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Research Article

Comparison of Salivary pH Averages at Several Sites in the Oral Cavity According to Two Protocols for Polymerization of Prosthetic Bases in Polymethacrylate Resin

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Abstract

Introduction: In the elderly, the insertion of a complete assistant prosthesis in the oral environment leads to a reduction in salivary secretion leading to oral pathologies, such as stomatitis.

Objective of the Study: The objective of this work was to look for variations in salivary pH according to the mode of polymerization, conventional (Protocol1) or by microwave cooking (Protocol2) of the prosthetic bases using the electrometric method at four sites of the oral cavity (inner side of the cheek, on and under the tongue, palate) and at different time intervals.

Materials and Methods: A single-blind randomized clinical trial Protocol 1 versus Protocol 2 was conducted in total bimaxillary edentulous patients divided into two homogeneous groups undergoing for the first a mode of polymerization in a Marie bath (Protocol 1) and the second a polymerization in the microwave (Protocol 2). The salivary pH was measured at the level of the palate, inner side of the cheeks and on, under the tongue before insertion, at d30, j90 after the insertion of the prosthesis.

Results: Our results showed differences in pH averages, from one anatomical site to another. The averages measured on the tongue and at the level of the palate, being a little higher with each measurement time; and this for both methods. Changes in pH were statistically significant for microwave cooking, after d90.

Conclusion: Our results indicate that the pH was not uniform in the oral cavity and that it varies depending on the measuring point. Thus, we were able to highlight a high palatine pH compared to other sites.

Keywords: *Salivary pH-Saliva; Complete Assistant Prosthesis; Slowly Complete Polymerization; Methyl Polymethacrylate; Microwave; Bath Mary*

Problematic

The insertion of a complete assistant prosthesis into the oral environment leads to a qualitative and quantitative reduction in salivary secretion due to the significant covering of the prosthetic base obstructing the orifices of the excretory ducts of the salivary glands; which leads to prosthetic acidosis [10,11]. Under these conditions, the oral flora necessarily develops and changes, thus contributing to the process of irritation and inflammation of the mucous membranes [4-6]. The accumulation of microbial plaque is influenced by variations in pH, surface finish and the absence of residual monomer at the end of polymerization [7,8,12]. It is therefore necessary to seek to reduce its presence as much as possible, in order to reduce the pathologies related to the wearing of complete assistant prostheses which are substhetic stomatitis and oral candidiasis [1, 3, 7-9].

The numerical indication that pH measurement gives us will inform us about biochemical dysregulation when we are confronted with mucosal pathologies related to prosthetic wearing [2,5-7]. As a result, salivary pH measurement is an effective diagnostic element in maintaining good tissue health [13].

Faced with this problem, we are interested in examining the variations in salivary pH according to the method of polymerization of prosthetic bases into polymethacrylate resin, depending on whether the mode is conventional or by microwave cooking at four sites of the oral cavity and at different time intervals.

Materials and Methods

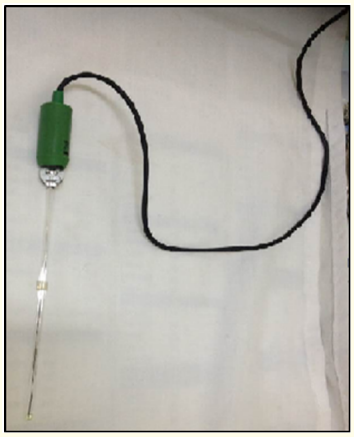
The target population consisted of 60 total bimaxillary edentulous patients, aged 40 years and older, who had never worn a complete removable prosthesis or fitted for more than 5 years, with no general disease having an influence on salivary pH and consultant to the prosthesis service at the Saouli Abdelkader clinic of the Ibn Rochd University Hospital, Annaba Hospital. Excluded will be diabetic subjects, under neuropsychotropics, subjects with dry mouth and smokers.

Methods

Type of study: This is a single-blind randomized clinical trial.

Sampling: The management of each patient consists first of all of a complete clinical examination and information of the patient on the study, to which he adheres after signing an informed consent. Patients were randomly assigned (randomized) into 2 equal groups (n = 30), corresponding to each therapeutic approach tested. The first group benefited from a restoration by means of a complete bi-maxillary assistant prosthesis in polymerized resin in the Marie bath and the second group, a restoration by a complete assistant prosthesis polymerized in the microwave. Patients are seated comfortably, relaxed on the dental chair a few minutes before the examination. Next, salivary pH (unstimulated saliva) was measured using the type pH meter (HANNA HI 2211). This device is supplied with the probe holder, power adapter and starter buffer solutions (Photo 1). As well as a miniaturized glass measuring electrode (Photo 2).

