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RESEARCH ARTICLE

INFLUENCE OF MOUTH WASH AND BEVERAGE ON THE SURFACE ROUGHNESS AND COLOR-STABILITY OF ZIRCONIA RE-INFORCED LITHIUM DISLICATE AND SUPER-HIGH TRANSLUCENT ZIRCONIA

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Abstract

The goal of this study was to see how commercially available, commonly prescribed mouth rinse and black coffee affected the colour stability and surface roughness of Zolid fx, a recently introduced super high translucent zirconia, and Vitasuprinity, a zirconia reinforced lithium disilicate.To simulate 10 years of exposure to mouth-rinse solutions, Zolid fx and vitasuprinnity samples were immersed for 120 hours at a constant temperature of 37.C every 24 hours and the solutions were replenished, and immersion was continued up to 120 hours. After immersion, the samples were kept in an artificial salivary substitute until testing.A spectrophotometer was used to measure the colour change of the samples. The study employs a contact type spectrophotometer calibrated on white with D65 illumination and a geometric 2% observer curve. The CIE L*a*b* values were measured, and the average reading was calculated for each specimen, and the surface roughness was measured using a Mitutoyo SDA 350 profilometer over a transverse length of 4 mm and a cut-off value of 0.8 mm before and after immersion in the mouth rinse and black coffee. The measurements were repeated three times, and the mean values were computed. The findings were statistically examined.There were no significant differences in the colour of the samples before and after exposure to the mouth rinse, and the delta E value measured was less than 3, indicating that the difference was clinically insignificant. The surface roughness of the sample after immersion did not differ statistically between groups.As a result, it was concluded that Listerine can be safely prescribed and used in patients who have or are receiving Zolid fx and vitasuprinity restorations, and that black coffee does not stain them or affect their optical properties and surface texture, which can cause a perceptible amount of change.

Introduction:-

Dental esthetics plays a key role in nurturing self-esteem and developing a good quality life. Balancing and controlling several factors like method of fabrication, surface treatments, conditions of the dental substrate, cementation marginal adaptation, and occlusal adjustments, dietary and occlusal habits of the patient are vital in choosing the right material for each clinical scenarios. Computer aided design and computer aided manufacturing system has enabled production of dental restorations that are highly efficient both in mechanical properties and

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providing favorable esthetics. Monolithic restoration are prepared from materials like zirconia, lithium disilicate, zirconia reinforced lithium disilicate, high translucent and super high translucent zirconia.

Lithium disilicate (IPS E max CAD, IvoclarVivadent.) was initially introduced as a core material for dental restorations in 2000 which had favorable esthetic qualities but questionable physical properties. Lately lithium disilicate was reinforced with zirconia (about 10% by weight) and thus combined the positive aspects of zirconia and glass ceramic, giving it enhanced translucency and other esthetic properties with improved strength. As colour and translucency are important parameters in determining the final outcome of a ceramic restoration, its maintenance throughout its functional lifetime is important. Colour changes limit the quality and the longevity of restorations. These change in colour could be because of the alterations in surface texture, surface hardness, surface microstructure etc.

Beverages have long been considered a reason for the discoloration of ceramic restorations. Flavia et al has explained in their study that the pH levels, ionic concentrations and the ionic charges of the beverages, can cause dissolution of molecules from glass ceramics.[1] Roxana et al have proved in their study that thermocycling and surface treatments causes a marked increase in surface roughness with time.[2]

Oral hygiene is an important factor for not only preventing dental caries but also for treatment of gingivitis.besides brushing, two daily rinses with 10 ml of a 0.2 percent aqueous solution of chlorhexidinedigluconate virtually totally suppressed the formation of dental plaque, calculus, and gingivitis in the human model for experimental gingivitis, according to clinical research.[3] Some mouthwashes are used on a regular basis, while others are prescribed by dentists for individuals with periodontal disease, tooth caries, or sensitivity. Although, repeated usage of these mouth rinses can result in side effects such as tooth discoloration and medication resistance. Ceramic discoloration and surface roughness have also been found by researchers after using these mouth rinses.[3]

Color stability is essential for the long-term performance of aesthetic restoration. The CIE (Comission Internationale de L'Eclairage) L*a*b* colour space is often used to express colour in dentistry. The spectrophotometer is an accurate tool that records change in color in restorative materials and is extensively implemented.For each specimen, three CIE L*a*b* values are measured and the average reading is determined.[4] There are various means of checking the surface roughness. Surface roughness can be assessed by visual (microscopic) or profilometric method. For each specimen Ra(µm) values are measured and the average is determined.

Presently, the literature available does not infer much information on how and to what extend beverages and mouth washes could adversely affect zirconia reinforced lithium disilicate and super high translucent zirconia, as they are fairly new materials introduced to the market. Thus, this in-vitro experimental study aims at comparing the influence of beverage solutions on the surface roughness and color stability of super-high translucent zirconia and zirconia reinforced lithium disilicate.

Aim & Objectives of the Study:-

Aim:-

The aim of this study is to compare the colour stability and surface roughness of super-high translucent zirconia and zirconia reinforced lithium disilicate after being incubated in salivary substitute, alkaline mouthwash and a beverage.

Objectives:-

1) To evaluate the colour-stability of super-high translucent zirconia and zirconia reinforced lithium disilicate before and after incubating in salivary substitute, alkaline mouthwash and a beverage.
2) To evaluate the surface roughness of super-high translucent zirconia and zirconia reinforced lithium disilicate before and after incubating in salivary substitute, alkaline mouthwash and a beverage.
3) To compare the colour-stability of super-high translucent zirconia and zirconia reinforced lithium disilicate before and after incubating in salivary substitute, alkaline mouthwash and a beverage.
4) To compare the surface roughness of super-high translucent zirconia and zirconia reinforced lithium disilicate before and after incubating in salivary substitute, alkaline mouthwash and a beverage.

Study Design:
This is an in-vitro experimental study.

