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Dentistry Section

Evaluation of Elastic Recovery of Elastomeric Impression Materials Subjected to Various Disinfection Methods: An In-vitro Study

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ABSTRACT

Introduction: Disinfection of impressions is essential to prevent cross-contamination from the operatory to the laboratory. Various methods have been employed to disinfect the impressions. These disinfection methods should not alter the physical and mechanical properties of impression materials.

Aim: To evaluate the Elastic Recovery (ER) of elastomeric impression materials subjected to different disinfection methods.

Materials and Methods: This was an in-vitro study conducted at KIMS Dental College and Hospital, Amalapuram, Andhra Pradesh, India and Vishnu Dental College, Bhimavaram, Andhra Pradesh, India over a period of 5 months from August 2022 to December 2022. A total of 120 impressions were made using three different types of elastomeric impression materials: Poly Vinyl Siloxane (PVS), Vinyl Poly Ether Siloxane (VPES), and Poly Ether (PE). A metal die was made as per American Society for Testing and Materials (ASTM) D412 and International Organisation for Standardisation (ISO) Specification 4823, containing a lower and upper member. These impressions were trimmed to the dimensions of a stainless steel stencil, measuring at points with uniform thickness. The impressions were then subjected to autoclave and chemical disinfection using 5% Glutaraldehyde (Korsolex) and Ethanol-2-Propanol (Bacillol). The samples prepared were fixed in the tensile grips of a Universal Testing Machine (UTM) and subjected to tensile loading at a crosshead speed of 10 mm/minute until tearing. The distance between the break ends was measured using a digital Vernier Callipers, and ER was measured. One-way Analysis of Variance (ANOVA) followed by Tukey's post-hoc tests were used to analyse the obtained study data.

Results: The PE impression material demonstrated more ER when subjected to different disinfection methods compared to the other materials. Significant differences were observed between the ER of impression materials with different disinfection methods (Autoclave: $p<0.001$, Korsolex: $p<0.001$, and Bacillol: $p=0.007$).

Conclusion: For better ER, PVS can be sterilised with Bacillol and Korsolex. Korsolex should be avoided for disinfecting PE. VPES performed better with autoclave and Korsolex.

Keywords: Cross-contamination, Glutaraldehyde, Vinyl poly ether siloxane, Tear strength

INTRODUCTION

An impression may serve as a harbour for various pathogens, posing a risk of indirectly spreading infectious diseases, including Human Immunodeficiency Virus (HIV), hepatitis, and herpes, to dental professionals and laboratory personnel. Therefore, dental professionals should follow specified disinfection methods to reduce the risk of cross-infection and the possible transmission of diseases [1]. Dental impressions are disinfected using a variety of methods, such as autoclaving, chemical disinfection, microwave disinfection, etc. The most popular techniques are chemical disinfection and autoclaving. Alcohol, 2% glutaraldehyde, ethanol, propanol, sodium hypochlorite, and chlorhexidine are common chemical disinfectants used in dentistry [2].

During the disinfection procedure, the impression material should not undergo dimensional changes. However, numerous investigations have indicated that the mechanical and physical characteristics of the impression may be adversely affected by immersing the impression in the disinfectant or spraying it with the disinfectant. Disinfection methods that alter the volumetric shrinkage, surface texture, and elasticity of the impression material have been reported in the literature [3].

Recently, a hybrid elastomeric impression material, VPES, has been introduced by combining the favourable characteristics of both PVS and Polyether (PE) impression materials [4]. Numerous researchers have investigated the physical and mechanical properties of these newly developed hybrid elastomeric impression materials [5-7]. However, there is a research gap on the impact of various disinfection techniques on the physical and mechanical characteristics of the VPES impression material. Therefore, the present study aimed to investigate the impact of various disinfection methods on the ER of VPES impression material and compared them with PVS and PE impression materials. The present study is part of a larger project to assess the Dimensional Stability (DS) and ER of the elastic impression materials.

