Original Research Paper

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"A Comparative Evaluation of The Wettability of Four Denture Base Materials To Three Commercially Available Saliva Substitute: An In Vitro Study"

Abstract:

AIM: The purpose of this study was to compare the wettability of three saliva substitute (Saleva, Wet Mouth and GC Dry Mouth) to four denture base materials (Heat cured, High Impact, Nylon and Cobalt – Chromium metal base).

Materials and Methods: A total of 60 samples were made, 15 each of the four denture based materials used that are Heat cure PMMA, High impact PMMA, Nylon based denture base and cobalt chromium based denture base. Three commercially available saliva substitutes Saleva, Wet Mouth and GC Dry Mouth were taken to compare the wettability of the denture base materials with the help of Contact Angle Goniometer.

Results: According to the result derived from this study, the nylon based denture base material was the most easily wettable denture base material while the greatest hysteresis value was offered by Wet Mouth saliva substitute.

Conclusion: 1. It was concluded that the nylon based denture base material was most easily wettable denture base material and Wet Mouth offered the greatest hysteresis value. 2. It was also concluded that the combination of nylon based denture base material and Wet Mouth offered the greatest retention.

Keywords: Contact angle, denture base material, retention, saliva substitute, wettability

Introduction:

The specialty of Prosthodontics has emerged as a science to provide replacement of missing dentition for its form and functions along with associated structures. Any successful complete denture treatment combines exemplary technique, effective patient rapport, patient education, and familiarity with all possible management options in order to provide maximum satisfaction to patient. There are some forcing situations where providing desirable (optimal) retention may be a problem. In such types of patients use of denture adhesives is recommended for enhancing the quality of retention. The use of salivary substitutes provides comfort and additional confidence not only by increasing the adhesive and cohesive properties of the denture but also eliminating and compensating voids between the denture base and the basal seat. This study was undertaken to evaluate the enhancement of retentive quality of complete denture with the use of salivary substitutes available in Indian markets for the use by denture wearers. [1]

The successful complete denture must provide a desired degree of retention and stability to the prosthesis. Saliva is critical for retention of dentures and provides comfort while wearing removable prosthesis. Denture wearing may become difficult because dry mouth can significantly add to the problem of retaining and eating with the dentures, which

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invariably become loose. The salivary mucins possess rheological properties that include elasticity and adhesiveness, which aid in retention of dentures. [2]

Replacement of saliva by a fluid other than saliva has been proposed as a possible treatment in relieving subjective complaints of xerostomia for more than three decades. [3] Therefore, saliva substitutes containing thickening agents for longer relief and increased moistening and lubrication of the oral surfaces have been developed. These are agents formulated as solutions, sprays or gels and have multiple contents including carboxymethylcellulose, electrolytes and flavouring. Ideally saliva substitutes should be pleasant in taste and odour, non-toxic, non-addictive, economical and must exhibit good wetting of the tissue surface of the denture. Wettability is the tendency of one fluid to spread on, or to adhere to, a solid surface in the presence of other immiscible liquids. Complete dentures are retained by a combination of muscular forces exerted by the cheeks, tongue, and lips, and by physical forces acting between the supporting tissues, the denture base, and the interposed film of saliva. [4]
The four denture base materials (heat cured PMMA, high impact PMMA, nylon based and cobalt chromium based denture base materials) have been included in the study, few patients have been found allergic to methylmethacrylates. In such cases, the use of alternative denture base materials such as nylon based denture base materials e.g. Lucitone FRS and polycarbonates have been advocated. Therefore, the study of wetting properties on these various denture base materials is essential to aid the clinician in his choice of material for various salivary substitutes.

Materials And Methods:

A total of 60 samples of denture base materials were made, 15 each of heat cured PMMA, high impact PMMA, nylon based denture base material and cobalt chromium based denture material. These were tested with three commercially available saliva substitutes Saleva, Wet Mouth (ICPA) and GC Dry Mouth gel. Conventional acrylic denture base resin – fifteen wax patterns of 21 mm × 16 mm × 2 mm (length × width × thickness) were fabricated. These were invested in flasks and dewaxed. Conventional acrylic denture base resin (DPI heat cure material) was then packed into these moulds and acrylized according to the manufacturer's instructions. The specimens obtained were trimmed and sandpapered to obtain specimens of dimensions of 20 mm × 15 mm × 2 mm with a uniform surface. The specimens were not polished to simulate the tissue surface of dentures.