Materials:-

- Zirconia blank - Zolid Fx (AmannGirrbachCeramill® CAD/CAM material)
- Lithium disilicatestookes - Vita Suprinity (AmannGirrbachCeramill® CAD/CAM material)
- Immersion media:
  - Artificial Salivary substitutes
  - Alkaline solution: Listerine mouth wash
  - Acidic solution: Beverage (coke)
- Glaze paste (IPS emax® Ceram)
- Petri dish

Equipments:
- Scanner- (AmannGirrbachCeramill® Map 400)
- Computer aided designing - (AmannGirrbachCeramill® Mind)
- Milling machine - (AmannGirrbachCeramill® Motion 2)
- Sintering Furnace – (Zircom, KDF Japan)
- Ceramic furnace - (IvoclarvivadentProgramat®)
- Reflectance spectrophotometer.
- Profilometer (Mitutoyo Surface profilometer SDA 350)
- Ultrasonic cleaner
- Digital caliper

Materials:-

-Zolid fx- super-high translucency zirconia. (AmannGirrbach).
-Vita Suprinity- zirconia reinforced lithium disilicate. (AmannGirrbach).
-Materials for immersion: salivary substitute (Wet Mouth), mouth wash (Listerine®), black coffee

Methodology:-

A total of 36 samples of A2 shade will be milled using CAD/CAM of which 18 of them will be of super-high translucent zirconia and 18 of them will be of zirconia reinforced lithium disilicate. (fig.1a), (fig 1b), (fig 1c), (fig.2)

Fig1a:-Ceramil® map 400- scanner-(AmannGirrbach).

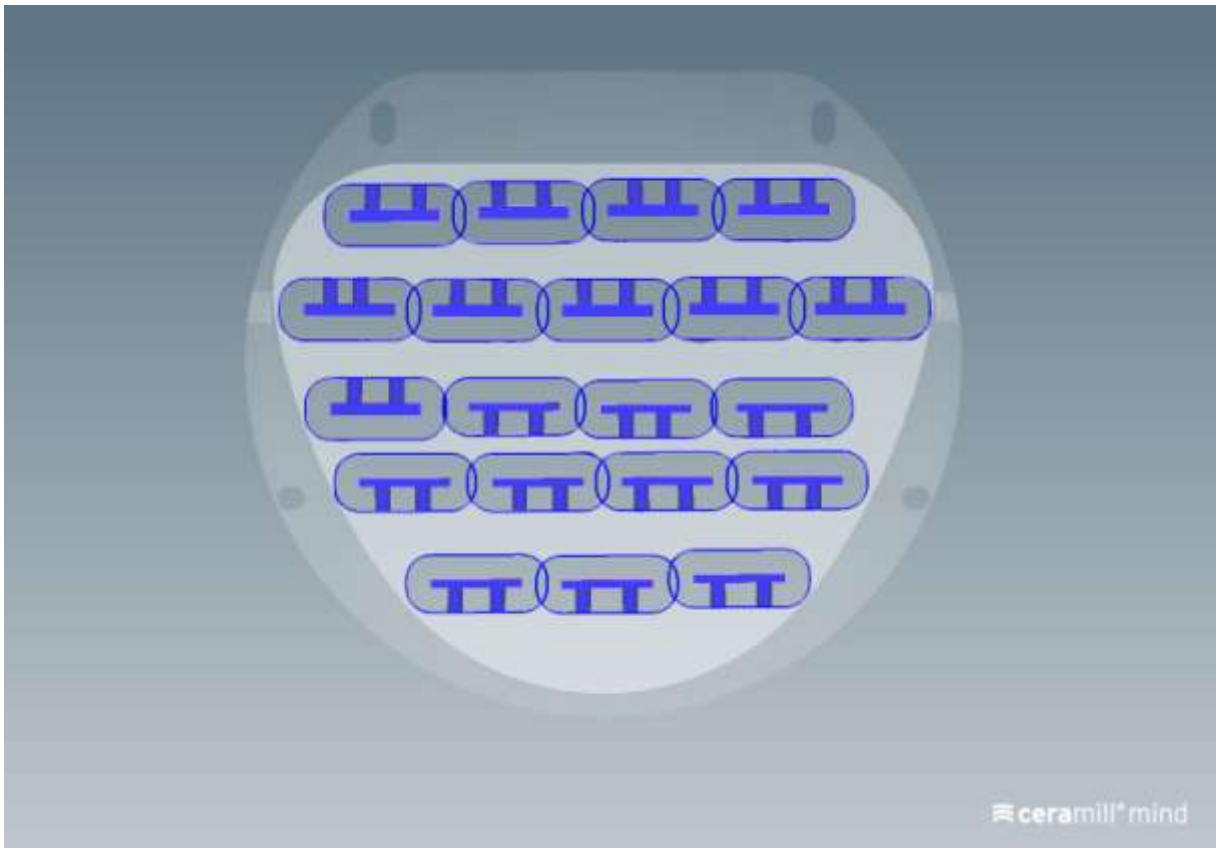


Fig1b:- CAD-CAM designing of ZrSH samples.