Photograph 1: *pH-meter HANNA HI 2211.*

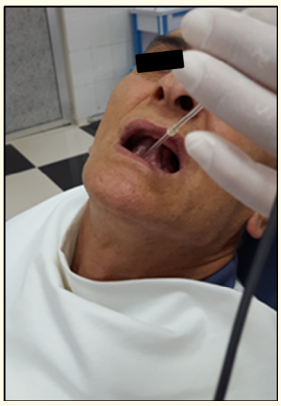


Photograph 2: *Glass electrode.*

The first salivary pH measurement (unstimulated saliva) was performed before the establishment of the prosthetic bases in the oral cavity, one month and three months later. The measurements were made between 9 am and 10 am (to avoid the influence of other factors on salivary pH, such as the stress of the day and diet) [13].

The miniaturized glass measuring electrode was placed in the oral cavity, at four sites (Dorsal side of the tongue: lingual pH) (Photo 3), (at the ostium of the Wharton canal: pH of the submandibular saliva) (Photo 4), (Inner side of the cheeks, next to the second upper molar: pH of the parotid saliva) (Photo 5) and at the level (of the hard palate) (Photo 6).

Photograph 3: *Lingual pH.*



Photograph 4: *pH of submaxillary saliva.*

Photograph 5: *pH of parotid saliva.*

Photograph 6: *pH of hard palate.*

Subjects will be checked according to the prosthetic follow-up schedule: before insertion (d0), 30 days (d30), 90 days (d90). At each time of the monitoring schedule, the salivary pH is evaluated at each site raised. The pH measurements were reported on a data collection sheet that also reported the sociodemographic characteristics of the patient: surname, first name, date of birth profession, address. Hygiene advice is an integral part of prosthetic treatment.

Statistical analyses

- The comparison of pH means between the two methods was carried out using analysis of variances (ANOVA)
- The estimation of the effectiveness of the method, for the improvement of the pH was made using bivariate analyses, using the test of chi two.
- The significance level was set at 0.05 for all tests performed.
- Data entry was done using Epi Data software® Version 3.01. The statistical analyses were performed using SPSS version 18 software on the Windows platform.

Results

Comparison of pH averages between the 2 protocols by site.

	Total study population (n = 60)	**Conventional Method (n = 30)**	**Microwave method (n = 30)**	
pH averages	**m ± ET**	**m ± ET**	**m ± ET**	**P**
Inner side of the cheek				
T0	6,11 ± 0,32	6,20 ± 0,30	6,03 ± 0,32	0,035
On the tongue				
T0	6,69 ± 0,51	6,66 ± 0,43	6,72 ± 0,60	0,681
Under the tongue				
T0	6,26 ± 0,34	6,25 ± 0,31	6,28 ± 0,36	0,724
At palate				
T0	6,73 ± 0,35	6,71 ± 0,43	6,74 ± 0,24	0,785
Combined sites				
T0	6,45 ± 0,25	6,46 ± 0,27	6,44 ± 0,24	0,818

Table 1: *Description of the average pH by site at the beginning of the study (T0), according to the method of polymerization of prostheses.*

The results show that pH averages vary between 6.1 and 6.7 at time T0 and are generally comparable between the two protocols. The averages on the tongue and at the level of the palate are a little higher.

However, at the level of the inner side of the cheek, the basic average at T0 is statistically different between the two methods, which could explain possible differences in future time; hence the need to take this into account in the evaluation of the role of the method. Ideally, the averages at T0 should be comparable between the two methods.

	Conventional Method (n = 30)	Microwave method (n = 30)	
pH averages	**m ± ET**	**m ± ET**	**P**
Inner side of the cheek			
d30	6,20 ± 0,29	6.19 ± 0,23	0,869
d90	6,11 ± 0,34	6,34 ± 0,27	0,005
On the tongue			
d30	6.88 ± 0,39	7,22 ± 0,26	< 0,001
d90	6.66 ± 0,39	7,18 ± 0,32	< 0,001
Under the tongue			
d30	6.40 ± 0,29	6,45 ± 0,40	0,551
d90	6,24 ± 0,31	6,42 ± 0,35	0, 039
At palate			
d30	6,89 ± 0,33	6,82 ± 0,29	0,355
d90	6,75 ± 0,36	6,93 ± 0,16	0,017
Combined sites			
d30	6,60 ± 0,23	6,67 ± 0,18	0,151
d90	6,44 ± 0,24	6,72 ± 0,14	< 0,001

Table 2: *Description of pH averages by site at T30, T90, by prosthesis polymerization method.*

The results show that pH averages vary between 6.2 and 6.9 after 90 days depending on the site. The averages on the tongue and at the level of the palate are a little higher with each measurement time.

In addition, table 2 indicates that the differences between the means are statistically significant, between the two methods on Day 90, for all individual and combined sites; the microwave method generally producing higher pH at d90. These results are also presented graphically for each site.

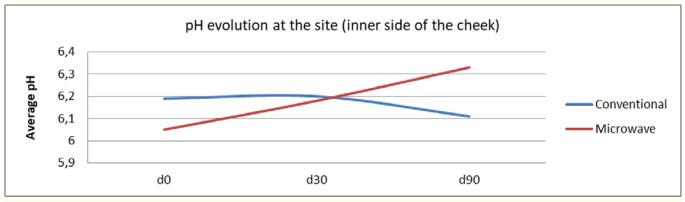


Figure 1: *Evolution of pH at site level (inner side of the cheek) for P1, P2.*

For protocol 1, at d0, d30, the pH at the inner side of the cheek level was constant, then decreased until day 90, while for protocol 2, the pH remained growing until day 90.