MATERIALS AND METHODS

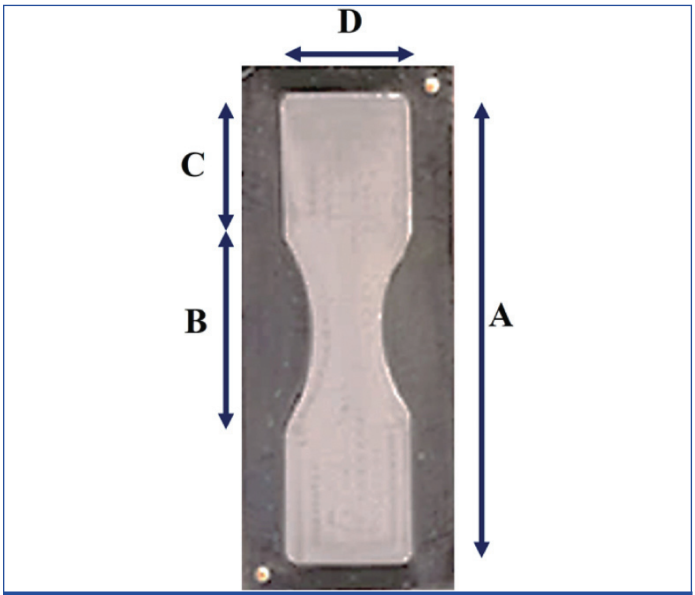
This was an in-vitro study conducted at KIMS Dental College and Hospital, Amalapuram, Andhra Pradesh, India and Vishnu Dental College, Bhimavaram, Andhra Pradesh, India over a period of 5 months from August 2022 to December 2022. The Institutional Ethical Committee (IEC) approval was obtained with the IEC No: 010/KIMSDENTAL/2020.

Sample size calculation: Sample size calculations were conducted using G*Power 3.1.9.7 software to determine the difference in ER between groups as the primary outcome. The calculations were based on an effect size of 0.31 (derived from the pilot study), an alpha level of 0.05, and a desired power of 80%. The estimated sample size required for the study was determined to be 118.

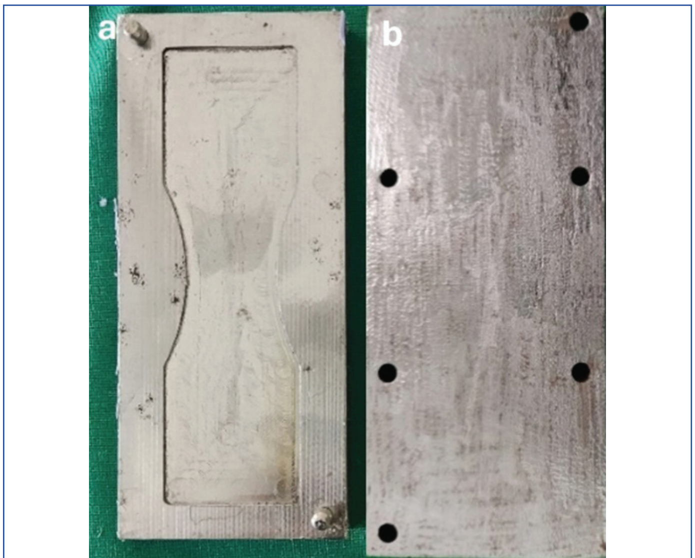
Study Procedure

Die preparation: A custom-made metal die was fabricated according to ASTM specification number D 412 [7], containing a lower and upper member with dimensions of 11.5 cm length×5 cm breadth×1 cm width.