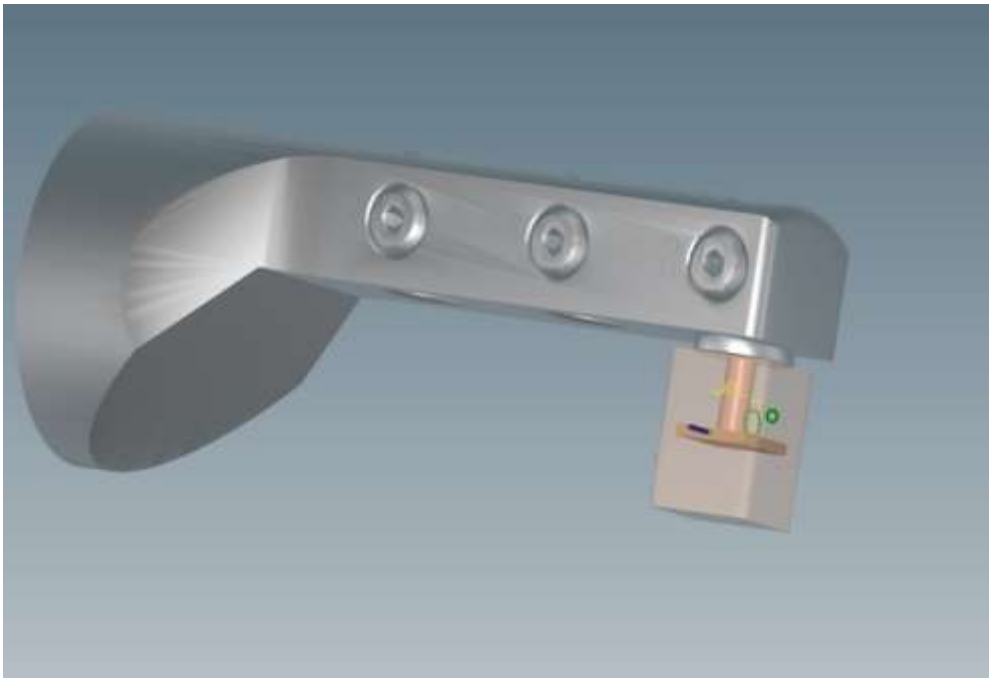


Fig.1c:- CAD-CAM designing of LDS samples:

Fig.2:- Milling machine (AmannGirrbachCeramill® motion2).

Preparation of super high translucent zirconia samples:
18 A2 pre-shaded samples of super-high translucent zirconia will be tested in two groups (9 each) based on their thickness of 0.9mm and 1.3mm.
The dimensions of the samples in two groups (9 each) will be:
ZrSH-1 – 10mm x10mm x 0.9mm
ZrSH-2 – 10mm x 10mm x 1.3mm
Zirconia can take up the high temperatures generated during milling hence they will be dry milled. Once they were dry-milled, sintering of the blocks will be done in the ceramic furnace. Then the specimens were spray glazed and placed into the ceramic furnace. (fig.3), (fig.4a), (fig.4b), (fig.5), (fig.6)

Fig 3:- Computer assisted milling of ZrSH samples:

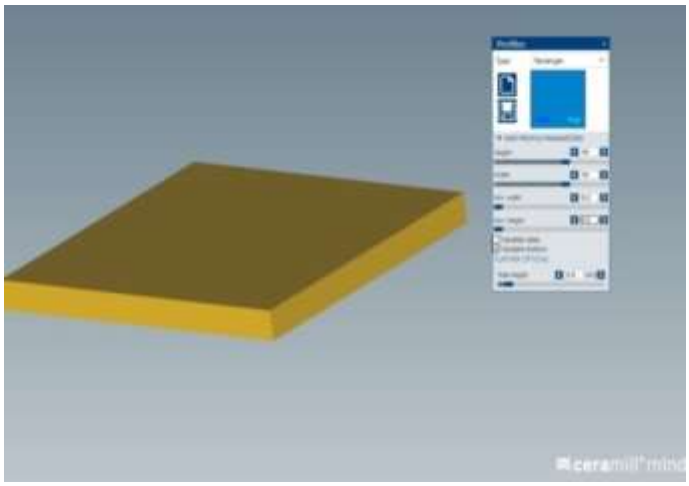


Fig4a:- STL file for ZrSH- 1(0.9mm thick.)

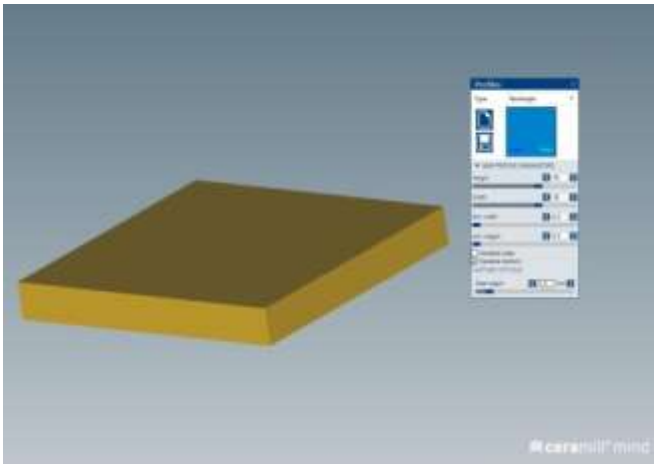


Fig4b:- STL file for ZrSH- 2(1.3mm thick.).

Fig5:- ZrSH samples in sintering tray.

Fig6:-Sintering furnace (AmannGirrbachCeramill®Rtherm).

Preparation of zirconia reinforced lithium disilicate samples:
18 A2 pre-shaded samples of zirconia re-inforced lithium disilicate were tested in two groups (9 each) based on their thickness of 0.9mm and 1.3mm.
The dimensions of the samples in two groups (9 each) will be:
LDS-1 - 10mm x10mm x 0.9mm.
LDS-2 - 10mm x 10mm x 1.3mm.

Lithium disilicate cannot withstand the excess heat generated during milling, hence it will be wet milled. Once wet milled they will be spray glazed and placed into the ceramic furnace. Fig.7, Fig.8.

Fig 7:-Milling of LDS samples.

Fig 8:- Ceramic furnace.

Grouping of the sample / Group allocation

- 36 samples will be divided into 2 different groups of super high translucent zirconia (ZrSH1 and ZrSH2) and zirconia reinforced lithium disilicate (LDS-1 and LDS-2) with a sample size of 18(n= 18) in each group.
- These groups will be further divided into two groups based on the thickness ie, 1.3mm (ZrSH-1 And LDS-1) and 0.9mm (ZrSH-2 and LDS-2), each with 9 samples.

Baseline reading will be done before the samples were immersed and stored in artificial salivary substitute, mouthwash and black coffee.

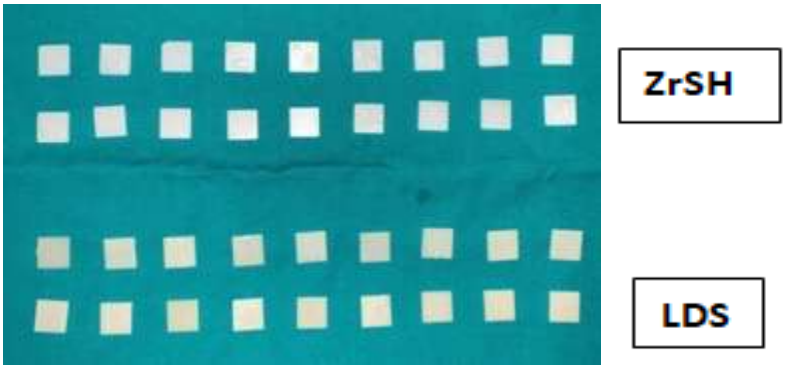


Fig 9:-Milled samples of ZrSH and LDS after glazing:

1) Preparation for storage.