High-impact acrylic denture base resin – fifteen wax patterns were prepared as with conventional acrylic denture base resin, invested, and dewaxed. The moulds were packed with high-impact acrylic denture base resin (Trevalon HI) and acrylized according to the manufacturer's instructions. The specimens were trimmed and sandpapered to obtain specimens of 20 mm × 15 mm × 2 mm dimensions with a uniform surface. The specimens were not polished as with the conventional acrylic resin. Nylon (Lucitone FRS) -based denture base material – fifteen specimens of 20 mm × 15 mm × 2 mm with a uniform surface were fabricated using injection moulding technique. The moulds were packed with nylon based denture base material and acrylized according to the manufacturer's instructions. The specimens were trimmed and sandpapered to obtain specimens of 20 mm × 15 mm × 2 mm dimensions with a uniform surface. The specimens were not polished as with the conventional acrylic resin. Cobalt - Chromium metal denture base – fifteen specimens of 20mm X 15mm X 2mm with uniform surface were fabricated using centrifugal technique. The wax patterns were invested in phosphate bonded investment material and casting was done according to the manufacturer's instructions. The specimens were trimmed and sandpapered to obtain specimens of 20 mm × 15 mm × 2 mm dimensions with a uniform surface. The specimens were not polished as with the conventional acrylic resin.

Dynamic contact angle analysis was used to measure the advancing and receding contact angles using a goniometer (Dataphysics, SCA 20). The fluid/media was tested and dispensed by a syringe onto the specimen. The system allows for a standardized volume of fluid to be used on the specimen surface while measuring the advancing and receding contact angles. The system uses a high-speed camera to record changes of the drop contour which has been dispensed on to the specimen surface. The system's program determines the advancing and receding contact angles. The contact angle is the angle formed by the baseline of the drop and a tangent at the three phase line (solid/liquid/vapour).

The advancing contact angle was measured as the contact angle that the liquid drops forms when dispensed on the dry specimen surface, while the receding contact angle formed after the liquid has receded from the surface. Before dispensing a different fluid onto the specimen, care was taken to thoroughly rinse the dispensing syringe with water, followed by the fluid which was tested. Advancing and

receding contact angles of each of the three media to ten specimens of each denture base material were measured, that is, a total of 12 groups were tested. The groups were:

Group A:

(a) Conventional heat polymerized polymethylmethacrylate denture base resin & Saleva.
(b) Conventional heat polymerized polymethylmethacrylate denture base resin & Wet Mouth
(c) Conventional heat polymerized polymethylmethacrylate denture base resin & GC Dry Mouth

Group B:

(a) High-impact polymethylmethacrylate acrylic denture base & Saleva.
(b) High-impact polymethylmethacrylate acrylic denture base & Wet Mouth.
(c) High-impact polymethylmethacrylate acrylic denture base & GC Dry Mouth.

Group C:

(a) Nylon-based denture base material & Saleva.
(b) Nylon-based denture base material & Wet Mouth.
(c) Nylon-based denture base material & GC Dry Mouth.

Group D:

(a) Cobalt – Chromium metal denture base & Saleva.
(b) Cobalt – Chromium metal denture base & Wet Mouth.
(c) Cobalt – Chromium metal denture base & GC Dry Mouth.

Results:

The present in-vitro study evaluates and compares the wettability of three saliva substitute (Saleva, Wet Mouth and GC Dry Mouth) to four denture base materials (Heat cured, High Impact, Nylon and Cobalt – Chromium metal base). Total 60 casts/samples were selected and randomized equally (i.e. n=15 per group) into four groups and treated with three different commercially available saliva substitutes.

Obtained values of Advancing and Receding contact angles:

N = 60	Group A : Heat cured PMMA (DPI)	Group B : High Impact PMMA (Trevalon)	Group C : Nylon based (Lucitone FRS)	Group D : Cobalt – chromium metal base
Saliva substitute 1 (Saleva) N1 = 20	A1 na1=51.9°, nr1=53.9° na2=52.3°, nr2=52.6° na3=52.7°, nr3=52.5° na4=53.1°, nr4=53.4° na5=52.4°, nr5=52.9°	B1 na1=57.3°, nr1=52.7° na2=62.3°, nr2=58.2° na3=58.4°, nr3=64.2° na4=61.6°, nr4=57.3° na5=56.4°, nr5=51.8°	C1 na1=69.4°, nr1=71.3° na2=64.2°, nr2=64.7° na3=64.6°, nr3=61.8° na4=67.6°, nr4=69.3° na5=68.4°, nr5=71.8°	D1 na1=58.3°, nr1=58.6° na2=60.9°, nr2=61.2° na3=59.2°, nr3=59.8° na4=61.4, nr4=61.9° na5=60.2°, nr5=61.1°
Saliva substitute 2 (Wet Mouth – ICPA) N2 = 20	A2 na1=97.0°, nr1=97.6° na2=99.8°, nr2=100.7° na3=101.2°, nr3=100.2° na4=98.4°, nr4=99.0° na5=99.2°, nr5=99.9°	B2 na1=100.0°, nr1=99.8° na2=107.6°, nr2=107.3° na3=117.6°, nr3=116.8° na4=61.6°, nr4=103.6° na5=110.3°, nr5=109.6°	C2 na1=109.6°, nr1=107.8° na2=102.0°, nr2=101.8° na3=99.0°, nr3=99.2° na4=106.6°, nr4=106.8° na5=106.2°, nr5=104.6°	D2 na1=90.6°, nr1=90.8° na2=98.9°, nr2=100.2° na3=92.6°, nr3=92.9° na4=94.3°, nr4=94.8° na5=101.2°, nr5=101.6°
Saliva substitute 3 (GC Dry mouth) N3 = 20	A3 na1=81.6°, nr1=84.6° na2=79.3°, nr2=80.9° na3=78.3°, nr3=81.2° na4=81.2°, nr4=83.8° na5=79.7°, nr5=81.6°	B3 na1=92.0°, nr1=92.9° na2=106.1°, nr2=103.7° na3=93.6°, nr3=90.8° na4=103.2°, nr4=101.6° na5=96.4°, nr5=94.1°	C3 na1=94.8°, nr1=96.6° na2=80.3°, nr2=77.8° na3=88.6°, nr3=91.8° na4=92.6°, nr4=94.2° na5=91.4°, nr5=93.6°	D3 na1=93.7°, nr1=96.6° na2=89.3°, nr2=88.6° na3=82.0°, nr3=77.7° na4=92.8°, nr4=91.2° na5=86.2°, nr5=84.8°

Table 1 – Advancing and Receding Contact Angle Values

Where, na1, na2, na3, na4 & na5 are the advancing contact angle values of the respective sub groups i.e. A1, A2, A3, B1, B2, B3, C1, C2, C3, D1, D2 and D3.

nr1, nr2, nr3, nr4 & nr5 are the receding contact angle values of the respective sub groups i.e. A1, A2, A3, B1, B2, B3, C1, C2, C3, D1, D2 and D3.

Calculation of hysteresis value:

The hysteresis was calculated as the difference between the advancing and receding contact angles for each of the specimens tested.

For example, for subgroup A1:

Hysteresis value will be H1 = (na1 – nr1)

Similarly, the hysteresis value for all subgroups were calculated, as shown in the following table.

N = 60	Group A : Heat cured PMMA	Group B : High Impact PMMA	Group C : Nylon based (Lucitone FRS)	Group D : Cobalt – chromium metal base
Saliva substitute 1 (saliva)	A1 H1= -2° H2= -0.3° H3= -0.1° H4= -0.3° H5= -0.5°	B1 H1= 2° H2= 0.2° H3= -0.2° H4 = 0.8° H5= 0.6°	C1 H1= -1.9° H2= -0.5° H3= 2.7° H4= -1.7° H5= -3.4°	D1 H1= -0.3° H2= -0.3° H3= -0.6° H4= -0.5° H5= -0.9°
Saliva substitute 2 (Wet Mouth – ICPA)	A2 H1= -0.5° H2= -1.5° H3= 1° H4= -0.6° H5= -0.7°	B2 H1= 0.5° H2= 0.3° H3= 0.8° H4= 0.7° H5= 0.7°	C2 H1= 4.6° H2= 4° H3= 4.2° H4= 4.3° H5= 4.6°	D2 H1= -0.3° H2= -1.3° H3= -0.3° H4= -0.5° H5= -0.4°
Saliva substitute 3 (GC Dry mouth)	A3 H1= -3° H2= -1.6° H3= -2.8° H4= -2.6° H5= -1.9°	B3 H1= 0.9° H2= 2.4° H3= 3.1° H4= 1.6° H5= 2.3	C3 H1= -1.8° H2= 2.8° H3= -3.2° H4= -1.6° H5= -2.1°	D3 H1= -1.8° H2= 0.7° H3= 4.3° H4= 1.6° H5= 1.4°

Table 2 – Hysteresis Values Calculated

Now, the mean hysteresis value was calculated for all the subgroups in order to compare the hysteresis of the different combinations of denture base and salivary substitutes tested.