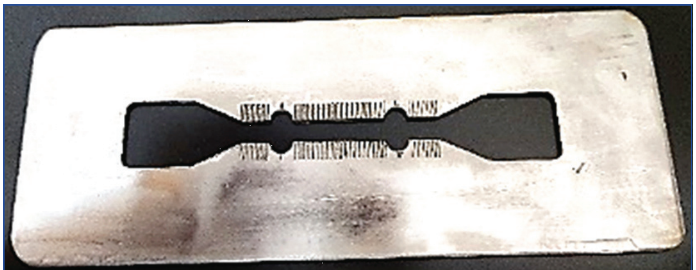
This die was manufactured using Standard Triangular Language (STL) format with respective dimensions with a 4-axis Computerised Numerically Controlled (CNC) Milling Machine (Kent India Co., Ltd., Taiwan) and a coolant (CUT S, Servo, Indian Oil Corporation Ltd, Mumbai, India, Batch No. 082ITD0011). It had an hourglass-shaped recess cut to a thickness of 1 mm and dimensions of A 10 cm, B 4 cm, C 3 cm, D 3 cm [Table/Fig-1]. The upper component comprised a metal lid that covered the lower part. It incorporated four escape holes to facilitate the overflow of excess material, ensuring a consistent 1 mm thickness of the specimen [Table/Fig-2a,b]. Additionally, the lid was equipped with two stops positioned diagonally on two corners to ensure stable alignment when placing the upper component onto the lower component [Table/Fig-2a,b]. A stainless-steel stencil [Table/Fig-3] of 1 mm thickness was also manufactured. Dimensions measuring the width of 4 mm, a semi-circular shaped projection placed at 10 mm away from the centre of the specimen on either side [Table/Fig-2]. The samples were made at room temperature (27±2°C) with each elastomeric impression material (PVS, PE, VPES) [Table/Fig-4].



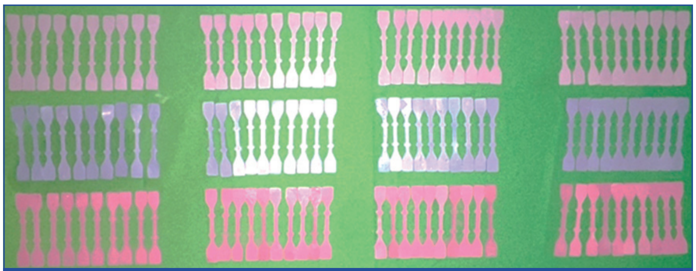
[Table/Fig-1]: Hourglass-shaped recess.



[Table/Fig-2]: Metal recess lid.



[Table/Fig-3]: Stainless-steel stencil.



[Table/Fig-4]: The specimens made with different elastomeric impression materials.

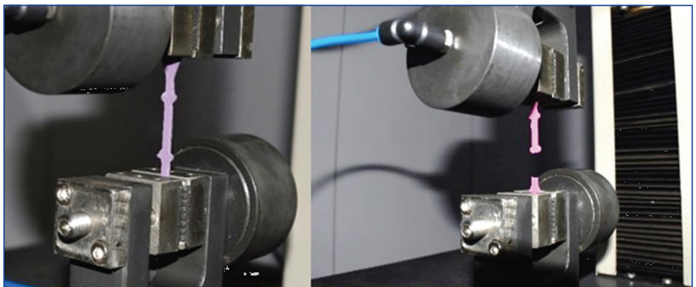
Sample preparation: All the elastomeric impression materials were of medium body (Monophase) consistency opted for the present study. The impression materials were manually dispensed and mixed in accordance with the manufacturer's specified instructions. The mix was loaded into the lower member of the die, and the upper member was placed upon the lower member, and a constant weight of 5 lbs for 10 minutes was applied to the upper member. The mix was left for a few minutes and allowed to set, and after setting, the excess material was removed with a BP Blade. A thickness of 1 mm was measured for the sample with a digital Vernier calliper to rule out any discrepancies that occurred during sample preparation. The resultant samples were trimmed to the dimensions of a metal stencil. The metal stencil was dumbbell-shaped measuring at (1 mm Thickness, 4 mm Width×75 mm Length) provided with two semi-circular measuring marks on each side, positioned 20 mm apart from the centre.