- 3 samples each from ZrSH-1, ZrSH-2, LDS-1 and LDS-2 will be stored in an artificial saliva as a control for 5 days in an incubator at 37^0C (to simulate the oral environment) where the artificial saliva will be changed every 2 days as a control group.
- 3 samples each from ZrSH-1, ZrSH-2, LDS-1 and LDS-2 will be stored in Listerine mouthwash for 5 days.
- 3 samples each from ZrSH-1, ZrSH-2, LDS-1 and LDS-2 will be stored in a beverage (lack coffee) for 5 days.

2) To check for the colour stability and surface roughness at the baseline

- All the samples will be checked for colour stability using spectrophotometer and the values will be noted at the baseline.
- All the samples will be checked for surface roughness using Surface Profilometer and the values will be noted at the baseline.

3) Preparation of media: (fig.10)

- Artificial salivary substitute.
- Listerine mouth wash (alkaline solution).
- Coke (acidic solution).

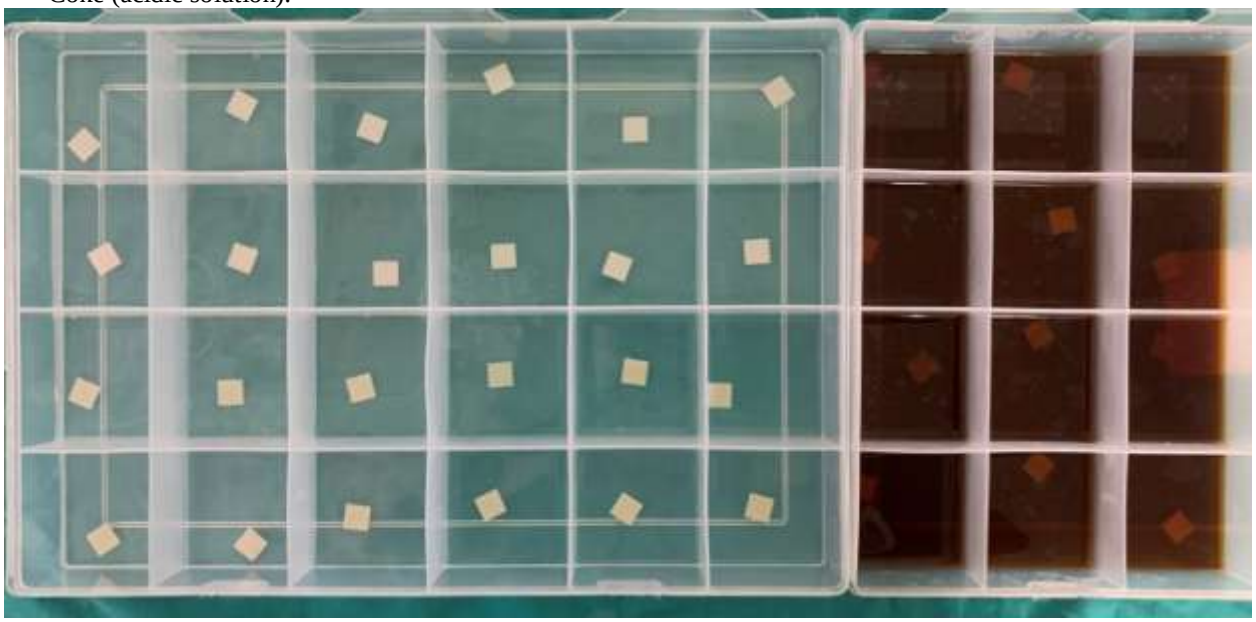


Fig10:- Samples immersed in msaliavry substitute, Listerine mouth was and black coffee.

4) To check for the colour stability and surface roughness:

- Before each measurement, the samples were gently rinsed with distilled water for 10 minutes and will be air-dried.

To check colour stability: (fig.11)

- All the samples will be checked for colour stability using reflectance spectrophotometer and the values were compared with the baseline values.

Fig11:- Reflectance spectrophotometer. (I1 Pro® X-Rite).

To check the Surface roughness : (fig.12)

Fig 12:-Checking for surface roughness baseline values using profilometer (Mitutoyo Surface Profilometer SDA 350).

All the samples will be then checked for surface roughness using Mitutoyo surface profilometer SDA 350 and then compared with the values obtained at the baseline.

Source of data/sampling method:

The super high translucent Zirconia samples and zirconia reinforced lithium disilicate will be fabricated in the 'Cad n mill' dentallaboratory at Yenepoya Dental College, Mangalore.

Sample size (including sample size calculation):

Sample Size Calculation:

Sample size is calculated by G* power software. At 80% power and 5% level of significance with calculated effect size 1.261 (from related article ie. Mean +/_ SD= 4.0=/- 0.35, 4.33= 0.12 for 2 groups).

Minimum sample size will be 9 in each group i.e a total of 18.

i.e, 3 3 3 = 9

3 3 3 = 9

i.e, n=18.

Proposed Statistical Analysis

- Study data obtained with be entered to Microsoft Excel Software, which then will be exported to Statistical Package for Social Sciences (SPSS) Version 22, IBM Statistics, USA.
- Descriptive Statistics (Mean, Standard Deviation, Frequency and Percentages) will be obtained.
- Intergroup comparison will be done using Independent-t-Test.
- Correlation assessment will be done using Pearson Correlation Coefficient and Scatter Plot Graphs.

