660±0.01140	0.00510	0.0518	0.08002	0.05	0.08			
		000	5	0.0460±0.00894	0.00400	0.0349	0.05571	0.04	0.06			
		Total	15	0.0467±0.01799	0.00465	0.0367	0.05566	0.02	0.08			
Oxy Met	**Saliva**	**0**	5	0.0280±0.00447	0.00200	0.0224	0.03036	0.02	0.03	2	5.200	**0.024***
		00	5	0.0360±0.00548	0.00245	0.0292	0.04028	0.03	0.04			
		000	5	0.0300±0.00000	0.00000	0.0300	0.03000	0.03	0.03			
		Total	15	0.0313±0.00516	0.00133	0.0285	0.03342	0.02	0.04			
	Human Plasma	**0**	5	0.0260±0.00548	0.00245	0.0192	0.03328	0.02	0.03	2	7.385	**0.008***
		00	5	0.0420±0.00447	0.00200	0.0364	0.04776	0.04	0.05			
		000	5	0.0340±0.00894	0.00400	0.0229	0.04551	0.03	0.05			
		Total	15	0.0340±0.00910	0.00235	0.0290	0.03990	0.02	0.05			

*P value significant at 0.05. **P value not significant. Hence, No post hoc done.

Fig. 4: Comparison of Size 0 cord weights in dry as well as dipped in Medicament 1 & 2 and after dipping it in Saliva and Human Plasma

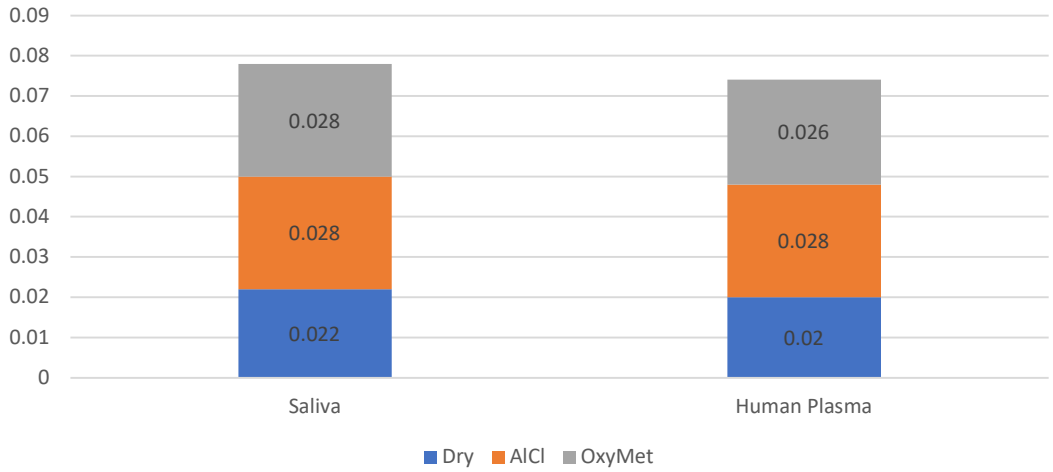
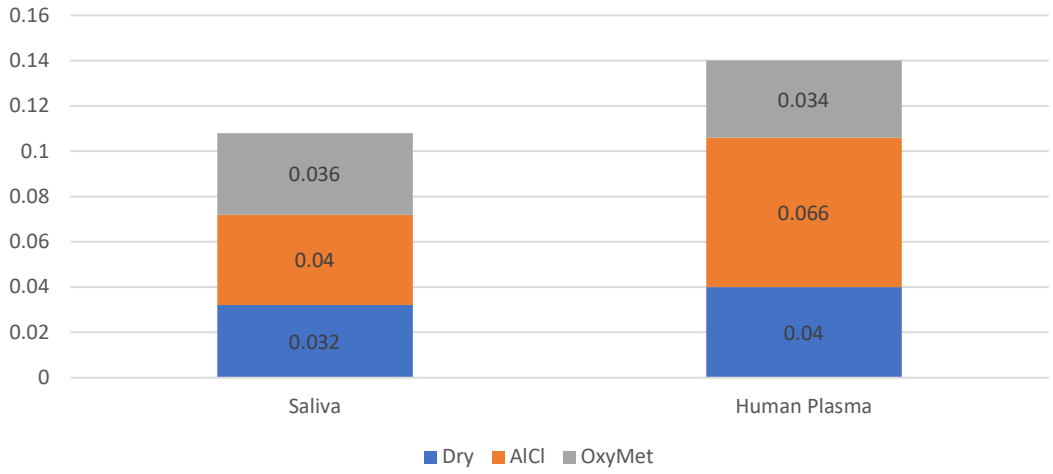


Fig. 5: Comparison of Size 00 cord weights in dry as well as dipped in Medicament 1 & 2 and after dipping it in Saliva and Human Plasma