A total of 120 samples were prepared, with 40 samples from each of the three different elastomeric impression materials. The 40 samples from each impression material were further divided into four groups, with 10 samples (n=10) in each group based on the disinfection methods.

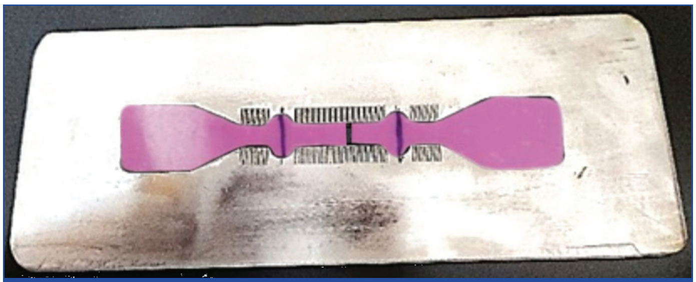
Sample disinfection: The samples were subjected to three disinfection methods, including autoclaving, immersion in the disinfection solution, and spraying the disinfectant. The samples washed under running tap water were considered the control group. Ten samples (n=10) from each impression material were allocated to each disinfection method.

Autoclaving was performed at 121°C for 15 minutes at an atmospheric pressure of 12 Pounds per Square Inch (PSI). For the immersion disinfection method, the samples were immersed in the disinfection solution, Korsolex (5% Glutaraldehyde) Rapid, for 5 minutes. In the spraying method, the samples were sprayed with the disinfectant, Bacillol (10% Ethanol), for 20 seconds and left for 10 minutes.

Elastic Recovery (ER) measurement: After the disinfection process, the samples were washed under tap water and air blown to remove any disinfectant residues. Subsequently, the samples were subjected to tensile loading using the Universal Testing Machine (UTM) (AE-UTM-LC2, India) [Table/Fig-5]. The samples were fixed in the pneumatic grips of the UTM and subjected to tensile load at a crosshead speed of 10 mm/min until the specimens tore. The torn samples were reattached using the metal stencil [Table/Fig-6], and the distance between the marked lines was measured two



[Table/Fig-5]: The specimen subjecting to tensile loading on the UTM.



[Table/Fig-6]: The specimen refitted into the metal stencil after subjecting to tensile loading.

hours after the sample failure using a Digital Vernier Callipers with a resolution of 0.01 mm. The change in length (ΔL) was measured to calculate the percentage deformation, which helped in assessing the ER. The ER was measured with the formula:

ER=(Final length after 2 hours of specimen failure/Original length)×100

STATISTICAL ANALYSIS

The obtained data were analysed using the Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM SPSS, IBM Corp., Armonk, NY, USA). One-way ANOVA was used for analysing the ER of the samples. Tukey's post-hoc tests were conducted for inter group comparisons. A p-value less than 0.05 was considered statistically significant.

RESULTS

The mean ER of three elastomeric impression materials disinfected with different methods is described in [Table/Fig-7]. Among the VPES group, the VPES control group showed a higher mean ER. A decrease in the ER was observed in the disinfected groups of VPES material compared to the control group. In the PVS impression material, disinfected with Korsolex, showed a higher ER followed by the control group and Bacillol groups. The autoclaved PVS material demonstrated a lower ER (2.640±1.151%). In the PE material, autoclaved PE material showed a higher ER (4.970±1.666%) compared to the other groups. For each of the three elastic impression materials, no significant differences (p=0.44, p=0.083, and p=0.689 for VPES, PVS, and PE, respectively) were observed in ER based on the type of disinfection [Table/Fig-7].