Mean Hysteresis Values of Different Subgroups:

HA1 = -0.6°

HA2 = -0.4°

HA3 = -2.3°

HB1 = -0.9°

HB2 = 0.6°

HB3 = -1.1°

HC1 = 2.0°

HC2 = 4.3°

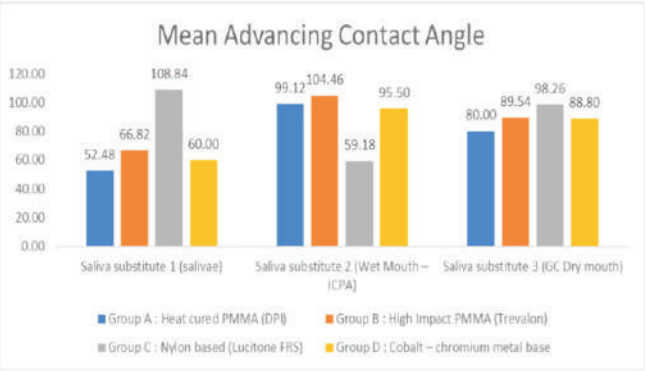
HC3 = 0.6°

HD1 = -0.5°

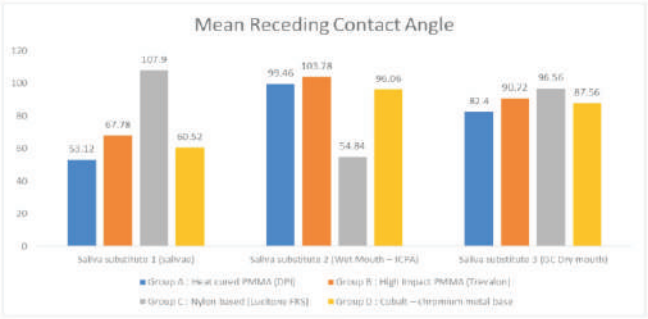
HD2 = -0.5°

HD3 = 1.2°

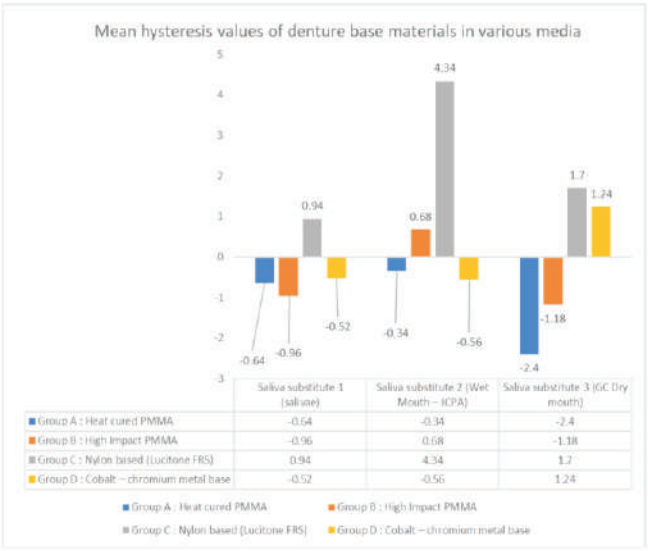
Thus, HC2 subgroup i.e. the combination of high impact PMMA (Trevalon) and Saleva, the salivary substitute gave the highest hysteresis value and therefore the maximum retention will be achieved by the above combination of denture base and the salivary substitute.



Graph 1: Mean advancing contact angle values of denture base materials in various media



Graph 2: Mean receding contact angle values of denture base materials in various media



Graph 3: Mean hysteresis values of denture base materials in various media

Discussion:

The purpose of this study was to compare the wettability of three saliva substitute (Saleva, Wet Mouth and GC Dry Mouth) to four denture base materials (Heat cured, High Impact, Nylon and Cobalt – Chromium metal base).

The advancing contact angle was measured as the contact angle that the liquid drops forms when dispensed on the dry specimen surface, while the receding contact angle formed after the liquid has receded from the surface. Before dispensing a different fluid onto the specimen, care was taken to thoroughly rinse the dispensing syringe with water, followed by the fluid which was tested. Advancing and receding contact angles of each of the three media to ten specimens of each denture base material were measured, that is, a total of 12 groups were tested.