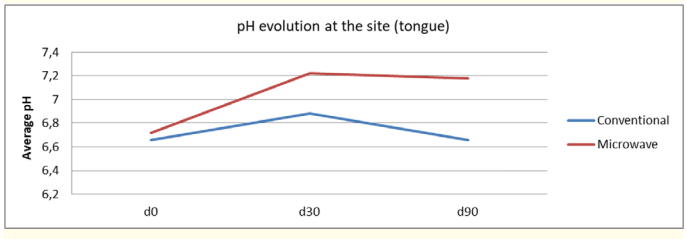


Figure 2: *Evolution of pH at the site level (on the tongue) for P1, P2.*

On the tongue site level, there was an increase in pH between d0 and d30, for both protocols but a decrease to d90 at the same level as to d0 for the conventional method compared to a smaller decrease for the microwave method.

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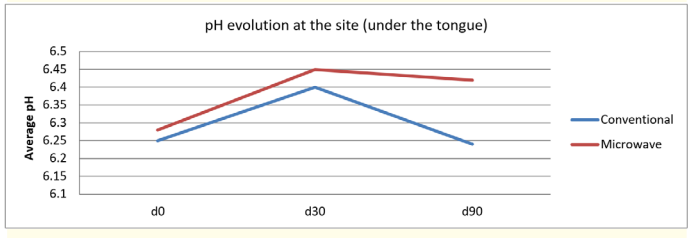

Figure 3: *Evolution of pH at the site level (under the tongue) for P1, P2.*

At the site level under the tongue, we noted an increase in pH from d0 to d30 and then a decrease to d90, for both protocols P1 and P2; however, a greater decrease again for Protocol 1 (conventional method).

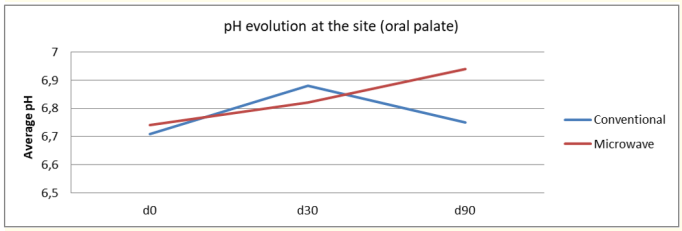

Figure 4: *Evolution of pH at the site level (Palate) for P1, P2.*

Finally at the level of the palate, for protocol 1, we noted an increase in pH from d0 to d30 and then a decrease to d90. On the other hand, for protocol 2, there was a constant growth from d0 to d90.

Discussion and Conclusion

The purpose of this work was to measure salivary pH, at different sites of the oral cavity. between two protocols (conventional mode or microwave cooking).

This research is justified by the fact that improving pH is a key aspect for the oral health of patients requiring prosthesis; so it is essential to have an effective polymerization method to guarantee this stability. To do this, the effectiveness of two methods was compared using a clinical trial involving 60 patients, randomly divided into two groups, of 30 people each One group benefited from the called conventional polymerization technique based on marie bath polymerization (protocol1) and the other group benefited from the polymerization technique using electromagnetic radiation called microwave polymerization (protocol2). In our work, salivary pH was measured at d0, d30, d90 using a HANNA HI 2211 pH meter equipped with a glass measuring electrode. In accordance with ethical rules, an informed consent, written in Arabic and French, was given to the patient for reading and signature.

The results of our study showed are discussed below

The measurement of salivary pH averages, at different sites of the oral cavity

Our results indicate that the pH was not uniform in the oral cavity and that it varies depending on the measuring point. Thus, we were able to highlight a high palatine pH compared to other sites.

The results showed differences between the pH means, not only between the Time 0 and Times 90 but also variations from one site to another, the pH averages, measured on the tongue and at the palate, were a little higher at each measurement time, and this for both methods. Our results corroborate with previous research by Laudenbach, 1974; Jyrki Kivelä, 1999; Yosipovitch, 2001; Aframian, 2006, who found that the pH was not uniform in the oral cavity and that the latter varies according to the measuring point. Thus, they were able to highlight a high palatine pH compared to that of parotid and submaxillary saliva.

This last scientific evidence was explained by the secretions of the mucous glands that are numerous in the palate and whose mucous saliva is closer to neutrality than parotid saliva and carbonic anhydrase (endogenous buffer system) which is found in oral epithelial cells, including those of the palate and tongue in addition to the salivary buffer system.

Impact of the polymerization method

In general, the results showed that the average changes in pH were statistically higher with the microwave method, after 90 days, for the sites inside the cheek and on the tongue. The results do not reveal significant changes for the other sites (under the tongue, on the palate), regardless of the polymerization method.

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