Impression material	Type of disinfection	Mean±SD#	p-value
VPES	Control	2.560±1.080	0.44
	Autoclave	1.900±1.335	
	Korsolex	1.660±1.265	
	Bacillol	2.030±1.318	
PVS	Control	4.080±2.535	0.083
	Autoclave	2.640±1.151	
	Korsolex	4.495±0.910	
	Bacillol	3.475±1.489	
PE	Control	4.495±2.229	0.689
	Autoclave	4.970±1.666	
	Korsolex	4.410±1.330	
	Bacillol	4.075±1.239	

[Table/Fig-7]: Comparison of Elastic Recovery (ER) (%) within each type of impression material based on the type of disinfection (one-way ANOVA).
#Standard deviation

In comparisons based on the impression material within each type of disinfection, there were no significant differences between impression materials in the control group, while significant differences were noted with autoclave, Korsolex, and Bacillol ($p<0.001$, $p<0.001$, and $p=0.007$, respectively) [Table/Fig-8].

Disinfection	Impression material	Mean±SD#	p-value
Control	VPES	2.560±1.080	0.103
	PVS	4.080±2.535	
	PE	4.495±2.229	
Autoclave	VPES	1.900±1.335	<0.001*
	PVS	2.640±1.151	
	PE	4.970±1.666	
Korsolex	VPES	1.660±1.265	<0.001*
	PVS	4.495±0.910	
	PE	4.410±1.330	
Bacillol	VPES	2.030±1.318	0.007*
	PVS	3.475±1.489	
	PE	4.075±1.239	

[Table/Fig-8]: Comparison of Elastic Recovery (ER) (%) between different impression materials within each type of disinfection (one-way ANOVA).
#Standard deviation and *Significant difference

In inter group comparison, PE showed significant differences with VPES ($p<0.001$) and PVS materials ($p=0.003$) after subjecting autoclave disinfection. Korsolex disinfection demonstrated significant differences between the impression materials (VPES-PVS: $p<0.001$; VPES-PE: <0.001) except between PVS and PE. Bacillol disinfection displayed significant differences between VPES and PE materials ($p=0.006$) [Table/Fig-9].

Dependent variables	(I) Group	(J) Group	Mean difference (I-J)	Std. error	Significance
Control	VPES	PVS	1.520	0.915	0.239
		PE	1.935	0.915	0.106
	PVS	PE	0.415	0.915	0.893
Autoclave	VPES	PVS	0.740	0.626	0.474
		PE	3.070	0.626	<0.001*
	PVS	PE	2.330	0.626	0.003*
Korsolex	VPES	PVS	2.835	0.529	<0.001*
		PE	2.750	0.529	<0.001*
	PVS	PE	0.085	0.529	0.986
Bacillol	VPES	PVS	1.445	0.605	0.061
		PE	2.045	0.605	0.006*
	PVS	PE	0.600	0.605	0.589

[Table/Fig-9]: Multiple pair-wise comparisons for Elastic Recovery (ER) between different impression materials within each type of disinfection.

DISCUSSION

Sterilisation and disinfection of impressions have become mandatory protocols for every dentist to prevent several cross infections that are caused by saliva [8-10]. High-level disinfection involves the maximum elimination of all microorganisms from an object, except for a few bacterial spores. It entails using a sterilant to kill appropriate Mycobacterium species with a shorter contact time, according to Food and Drug Administration (FDA) guidelines [11].

In present study, the ER was considered another important parameter among the ideal requisites of an elastomeric impression material [12]. Elastomer theory states that the impression removal from the oral cavity and the resulting gypsum model are closely related to an impression material's shear modulus [13]. According to the fracture mechanics theory, stresses at a weak or critical spot are those that cause an impression to fail. Thus, there is a connection between tear strength and modulus of elasticity [14].