A total of 5 values of the advancing and receding contact angel values were recorded by the contact angel goniometer for each of the subgroups that is for each and every possible combination of the denture base material and saliva substitutes were tested. Also the hysteresis value was calculated for all of these possible combinations of the denture base material and saliva substitute which was basically the difference the between the advancing contact angle and receding contact angles.

Then, statistical analysis was done where all the advancing contact angels, receding contact angels and hysteresis values of all subgroups were compared, assessed and analysed. The results are discussed below.

The univariate analysis of variance of advancing contact angle for various saliva substitutes (media) and denture-based materials used in the study respectively. Following is the univariate analysis of variance for advancing contact angle based on various Denture based materials (refer Table 1): Heat cured PMMA (DPI), High Impact PMMA, Nylon based and Cobalt - Chromium metal.

According to this study, the highest mean of advancing contact angles came to be for media 1 and Group C that is the combination of Saleva and nylon based denture base material. While the second highest is for media 2 and Group B that is the combination of Wet mouth (ICPA) and high impact PMMA (Trevalon). The lowest mean of advancing contact angle is for media 1 and Group A that is Saleva and heat cure PMMA. And the second lowest also falls in this media with Group D: Cobalt - Chromium metal denture base. In totality, the highest mean of advancing contact angles is for saliva substitute 2 (Wet Mouth): 358.26 with a standard deviation of 12.67 thus, implying a tendency to offer more adhesive property and therefore the retention.

Monsenego et al. concluded from their in vitro study that the most convenient denture base material would be that exhibiting the highest contact angle hysteresis, such as high advancing contact angle and low receding contact angle, and found that sand-abraded heat-polymerized resin would fulfil this condition better than the other materials studied. [5]

Following is the univariate analysis of variance for receding contact angle based on various Denture based materials (refer Table 2): Heat cured PMMA, High Impact PMMA, Nylon based and Cobalt - Chromium metal. The highest mean is for saliva substitute 1 (Saleva) and Group C: Nylon base. While the second highest is for saliva substitute 2(wet mouth) and Group B: High Impact. Which is similar to advancing contact angle observation. The lowest mean is for saliva substitute 1 and Group A: Heat Cured. And the second lowest is for saliva substitute 2 with Group C: Nylon base. In totality, the highest mean for receding contact angles is for saliva substitute 3 (GC Dry mouth): 357.24 with a standard deviation of 21.73 thus, indicating that it offers comparatively less retention.

Zississ et al. concluded from their in vitro study that the most convenient denture base material would be that exhibiting the highest contact angle hysteresis, such as low receding contact angle, and found that sand-abraded heat-polymerized resin would fulfil this condition better than the other materials studied. [6]

The univariate analysis of variance for hysteresis based on various Denture based materials (refer Table 2): Heat cured PMMA (DPI), High Impact PMMA, Nylon based and Cobalt - Chromium metal. The highest mean is for saliva substitute 2 (Wet Mouth) and Group C: Nylon base, which supports the hypothesis of this study. While the second highest is also for Group C with saliva substitute 3 (GC Dry Mouth). The lowest mean is for saliva substitute 3 and Group A: Heat Cured PMMA, And the second lowest is for saliva substitute 3 with Group B. In totality, the highest mean value for hysteresis is for saliva substitute 2: 4.12 with a standard deviation of 2.27 thus implying maximum retention and cohesive property with the denture base.

Waters et al. concluded that higher contact angle hysteresis values of soft-lining denture materials in comparison to polymethylmethacrylate denture base material gave an indication that the all soft lining materials would improve denture stability under dislodgement forces. [7]

Nakamoto RY et al. also applied contact angle hysteresis as an indicator of retention and found two of the soft liners tested showed greater contact angle hysteresis and concluded that, this indicted better retention properties. [8]

Univariate analysis of variance showed there was statistically significant difference in the advancing contact angle, receding contact angle, and hysteresis values between the three media, that is, Saleva, Wet Mouth – ICPA, and GC Dry mouth. And there was also statistically significant difference in the advancing contact angle, receding contact angle, and hysteresis values between the four denture base materials: Heat cured PMMA (DPI), High Impact PMMA, Nylon based and Cobalt - Chromium metal.