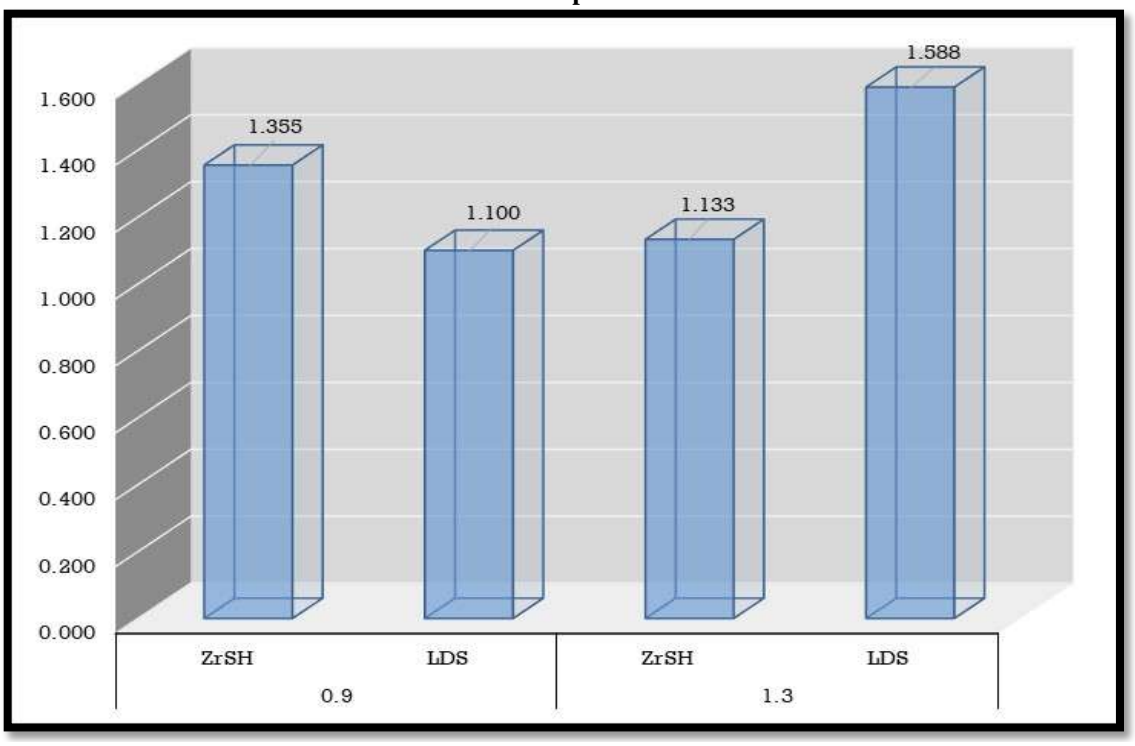
Table 1:- Inter-group Comparison of translucency.

	N	Mean	Standard Deviation	p-value
ZrSH - 0.9	9	1.355	0.524	0.285
LDS - 0.9	9	1.100	0.452	

ZrSH - 1.3	9	1.133	0.632	0.175
LDS - 1.3	9	1.588	0.725	
p-value based on Independent-t-Test Test * = Statistically Significant ($p < 0.05$)				

The table 1 is shown in Graph 1 as a bar graph, which demonstrates that the mean values of the differences in translucency between any two groups lacked statistical significance.

Graph 1:-



	Result: Colorimetric Reading											
				Reference				Reference				
	Color Space	Lab		L	95.9			L	95.9			
	Illumination	D65		a	-0.2			a	-0.2			
	Observer angle	2 degrees		b	2.9			b	2.6			
		SAMPLE		L	a	b	delta E	L	a	b	delta E	Change in Color
	0.9	1	Salivary Substitute	63.30	-0.90	1.90	22.40	61.50	-0.80	2.70	24.10	1.70
		2		62.60	-0.70	2.90	23.20	60.60	-0.70	2.70	24.90	1.70
		3		62.70	-1.00	2.30	23.10	63.70	-0.90	2.70	22.40	0.70
		4	Listerine Mouthwash	64.40	-1.10	1.50	21.80	62.90	-0.70	2.60	23.00	1.20
		5		64.90	-0.90	1.60	21.40	63.50	-0.80	2.40	22.50	1.10
		6		64.20	-0.80	2.30	21.90	63.60	-0.60	2.80	22.40	0.50
		7	Black Coffee	63.90	-0.90	1.70	22.20	61.50	-0.60	2.90	24.10	1.90
		8		63.50	-0.80	2.20	22.50	61.80	-0.40	4.00	23.90	1.40
		9		63.50	-0.80	2.20	22.50	61.10	-0.40	4.00	24.50	2.00
		AVERAGE		63.67	-0.88	2.07	22.33	62.24	-0.66	2.98	23.53	**1.36**
L ZrSH	1.3	1	Salivary Substitute	57.90	-0.80	1.10	27.20	59.20	-0.80	1.30	26.10	1.10
		2		60.60	-0.90	0.50	25.00	58.40	-0.90	1.30	26.80	1.80
		3		60.90	-1.00	0.50	24.70	60.10	-0.90	0.70	25.40	0.70
		4	Mouth-Listerine wash	59.70	-1.00	0.40	25.70	58.60	-0.90	1.10	26.70	1.00
		5		58.60	-1.00	0.60	26.70	57.30	-0.70	1.20	27.80	1.10
		6		59.70	-1.00	0.40	25.80	58.20	-0.90	1.20	27.00	1.20
		7	Black Coffee	59.60	-0.90	1.10	25.80	56.80	-0.80	1.30	28.20	2.40
		8		58.70	-1.00	0.50	26.60	58.00	-0.60	1.90	27.10	0.50
		9		58.70	-1.00	0.50	26.60	58.20	-0.60	1.90	27.00	0.40
		AVERAGE		59.38	-0.96	0.62	26.01	58.31	-0.79	1.32	26.90	**1.13**
	0.9	1	Saliv ar	68.10	-	10.40	19.70	67.00	-	10.40	20.60	0.90