The present study demonstrated no significant differences within the individual disinfection methods of the three impression materials. However, significant differences were observed between the materials subjected to different disinfection

S. No.	Author's name and year	Number of subjects	Materials compared	Disinfection methods used	Parameters assessed	Conclusion
1	Miller BJ (2014) [15]	24	Two addition-cured elastomers, Affinis light body (Coltene) and Aquasil low viscosity (Dentsply) and one Condensation - cured elastomer, Speedex (Coltene).	Autoclave, and disinfection with Perform®-ID (an aldehyde-free chemical disinfectant solution with potassium peroxomonosulphate)	Dimensional stability and tear strength	The findings of this laboratory research indicate that steam autoclaving can be successfully employed for the sterilisation of dental impressions made from either addition- or condensation-cured silicone. This method showed comparable results to disinfection with Perform-ID and untreated samples, without causing notable changes in dimensions or tear strength that would be clinically significant.
2.	Khatri M et al., (2020) [16]	30	Poly Vinyl Siloxane (PVS), Polyether (PE) and Vinyl Polyether Siloxane (VPES) of heavy and light body consistencies	2.45% Glutaraldehyde, 3% Sodium Hypochlorite	Surface detail replication and dimensional stability.	Upon immersion disinfection, VPES exhibited superior Dimensional Stability (DS) and surface detail reproduction compared to PVS and PE. Despite minor differences, all materials (PVS, PE, VPES) were deemed clinically acceptable with high accuracy levels.
3.	Kavita K et.al., (2021) [17]		Polyvinyl siloxane (PVS) (regular body), PVS (medium body), PVS (heavy body), and polyether (medium body) impression materials.	Glutaraldehyde (2%) and Sodium Hypochlorite (NaOCl, 0.525%)	Dimensional accuracy	The most stable among the impression materials analysed was found to be PVS (heavy body). The authors also discovered that polyether was stable based on the impression materials tested.
4.	Guiraldo RD et al., (2018) [18]	40	Polydimethylsiloxane (Oranwash L), polyvinyl siloxane (Express), polysulfide (Permlastic), and polyether (Impregum Soft)	0.2% chloramine-T.	The stability of elastomers through detail reproduction and its Dimensional Stability (DS)	All the impression materials made of elastomers were able to reproduce details with 100% accuracy, regardless of the disinfection process used. The mean values of DS for polysulfide (without disinfection) and polysulfide and polydimethylsiloxane (after being disinfected with 0.2% chloramine-T) were found to be smaller than the other materials.
5.	Gothwal G et al. (2019) [12]	90	Two PVS (Affinis and Aquasil) and one condensation-polymerised silicone (Speedex) impression materials	Chemical disinfection (Surfasept S.A, aldehyde free disinfectant solution with 70% w/w of isopropyl alcohol and 2.5% w/w chlorhexidine gluconate) and steam autoclaving.	Elastic Recovery (ER)	The three materials utilised in the research can be sterilised without any risk after clinical usage and before being dispatched to the laboratory. This process did not have a significant effect on their elastic recovery.
6.	AlZain S (2019) [19]	36	Vinyl polysiloxane-light (VPL), Vinyl Polysiloxane-regular (VPR) viscosity and Polyether-monophase (PE)	0.5% glutaraldehyde spray disinfection method.	surface wettability	The wettability of impression materials was improved by using 0.5% glutaraldehyde for disinfection purposes. Glutaraldehyde worked as a surfactant, reducing the surface tension and thereby enhancing the wetting potential of the impression materials.
7.	Kamble SS et al. (2015) [20]	30	Dentsply aquasil (addition silicone polyvinylsiloxane syringe and putty), Zetaplus (condensation silicone putty and light body), and Impregum penta soft (polyether)	Autoclave, chemical (1% sodium hypochlorite), and microwave methods.	Dimensional accuracy	The impression material undergoes slight dimensional changes during disinfection procedures. However, these changes fall within the American Dental Association's specifications. Therefore, steam autoclaving and microwave techniques can be employed as effective alternatives to chemical sterilisation.
8.	Wezgowiec J et al. (2022) [21]		Putty, medium, and light consistencies of condensation silicones and addition silicones.	Ultraviolet C (UVC) radiation, gaseous ozone, and common chemical disinfectants (commercial spray and solution)	Antimicrobial efficacy against *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Candida albicans*.	The three disinfection methods, UVC radiation, gaseous ozone, and liquid chemical, employed in this study had similar levels of efficiency.
9.	Mathew S et al. (2017) [22]	20	Addition silicone	Radiofrequency glow discharge (RGD)	Antimicrobial efficacy.	The authors suggested that the RGD is a rapid and convenient method of infection control and handy in dental operatory compared to other methods.
10	Poulis N et al. (2016) [23]	32	Two vinyl polysiloxane silicones, one polyether, and one vinyl polyether silicone.	Immersion and ozone disinfection.	Surface quality through Scanning Electronic Microscopy (SEM)	The results of the SEM analysis indicate that both ozone and immersion disinfectants cause comparable changes to the surface of impression material.
11.	Ashil AM et al. (2024) [24]		Elastomeric impression materials.	Ozone, UV radiation (254 nm), herbal, and 2%glutaraldehyde.	Antimicrobial activity	Dry gaseous ozone and UV radiation were more effective for the disinfection of impressions.
12.	Nassar U et al. (2017) [4]	200	Vinyl Polyether Silicone (VPES)	Immersion in a 2.5% buffered glutaraldehyde solution for 30 minutes	Dimensional stability	The VPES remained dimensionally stable and suitable for clinical use even after undergoing a 30-minute disinfection process using glutaraldehyde and stored for a period of up to 2 weeks.
13.	Melilli D et al. (2008) [25]	24	Polyether (PE) and addition polysilicone (PVS)	Immersion in quaternary ammonium compounds, and glutaraldehyde plus	Dimensional stability	The effects of immersion disinfection on the dimensions of elastomers are not clinically relevant.
14.	Lad PP et al. (2015) [26]		Addition silicone, condensation silicone and polyether.	4-6% Sodium hypochlorite, 2% glutaraldehyde and a surface wetting agent	Wettability	The short-term disinfection did not affect the wettability of the three elastomeric impression materials.