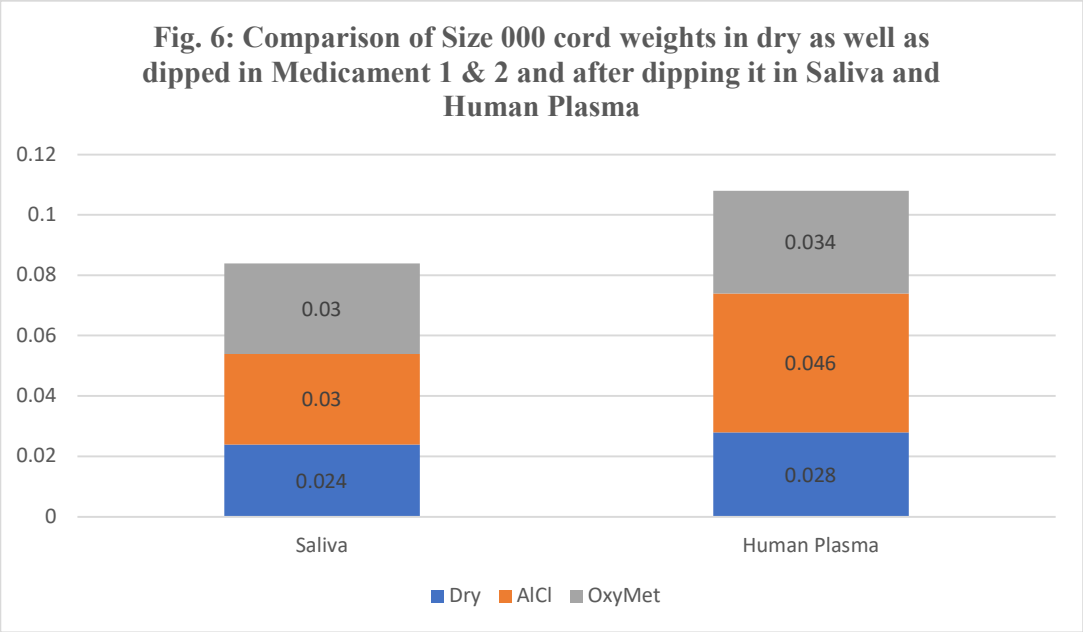


Table no. 8: Post-hoc Bonferroni Correction

Dependent Variable		(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Dry cord	**Human Plasma**	0	00	-0.02000*	0.00306	**0.000**	-0.0285	-0.0115
			000	-0.00800	0.00306	0.067	-0.0165	0.0005
		00	0	0.02000*	0.00306	**0.000**	0.0115	0.0285
			000	0.01200*	0.00306	**0.006**	0.0035	0.0205
		000	0	0.00800	0.00306	0.067	-0.0005	0.0165
			00	-0.01200*	0.00306	**0.006**	-0.0205	-0.0035
AlCl	**Saliva**	0	00	-0.01200*	0.00163	**0.000**	-0.0165	-0.0075
			000	-0.00200	0.00163	0.733	-0.0065	0.0025
		00	0	0.01200*	0.00163	**0.000**	0.0075	0.0165
			000	0.01000*	0.00163	**0.000**	0.0055	0.0145
		000	0	0.00200	0.00163	0.733	-0.0025	0.0065
			00	-0.01000*	0.00163	**0.000**	-0.0145	-0.0055
	Human Plasma	0	00	-0.03800*	0.00554	**0.000**	-0.0534	-0.0226
			000	-0.01800*	0.00554	**0.021**	-0.0334	-0.0026
		00	0	0.03800*	0.00554	**0.000**	0.0226	0.0534
			000	0.02000*	0.00554	**0.011**	0.0046	0.0354
		000	0	0.01800*	0.00554	**0.021**	0.0026	0.0334
			00	-0.02000*	0.00554	**0.011**	-0.0354	-0.0046
OxyMet	**Saliva**	0	00	-0.00800*	0.00258	**0.028**	-0.0152	-0.0008
			000	-0.00200	0.00258	1.000	-0.0092	0.0052
		00	0	0.00800*	0.00258	**0.028**	0.0008	0.0152
			000	0.00600	0.00258	0.116	-0.0012	0.0132

		000	0	0.00200	0.00258	1.000	-0.0052	0.0092
			00	-0.00600	0.00258	0.116	-0.0132	0.0012
	Human Plasma	0	00	-0.01600*	0.00416	**0.007**	-0.0276	-0.0044
			000	-0.00800	0.00416	0.236	-0.0196	0.0036
		00	0	0.01600*	0.00416	**0.007**	0.0044	0.0276
			000	0.00800	0.00416	0.236	-0.0036	0.0196
		000	0	0.00800	0.00416	0.236	-0.0036	0.0196
			00	-0.00800	0.00416	0.236	-0.0196	0.0036
*. The mean difference is significant at the 0.05 level.								

One way ANOVA comparison was done between a dry cord, aluminium chloride and oxymetazoline hydrochloride. The results of Bonferroni Post-hoc test show that there is a significant difference in absorbency between dry cord, Aluminium chloride and oxymetazoline hydrochloride. immersed cord. The absorbancy with aluminium chloride is more when comparsion amongst the three is done. The results of present study show that the fluid absorbency with or without medicament increases as the thickness of the cord increases. With respect to treatment with aluminium chloride, the cord which absorbed maximum fluid is size "000" in accordance with Spearman's correlation test and the fluid which got absorbed highest was human plasma. Same in the case of oxymetazoline hydrochloride, but amongst the two medicaments aliminium chloride showed better absorption.

DISCUSSION: -

The need for the study is to determine an effective mechanic- chemical retraction method without causing much adverse systemic effects. The medicaments aluminium chloride and oxymetazoline hydrochloride are used as they are readily available and may cause lesser tissue damage.

Retraction also depends on amount of fluid absorbed which again dependent upon the structure of cord, length of the cord, time period it was soaked in the medicament, etc. The fluids plasma and saliva were used in the study because these fluids are encountered during the process of gingival retraction in the patient. Plasma will be a synonym for GCF because of similar composition.

CONCLUSION: - Gingival retraction is an important part in the prognosis or longevity of fixed dental prosthesis. A thorough knowledge of the retraction techniques and materials is required to gain the adequate retraction simultaneously with good haemorrhage control. The selection of method and gingival retraction material used are frequently determined by the clinical situation. The extent of haemorrhage influences the preference for a specific retraction cord. Dentists should carefully assess the benefits and drawbacks of various materials and procedures of gingival retraction. The better medicament among the two is aluminium chloride.

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