Original Research Article

COMPARATIVE CONTACT ANGLE ANALYSIS OF CHLORHEXIDINE AND METRONIDAZOLE MOUTHGEL - AN IN VITRO STUDY

ABSTRACT

Introduction: Chlorhexidine is considered to be gold standard drug in treating various oral infections. Metronidazole is effective for treating various anaerobic infections, including dental abscess and periodontal abscess. Contact angle is a thermodynamic property that characterizes the wettability of solid surfaces is of utmost importance in modern technological applications and material sciences. The aim of this study is to compare the contact angle of chlorhexidine and metronidazole mouth gel.

Materials and methods: This in vitro study was conducted in white lab, Saveetha Dental College, Chennai, India. Total 10 samples of gel was used, involving 5 samples of chlorhexidine gel and 5 samples of metronidazole gel. Each sample were dispensed from a microsyringe on the facial surface of the microtomed tooth and the contact angles were measured with the help of the Ossila Goniometer. The obtained values from the samples were determined and the data was exported to SPSS software version 20.0 and was statistically analyzed. Data analysis was done using paired t test. P value was set as 0.05 as level of significance.

Results and discussion : From the data collected it was found that the average contact angle of the mouth gels that is chlorhexidine and metronidazole gel were 51.58 & 67.04 respectively. T test showed p value of 0.157, (p value < 0.05). Hence, it is statistically not significant. Chlorhexidine gel had a lower average mean of contact angle than metronidazole gel, which means chlorhexidine gel had got better wettability when compared to metronidazole gel.

Conclusion: Thus, it can be concluded that chlorhexidine gel has a better tendency to wet the tooth or oral cavity surfaces when compared to metronidazole gel, thereby it can have better action in treating various oral conditions.

Keywords: Chlorhexidine, Metronidazole, Contact angle, Wettability, Gel

INTRODUCTION

Gingivitis is one of the most prevalent diseases that affects 82% of the adult population worldwide(1). Dental plaque is an etiological factor in the development of gingivitis and periodontitis (2). Plaque is primarily composed of bacteria in a matrix of salivary glycoprotein and extracellular matrix and removal of this bacterial biofilm is the cornerstone in the treatment of gingivitis and periodontitis (3). Bacterial biofilm is primarily disrupted mechanically by scaling and root planing, however, several studies have shown that mechanical debridement alone sometimes remains insufficient in the removal of flora responsible for the periodontal diseases (4). Due to this reason chemical plaque removal agents as an adjuvant to mechanical therapy have gained popularity. Several antimicrobials including Chlorhexidine and Metronidazole have been used as an adjuvant to mechanical plaque removal. Chlorhexidine is the gold standard mouthrinse to treat gingivitis. Several studies have proved that adjuvant use of Chlorhexidine does not provide additional benefits on periodontitis. It has a broad antiseptic spectrum and substantivity (5). Metronidazole has been used by several researchers due to its selective antimicrobial activity

against the obligate anaerobes. It has been used successfully for the treatment of gingivitis and periodontitis.

Contact angle is a thermodynamic property that characterizes the wettability of solid surfaces is of utmost importance in modern technological applications and material sciences (6). Contact angles are sensitive to many factors, such as surface geometry, roughness, contamination, deformation, etc. Such sensitivity enables detecting very small-scale effects by this rather macroscopic measurement (7). Based on its terminology, it is defined as –an angle experimentally observed on the liquid side (denser liquid side in case there are two liquids) between the tangent to the solid surface and the tangent to the liquid-fluid interface at the contact line between the three phases. The point of intersection between tangent lines is known as the contact point. The above definition is general in the sense that it applies to all equilibrium and non-equilibrium situations. As such, it is of little use without an adjective that describes the specific situation(8). Our team has extensive knowledge and research experience that has been translated into high quality publications (9–28) The aim of this study is to compare the contact angle of chlorhexidine and metronidazole mouth gel.

MATERIALS AND METHODS

This in vitro study was conducted in white lab, Saveetha Dental College, Chennai, India. Total 10 samples of gel was used, involving 5 samples of chlorhexidine gel and 5 samples of metronidazole gel. Each sample were dispensed from a microsyringe on the facial surface of the microtomed tooth and the contact angles were measured with the help of the Ossila Goniometer. The obtained values from the samples were determined and the data was exported to SPSS software version 20.0

and was statistically analyzed. Data analysis was done using paired t test. P value was set as 0.05 as level of significance.

RESULTS AND DISCUSSION

Table 1: Mean, Standard deviation and significance values between groups

	N	Mean	Std. Deviation	Std. Error Mean	Significance
Chlorhexidine	**5**	**51.58**	**29.150**	**13.036**	**0.157**
Metronidazole	**5**	**67.04**	**13.924**	**6.227**	**0.157**

Gels are intriguing materials that behave either like solid or liquids due to a three dimensional cross-linked network expanded throughout its whole volume by a fluid (29)(30). They have various pharmacological functions and other unique properties (31,32). Contact angle of the gels can be measured by Sissle-drop goniometry. The simplest contact angle is called the sessile drop or static contact angle. This is when the liquid drop is resting on the surface and not moving. To capture the entire range of angles for a given surface, dynamic advancing and receding contact angles are measured. This is defined as contact angle hysteresis which is the difference between the advancing and receding angles. Hysteresis arises from the chemical and topographical heterogeneity of a surface, solution impurities absorbing on the surface, or swelling, rearrangement or alteration of the surface by the solvent (33).

Contact angle is inversely proportional to the wettability. The simplest contact angle is called the sessile drop or static contact angle. This is when the liquid drop is resting on the surface and not moving. Previous study reported that low contact-angle values demonstrate a tendency of the water to spread and adhere to the surface, whereas high contact-angle values show the surface's tendency to repel water. The sessile drop method was used by Yan to determine the mechanisms of contact angle hysteresis and advancing contact angle. Determination of the contact angle with the geometric method (sessile drop method) accounts for different assumptions and models of the measuring liquid drops. The models of liquid drops are classified into the spherical droplet model, the drop curve model (the Bashforth method), and the ellipsoidal method (34).

Chlorhexidine has a broad spectrum action, active against Gram-positive and Gram-negative bacteria and also against fungi. It has a bactericidal action, drastically increasing the bacterial cell membrane permeability and altering the protein features. Chlorhexidine is considered to be gold standard drug in treating various oral infections. Metronidazole is effective for treating various anaerobic infections, including dental abscess and periodontal abscess. One systematic review has showed that adjunctive subgingival application of chlorhexidine gel is very effective in nonsurgical periodontal treatment for chronic periodontitis(35). From the data collected it was found that the average contact angle of the mouth gels that is chlorhexidine and metronidazole gel were 51.58 & 67.04 respectively. T test showed p value of 0.157, (p value < 0.05). Hence, it is statistically not significant. Chlorhexidine gel had a lower average mean of contact angle than metronidazole gel, which means chlorhexidine gel had got better wettability when compared to

metronidazole gel. The limitations of the study was less sample size and only static contact angle analysis for the mouthgels was done.

CONCLUSION

The average contact angle of chlorhexidine gel is lower than the average contact angle of metronidazole. Thus, it can be concluded that chlorhexidine gel has a better tendency to wet the tooth or oral cavity surfaces when compared to metronidazole gel, thereby it can have better action in treating various oral conditions.

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