15.	Kotha SB et al. (2017) [27]	200	Different Polyvinylsiloxane elastomers (Coltene President, Coltene Affinis, Dentsply Aquasil, 3M ESPE Express STD and GC Exafast)	Chemical disinfection, autoclave, and microwave sterilisation	Tensile strength, surface roughness, and wettability	Autoclave sterilisation and chemical disinfection did not show any statistically significant effect on the tested elastomer properties. Therefore, autoclave sterilisation can be considered a suitable and effective alternative for disinfection and sterilisation purposes.
16.	Thota KK et al. (2014) [28]	45	Condensation silicone, addition silicone, and polyether.	Autoclaving	Dimensional stability	All three impression materials exhibited considerable dimensional changes at three distinct time intervals, but none of these changes had any clinical significance.
17.	Bhasin A et al. (2013) [29]	180	Vinyl polysiloxane putty body material	Microwave	Antimicrobial activity	Complete elimination of C. albicans and P. aeruginosa was achieved after 5, 6 and 7 minutes of microwave disinfection. However, *Staphylococcus aureus* colonies were still present after 5 and 6 minutes of exposure but were eliminated completely after 7 minutes. The strains of *C. albicans and P. aeruginosa* were completely eliminated after 5 minutes of exposure, while S. aureus was completely eliminated only after a 7-minute exposure.
18.	Sinobad T (2014) [30]	120	Two condensation and 2 addition silicones.	Glutaraldehyde, benzalkonium chloride-Sterigum and 5.25% NaOCl	Dimensional accuracy.	The most significant changes in the dimensions of addition and condensation silicone impressions were noticeable within the initial hour of their removal from the model.
19.	Surendra GP et al. (2011) [31]	40	Polyvinyl siloxane-affinis	Autoclaving	Dimensional stability	This study reported that autoclaving of impression is an effective method of sterilisation.
20.	Present study	120	Polyvinyl Siloxane (PVS) and Polyether (PE), and Vinyl Polyether siloxane (VPES).	Autoclaving, immersion in the disinfection solution, Korsolex (5% Glutaraldehyde) Rapid, and spraying Bacillol (10% Ethanol).	Elastic Recovery (ER)	PE impression materials showed more Elastic Recovery (ER) on subjecting to different disinfection methods compared to the PVS and VPES materials.