					0.70				1.00			
		2		68.40	-0.70	10.50	19.50	66.80	-0.90	10.40	20.80	1.30
		3		68.30	-0.90	10.40	19.60	66.90	-1.00	10.30	20.70	1.10
		4	Listerine Mouth-wash	68.80	-0.90	10.40	19.20	67.00	-1.20	10.40	20.60	1.40
		5		68.50	-1.00	10.10	19.30	66.60	-1.10	10.70	21.00	1.70
		6		67.90	-0.80	10.60	19.90	67.60	-1.00	11.10	20.30	0.40
		7	Black Coffee	69.20	-0.80	10.60	19.00	69.40	-1.20	12.60	19.40	0.40
		8		68.70	-1.00	10.00	19.20	67.20	-1.10	10.50	20.50	1.30
		9		68.70	-1.00	10.00	19.20	67.10	-1.10	10.50	20.60	1.40
		AVERAGE		68.51	-0.87	10.33	19.40	67.29	-1.07	10.77	20.50	**1.10**
		1	Salivary Substitute	66.50	-0.90	9.70	20.80	63.80	-1.10	8.50	22.80	2.00
		2		66.20	-0.80	8.90	20.90	65.10	-1.30	9.60	22.00	1.10
		3		67.80	-1.10	9.80	19.90	64.20	-0.90	9.50	22.60	2.70
		4	Listerine Mouth-wash	67.10	-1.00	9.50	20.30	65.50	-1.10	9.40	21.60	1.30
		5		66.10	-0.80	9.10	21.00	65.60	-1.10	9.70	21.60	0.60
		6		67.60	-1.10	9.50	19.90	64.30	-0.90	9.50	22.50	2.60
		7	Black Coffee	66.70	-0.80	9.20	20.50	65.90	-1.30	10.20	21.40	0.90
		8		66.30	-0.80	9.30	20.90	64.50	-0.90	9.60	22.40	1.50
		9		66.30	-0.80	9.30	20.90	64.30	-0.90	9.50	22.50	1.60
	1.3	AVERAGE		66.73	-0.90	9.37	20.57	64.80	-1.06	9.50	22.16	**1.59**

Table 1.1:- Spectrophotometric reading of ZrSH-1,ZrSH-2,LDS-1 and LDS-2 before and after immersing in salivary substitute, Listerine mouth wash and black coffee.
CIEL*a*b coordinates along with color difference (ΔE) measured against white background.

Table 1.1 displays the translucency parameter (TP) values that were derived using CIE L* a* b* colour coordinates to assess the colour difference (DE) between a material of uniform thickness and a white backdrop.5

In accordance with the spectrophotometric measurements, the TP values for each sample in the groups—ZrSH-1, ZrSH-2, LDS-1, and LDS-2—were determined. The mean values found for ZrSH-1, ZrSH-2, LDS-1, and LDS-2 were 1.355, 1.100, 1.133, and 1.588, respectively. The p values following the intergroup comparison are not statistically significant, as shown in Table 1.

The difference in the translucency of the samples from each group before and after being submerged in artificial saliva, Listerine mouthwash, and black coffee is shown in Table 2 as an intra-group comparison. With the exception of ZrSH-2 and LDS-2, which were submerged in black coffee, the table demonstrates that there was no appreciable

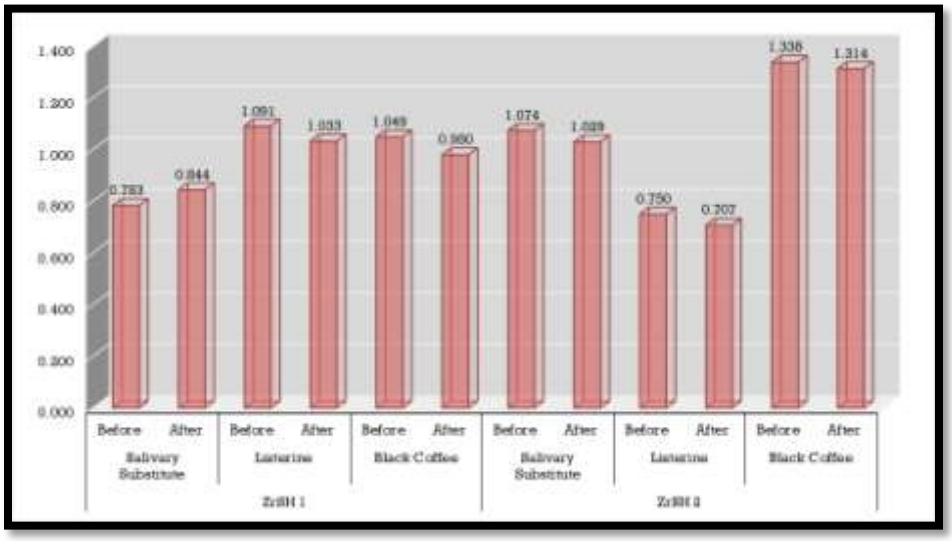
variation in the values of the sample's surface roughness before and after treatment, regardless of the thickness of either of the materials.

Table 2:- Intra-Group Comparison of roughness.

			Mean	Standard Deviation	p-value
ZrSH 1	**Salivary Substitute**	**Before**	0.783	0.451	0.603
		After	0.844	0.389	
	Listerine	**Before**	1.091	0.340	0.314
		After	1.033	0.302	
	Black Coffee	**Before**	1.049	0.241	0.330
		After	0.980	0.161	
ZrSH 2	**Salivary Substitute**	**Before**	1.074	0.190	0.199
		After	1.029	0.157	
	Listerine	**Before**	0.750	0.016	0.488
		After	0.707	0.078	
	Black Coffee	**Before**	1.338	0.546	0.016*
		After	1.314	0.544	
LDS 1	**Salivary Substitute**	**Before**	0.868	0.237	0.783
		After	0.870	0.240	
	Listerine	**Before**	1.164	0.381	0.870
		After	1.158	0.319	
	Black Coffee	**Before**	0.942	0.102	0.569
		After	0.984	0.111	
LDS 2	**Salivary Substitute**	**Before**	1.1313	0.461	0.312
		After	1.1153	0.454	
	Listerine	**Before**	0.970	0.298	0.867
		After	0.980	0.354	
	Black Coffee	**Before**	0.964	0.117	0.017*
		After	0.849	0.138	
p-value based on Paired-t-Test Test * = Statistically Significant (p < 0.05)					