The F-test was conducted to compare the means of various material/media-based population depending on their variances at 0.05 /0.01 level of significance (alpha) and the p-value < 0.10.

F-test results for Advancing Contact Angle: Denture based Material and Media was done. F-test is showing a significant statistical difference between means of various denture-based materials. F-test is showing an insignificant statistical difference between means of various medias. Thus implying that statistically there was no significant difference between the advancing contact angles of various saliva substitute media but wettability of the denture base 3 that is nylon based denture base material was found to be more than the rest that were used in this study.

F-test results for Receding Contact Angle: Denture based Material and Media was done. F-test is showing a significant statistical difference between means of various denture-based materials. F-test is showing an insignificant statistical difference between means of various medias. Similarly, as advancing contact angles, statistically there was no significant difference between the receding contact angles of various saliva substitute media but wettability of the denture base 3 that is nylon based denture base material was found to be more than the rest that were used in this study.

F-test results for Hysteresis: Denture based Material and Media was done. F-test is showing a significant statistical difference between means of various denture-based materials. F-test is showing an insignificant statistical difference between means of various medias. From all the above F-test we can conclude that there is a statistical difference between various denture-based material population, while media (saliva substitutes) are marginally statistically insignificant, they do not possess differences in their means based on the F-test.

Stanitz et al, in their study concluded that the retention force is a function of saliva surface tension, hysteresis, liquid film thickness, surface of contact, and liquid-denture contact angle. [9] Theoretical considerations and experimental results have demonstrated that, with the exception of some specific cases such as perfectly wettable solids, the contact angle of the advancing liquid front on a dry solid surface (advancing contact angle) is different than the receding contact angle which is formed when the liquid recedes on a previously wet surface. [10]

The Duncan post hoc comparison of advancing contact angles with the different denture base materials found that the highest advancing contact angle values were observed with Nylon, followed by High Impact PMMA and Cobalt – chromium metal denture base. While the lowest advancing contact angle value were observed for Heat cured PMMA. Therefore, implying that the nylon based denture base material is the most wettable denture base material and thus offering highest cohesion with the salivary substitutes used.

The Duncan post hoc comparison of receding contact angles with the different denture base materials showed a significantly higher receding contact angle value with heat cure PMMA than high impact PMMA (Trevalon) or nylon based denture base material (Lucitone FRS). Therefore, implying that the heat cure PMMA (DPI) based denture base material is the least wettable denture base material and thus offering lowest cohesion with the salivary substitutes used.

There was no statistically significant difference between the receding contact angle values with nylon based and high impact PMMA denture base materials. The Duncan post hoc comparison of the hysteresis values with the different denture base materials showed nylon had the highest statistically significant hysteresis value. There was no statistically significant difference between the hysteresis values of heat cured PMMA and high impact PMMA. Therefore, implying that the nylon based denture base material is the most wettable denture base material and thus offering highest cohesion with the salivary substitutes used.

The Duncan post hoc comparison of receding contact angles with the different denture base materials showed a significantly higher receding contact angle value with nylon based denture base material than high impact PMMA or heat cure PMMA or cobalt chromium denture base. There was no statistically significant difference between the receding contact angle values with heat cured PMMA and high impact PMMA. The Duncan post hoc comparison of the hysteresis values with the different denture base materials showed nylon had the highest statistically significant hysteresis value. There was no statistically significant difference between the hysteresis values of acrylic, high impact and cobalt chromium. Therefore, implying that the nylon based denture base material is the most wettable denture base material and thus offering highest cohesion with the salivary substitutes used.

Wettability of denture materials have been studied by Monsenego et al., Waters et al., and Zissis et al., by measuring the advancing and receding contact angles and hysteresis.

Monsenego et al. concluded from their in vitro study that the most convenient denture base material would be that exhibiting the highest contact angle hysteresis, such as high advancing contact angle (nA) and low receding contact angle (nR), and found that sand-abraded heat-polymerized resin would fulfil this condition better than the other materials studied. [11]

Waters et al. concluded that higher contact angle hysteresis values of soft-lining denture materials in comparison to polymethylmethacrylate denture base material gave an indication that the all soft lining materials would improve denture stability under dislodgement forces. [12]