[Table/Fig-10]: Comparison of effects of disinfection methods on the properties of elastomeric impression materials [4,12,15-31].

methods. Various disinfection techniques have been studied in the literature to determine their effect on the different properties of elastomeric impression materials [Table/Fig-10] [4,12,15-31].

The ER results of the present study were in accordance with Millar BJ and Sanjukta D [15]. They found significant differences between the groups with autoclave and disinfection with Perform®-ID (an aldehyde-free chemical disinfectant solution containing potassium peroxomonosulphate) compared to the control group. Also, Lawson NC et al., evaluated the tensile ER of five PVS materials and one hybrid VPES elastomeric impression material and suggested that all the materials tested exceeded the elongations of 100% tension before failure [32].

The PVS is often considered the optimal elastic impression material due to its superior ER and minimal permanent deformation compared to other elastomers [12]. The type and formulation of the elastomer, such as addition-cured silicones, condensation-cured silicones, polyethers, or vinyl polysiloxanes, could affect their elastic properties [33]. In the present study, the ER of PVS and PE impression materials increased with disinfection by Korsolex and autoclaving, respectively. Similarly, Gothwal G et al., reported an increase in the ER of PVS following disinfection [12]. However, the type of disinfectants used in their study was different from the present study.

According to Goldberg AJ, viscous flow and lack of ER led to permanent deformation in elastomeric impression materials [34]. However, with prolonged polymerisation and cross-linking of the material, all three deformation factors like immediate elastic, delayed elastic, and viscous flow will eventually be diminished. A high strain rate resulted in better overall ultimate tensile strength and ER [35]. The present study investigated the ER within 24 hours of the specimens being fabricated.

The VPES material has a quadra-functional hydrophilic feature consisting of a cross-linked polymer and a unique surface-active ingredient. The exceptional tear strength of the product is attributed to the polymer chain of the material and the surface-active agent responsible for making it equally wettable as polyether impression materials. This particular PVS modification makes it possible to record superb surface details even in humid environments. Modified PVS has extremely high tear strength due to its quadra-functional feature, which is unsurpassed by any other impression material [32].

The differences in the calculated measurements might be due to the cumulative effect of retarded ER, the shrinkage caused by continuous polymerisation, the evaporation of volatile constituents, and the viscoelastic nature (viscous flow) of the material that was tested [36,37]. In the present study, VPES has a lower ER with a minimal mean value when compared to the other materials (PVS and PE) when subjected to different methods of sterilisation disinfection. Further studies may focus on the impact of disinfection methods on the other physical and mechanical characteristics of elastomeric impression materials.

Limitation(s)

The present study was an in-vitro study conducted at room temperature, potentially differing from the oral environment. The absence of exposure to saliva during impression-making could introduce variability, given saliva's potential influence on material properties. The impressions were not exposed to microbial flora, another factor that wasn't considered in the study. Additionally, the study did not simulate the thermal changes impressions might undergo during transportation, which could impact their properties. Therefore, by addressing these limitations, future research can enhance understanding of the factors influencing impression material performance and contribute to improving the accuracy and reliability of dental impressions in clinical practice.

CONCLUSION(S)

From the present study, it can be concluded that the PE impression materials showed higher ER when subjected to different disinfection methods compared to the PVS and VPES materials. No significant differences were observed between the disinfection methods of impression materials. However, significant differences were observed between the impression materials with individual disinfection methods.

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