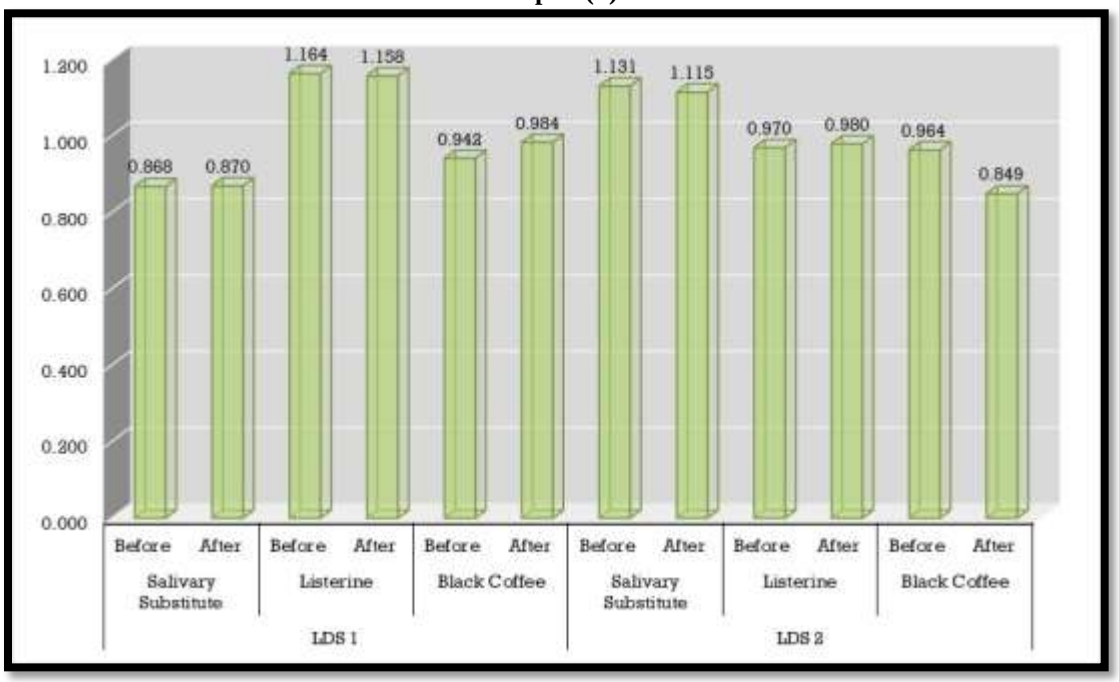
Roughness measurements for the ZrSH groups of 0.9 mm and 1.3 mm thicknesses are shown in Graph 2(a) before and after immersion in the solution. The graph displays the variation in sample ZrSH roughness between groups ZrSH-1 and ZrSH-2 before and after immersion.

Graph 2(a):-



Roughness measurements for the LDS groups of both 0.9 mm and 1.3 mm thicknesses are shown in Graph 2(b) before and after immersion in the solution. The graph displays the variation in sample roughness between groups LDS-1 and LDS-2 before and after immersion.

Graph 2(b):-



The overall comparison of the surface roughness following immersion for each group is shown in Table 3. There are no appreciable differences in the values, as seen.

Table 3:- Overall Comparison.

		Mean	Standard Deviation	p-value
ZrSH 1	**Salivary Substitute**	0.844	0.389	0.728
	Listerine	1.033	0.302	
	Black Coffee	0.980	0.161	
ZrSH 2	**Salivary Substitute**	1.029	0.157	0.159
	Listerine	0.707	0.078	
	Black Coffee	1.314	0.544	
LDS 1	**Salivary Substitute**	0.870	0.240	0.393
	Listerine	1.158	0.319	
	Black Coffee	0.984	0.111	
LDS 2	**Salivary Substitute**	1.115	0.454	0.657
	Listerine	0.980	0.354	
	Black Coffee	0.849	0.138	
p-value based on Analysis of Variance (ANOVA) Test * = Statistically Significant ($p < 0.05$)				

The bargraph depiction of the readings taken after immersion is shown in Graph 3. ZrSH-2 displays the lowest reading when immersed in Listerine and the greatest reading when immersed in black coffee.

Discussion:-

Ever growing esthetic concerns in patients for exact tooth colored restorations makes it a never ending dilemma for the dentists. Materials like lithium disilicate shows enhanced esthetic properties but exhibits poor strength.They are recommended for anterior restorations due to their increased translucency.A new material, Vita Suprinity with an addition of 10% ZrO2 to lithium disilicate has been introduced in the market, which claims of superior translucency and physical properties. This study was designed to evaluate the translucency parameter of two new promising

highly esthetic materials, zolid-fx (super high translucent zirconia) and vita - suprinity (zirconia reinforced lithium disilicate) at two different thicknesses of; 0.9mm and 1.3mm.
In this study, a total of 36 ceramic samples were milled using CAD/CAM of which 18 of them were of A2 pre-shaded super-high translucent zirconia (ZrSH) and the other 18 were A2-preshaded zirconia reinforced lithium disilicate (LDS). Both the groups were further sub-divided into two based on their thicknesses. i.e. 9 samples of 0.9mm thickness, and 9 samples of 1.3mm thickness. The groups were named as ZrSH-1 (0.9mm), ZrSH-2 (1.3mm), LDS-1(0.9mm) and LDS-2 (1.3mm). From each group samples were immersed in salivary substitute (control), three in listerine mouthwash and three in black coffee. The samples were milled in Ceramill motion 2. The specimen were analysed through a spectrophotometer, for the evaluation of change in colour an through a profilometer for the change in surface texture.