Zissis et al. also applied contact angle hysteresis as an indicator of retention and found two of the soft liners tested showed greater contact angle hysteresis and concluded that, this indicted better retention properties. [13] In this study, high-impact heat-polymerized polymethylmethacrylate denture base resin demonstrated the best wettability with the lowest advancing and receding contact angle values. Nylon based denture base material, however, exhibited poor initial wettability with the highest advancing contact angle values. However, it also had the lowest receding contact angle values and the highest hysteresis value. This implies that nylon denture base would provide the best retention among the four denture base materials tested. [13]

A study by Vissink et al. on the wetting properties of human saliva and saliva substitutes found that contact angles of sample preparations and human whole saliva were comparable on the human mucosa. However, the contact angle of water on human mucosa was significantly higher than that of whole human saliva. Furthermore, on ground polished enamel, the contact angles of water, sample, or mucin-containing saliva substitutes were significantly lower than whole human saliva. [14]

Craig et al. stated that the contact angle showed better wetting of the dentures if the dentures were previously soaked in saliva before use. The length of the soaking period was not given. It has been seen that the contact angle for saliva freshly applied to the acrylic plastic surface is 75°, which is the same as that of water. [15] When saliva is allowed to stand overnight in contact with the plastic material, the contact angle of saliva was reduced to approximately 68°, which indicates that the surface wetting is somewhat improved after remaining in contact with saliva. The effect on the contact angle values due to prolonged contact of the media with the denture base materials was not considered in this study. Further studies incorporating this factor would be useful. Saliva aids in the preservation and maintenance of oral health. It plays a significant role in prosthodontic rehabilitation with complete dentures by aiding in retention and providing comfort. [16]

Niedermeier and Kramer in their study emphasized that the secretion of the palatal salivary glands is primarily responsible for the physical retention of maxillary complete dentures. Loss of salivary flow or xerostomia is both unpleasant and harmful to the patient. In addition to tissue irritation, it predisposes to candida infections and periodontal disease. It affects denture retention and causes discomfort. [17]

Studies by Nakamoto and Duxbury et al. have found commercially available saliva substitutes such as VA-Oralube (Carboxymethyl cellulose based) and Saliva Orthana (mucin-based) as effective substitutes.[18] Mucin-based saliva substitutes have been proved to show better wettability than carboxymethyl cellulose-based saliva substitute, but they are of bovine or porcine origin and may not be accepted by the Indian population.[19] The commercially available saliva substitute (WET MOUTH) tested in this study was carboxymethyl cellulose-based and was found to have wetting properties not significantly different from human saliva. [20]

Conclusion:

The present study compared and assessed the wettability of four denture base materials with three commercially available saliva substitutes calculating the advancing and receding contact angels made by wetting of the denture base surface by various saliva substitutes used in the study.
Within the limitations of this study, following conclusions were drawn:

1. Univariate analysis of variance showed there was statistically significant difference in the advancing contact angle values between the three media, that is, Saleva, Wet Mouth (ICPA), and GC Dry mouth. It was concluded that the highest mean value of advancing

contact angle was found for saliva substitute 2 that is Wet Mouth (ICPA).

2. Univariate analysis of variance showed there was statistically significant difference in the receding contact angle values between the three media, that is, Saleva, Wet Mouth (ICPA), and GC Dry mouth. It was concluded that the highest mean value of receding contact angle was found for saliva substitute 3 that is GC Dry Mouth gel.
3. Univariate analysis of variance showed there was statistically significant difference in the hysteresis values between the three media, that is, Saleva, Wet Mouth (ICPA), and GC Dry mouth. It was concluded that the highest mean value of receding contact angle was found for saliva substitute 2 that is Wet Mouth (ICPA).
4. Also statistically significant difference in the advancing contact angle, receding contact angle, and hysteresis values between the four denture base materials: Heat cured PMMA (DPI), High Impact PMMA, Nylon based and Cobalt - Chromium metal. It concluded that nylon based denture base material was easily wettable.
5. F-test showed a significant statistical difference between means of various denture-based materials, therefore implying the wettability of nylon based denture base material was found to be highest among all the tested denture base materials.
6. F-test is showing an insignificant statistical difference between means of various medias that is the three saliva substitutes therefore implying that there was no significant difference in wetting properties of the three saliva substitutes.
7. Nylon denture base material (Lucitone FRS) denture base material was the most easily wetted by saliva substitute 2 (Wet Mouth) as it demonstrated high advancing and receding contact angles.
8. Nylon denture base material (Lucitone FRS) in combination with Wet Mouth (ICPA) could possibly provide the best retention of the three denture base materials tested as it had the highest hysteresis value.

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