Table 1.1 shows the values that was calculated by measuring the color difference (DE) between a material of uniform thickness over a white backing [5]based onCIE L* a* b* color coordinates. The values for each of the 9 specimen in all the four study groups were measured using the spectrophotometer (i1-pro; x-rite). The ΔE values based on the L* a* b* coordinates were calculated before and after the immersion of the samples. The average values of the difference between before and after immersion ΔE values of ZrSH-1 was 1.36, of ZrSH-2 was 1.13, of LDS-1 was 1.10 and of LDS-2 was 1.59 respectively. This table shows that zirconia reinforced lithium di-silicate group, LDS-2 showed higher colour difference values in comparison to super high translucent zirconia groups ie, ZrSH-1 and ZrSH-2 and zirconia reinforced lithium di-silicate group, LDS-1. But the values showed no statistical significance when compared to the baseline.Table.1 shows the spectrophotometric readings obtained for each individual samples of the groups, ZrSH-1, ZrSH-2, LDS-1 and LDS-2 in a more simplified way. The mean value obtained for ZrSH-1 was 1.355, ZrSH-2 was 1.100, LDS-1 was 1.133, and for LDS-2 was 1.588 respectively.

Graph 1 depicts the table 1 in a bar graph form which shows that that the mean values of the difference in the translucency of any of the groups. The minor colour change can be attributed to the fact that the immersion in mouthwash of LDS-2 samples showed maximum deviation among all immersions which could be due to the mouthwash containing alcohol that could have altered the surface morphology of the bio-ceramic material. The alcohol content of Listerine® is 26.9% by volume. [5] This could also be due to the higher amount of ZrO2 in the ZrSH samples in comparison to LDS samples. The ZrSH material has ZrO2 as its primary constituent and 10% yttria added to tone down the opacity; in comparison to LDS samples which is primarily lithium disilicate, a glass ceramic, reinforced with 10% ZrO2.[6]

A smoother surface is less prone to plaque development and staining; zirconia is glazed and generates a polished surface with the least surface roughness as assessed by a profilometer, which may explain why there is no notable variation in colour following mouth-rinse immersion, which may explain why the zolid fx and vita suprinity samples did not exhibit much of a colour difference before and after the treatment. Aqueous acidic environments cause superficial surface deterioration, with dissolving of ceramic particles limited to the surface and little effect on the bulk crystal structure displaying a minor colour variation that was scarcely perceptible to the eyes in this study.[7-9]

Table 2 shows that the intra group comparison ie, the difference in the translucency of the samples within the group before and after immersing in salivary substitute, Listerine mouthwash and black coffee. Considering all the groups, it is the black coffee immersion values that has shown the last amount of standard deviation, i.e the before and after values for ZrSH-1, ZrSH-2, LDS-1 and LDS-2 being 0.241 and 0.161, 0.146 and 0.144, 0.102 and 0.111 & 0.117 and 0.138 respectively. Graph 2(a) and 2(b) depicts the graphic representation of difference between the roughness of the ZrSH and LDS samples, before and after immersion. They both imply that there was no significant difference in the before and after values of the surface roughness of the samples irrespective of the thickness of both the materials, except for samples immersed in black coffee in the groups, ZrSH-2 that showed a p-value of 0.016 and LDS-2 that showed a p-value 0.017. but these values were nothing that was perceptible to ones eyes; nor could this amount of roughness cause any adherence of debri or stains enough to cause noticeable color difference to the ceramic for years. Ceramic surface disintegration is affected by material composition, fabrication methods, surface treatment, and measurement techniques. Previous research found that coffee caused the least discolouration in glazed lithium disilicate restorations.[10] According to Palla et al, the rough surface of the unglazed ceramic allows water intrusion and, as a result, silica network breakdown. This results in decreased crystallinity and increased absorption of coloured pigments. Glazed ceramics, on the other hand, limit water penetration and silica network disintegration due to a lack of surface irregularity and micro-cracks.[11] The findings of their investigation agreed with the findings of our study. Gawriolek et al. observed a comparable mean colour parameter of IPS e-max after 72

hours of soaking in coffee at 1.07129. According to Alencar - Silva et al, the mean colour change due to drinks for both glazed and polished CAD-CAM lithium disilicate ceramic is less than 1.30. [12]

Table 3 shows an overall depiction of the roughness values after immersion in salivary substitute, Listerine and black coffee. The highest is shown by ZrSH-2 after immersion in black coffee and the lowest value is shown by ZrSH-2 immersed in Listerine mouthwash. Graph-3 shows the graphical representation of the same and shows no statistical significance in its values. The minor difference between before and post tests of ceramic materials could be attributed to the presence of different solutions (e.g., water and alcohol) in the immersion solutions. Other parameters like as temperature, pH, and chemical composition could all have an impact on the outcome. Organic dyes that penetrate the micro pores of Zirconia or soak on its surface could be responsible for the observed change in surface roughness. This change in surface shape affects light scattering, shifting UV scatter to a higher or lower value in the visible spectrum.[13] J.A Von Fraunhofer et al investigated the effect of essential oil-infused mouthwash on dental restorative materials. Fluid sorption was found to differ significantly between specimens immersed in pure water and those immersed in Listerine. According to their findings, while the alcohol/essential oil mixture affected fluid sorption, it had no significant impact on the strength or surface properties of the restorative materials. [49] But black coffee in comparison to mouthwash stains the zirconia due to its its acidic ph and there by its ability to dissolute.[14]

1) The following were the study's limitations:

1) Only one shade and one brand of Zirconia and lithium disilicate were tested.

2) It was not possible to reproduce oral circumstances.

3)Only two thickness of the materials were assessedin this study, but the thickness may vary in clinical circumstances.

4) The study did not take into account the complementary effects of brushing and colouring agents in nutrition. Furthermore, the study did not take into account the effect of UV light on the discoloration process. More research is needed to determine the effect of sunlight, salivary proteins, and nutritional colouring agents on the colour stability of all-ceramic restorations.

Conclusion:-

According to the findings of our study, black coffee and Listerine mouthwash did not produce a noticeable colour difference on Zolid-fx and Vita-suprinity restorations because it has no discernible effect on colour or surface roughness. Although there was a colour change, it was not at a level that is perceptible to the human eye.

In our study, mouthwash and coffee were found to change the surface texture of zirconia and lithium disilicate samples, but again, clinically at a less discernible amount.

The conclusions drawn fom this study indicates that Listerine mouth wash and black coffee causes no perceptive discoloration on zolid fx and vitasuprinity restorations of 0.9mm and 1.3mm thickness, under normal oral conditions over a long period of time.

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