EAS Journal of Dentistry and Oral Medicine
Abbreviated Key Title: EAS J Dent Oral Med
ISSN: 2663-1849 (Print) & ISSN: 2663-7324 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-7 | Issue-2 | Mar-Apr-2025 | DOI: https://doi.org/10.36349/easjdom.2025.v07i02.006

Original Research Article

Impact of Orthodontic Treatment on Salivary pH Variation

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Article History
Received: 04.03.2025
Accepted: 11.04.2025
Published: 16.04.2025

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Introduction*:** Orthodontics, a dental specialty focused on correcting dental anomalies and malocclusions, frequently relies on materials such as orthophosphoric acid (H_3PO_4) for enamel etching during bracket bonding procedures. However, this acid may induce changes in salivary pH, potentially altering the oral microbiota and increasing the prevalence of mucosal lesions. ***Methods***: A clinical and epidemiological study was conducted on 30 patients aged between 10 and 25 years, all undergoing fixed multibracket orthodontic therapy. Salivary pH variations were measured before and after the application of orthophosphoric acid to assess its impact. ***Results***: The findings revealed a significant decrease in salivary pH following acid application, indicating a more acidic environment capable of affecting the oral flora. ***Discussion***: These results highlight the influence of orthophosphoric acid on the oral ecosystem, emphasizing the need for preventive strategies to minimize adverse effects on the mucosa.

Keywords: Salivary pH, Orthophosphoric acid, Mucosal lesions, Orthodontic treatment.

INTRODUCTION

The oral cavity is a complex environment composed of various salivary secretions and gingival fluids that play a crucial role in ionic balance and the protection of oral tissues.

Orthodontics is a medical discipline aiming to correct dental anomalies and malocclusions in order to improve occlusal function and smile aesthetics.

Orthodontic devices and materials are essential in therapeutic practice. Several studies have reported that the application of orthophosphoric acid in clinical orthodontics alters salivary pH and subsequently influences the oral microbiota.

The observed frequency of mucosal lesions in patients wearing orthodontic appliances prompted us to conduct a clinical and epidemiological study to evaluate the salivary pH following the application of orthophosphoric acid used during the bonding of orthodontic brackets in fixed multibracket therapy.

The objective is to better understand the influence of orthodontic materials on the oral environment and to improve patient management.

Objective

The primary objective is to evaluate changes in salivary pH following the application of orthophosphoric acid used for orthodontic bracket bonding.

MATERIALS AND METHODS

This case series study was conducted at the Zabana Dental Clinic of the Blida University Hospital Center.

During the study period, ninety (90) saliva samples were collected from 30 patients aged 10 to 25 years undergoing fixed multibracket orthodontic treatment. Salivary pH was measured before and after the application of orthophosphoric acid using a calibrated pH meter.

Orthophosphoric acid, the most commonly used etching agent in orthodontics, dissolves hydroxyapatite crystals, creating a roughened enamel surface to enhance the adhesion of bonding materials. A 37% concentration was applied for 15 seconds.

Study Protocol

- Before etching, the first saliva sample was collected to measure salivary pH (T1).

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- After etching and rinsing, the second sample was collected to measure salivary pH (T2).
- Ten minutes later, the third sample was collected to measure salivary pH (T3).

Figure: Salivary pH Measurement

RESULTS

Table 1: Salivary pH before acid application (T1)

T1	N	Min	Max	Mean	SD
ph salivaire	30	4.40	8.78	6.44	1.97

Table 2: Salivary pH immediately after acid application (T2)

T2	N	Min	Max	Mean	SD
ph salivaire	30	2.80	6.96	4.90	1.09

Table 3: Salivary pH 10 minutes after acid application (T3)

T3	N	Min	Max	Mean	SD
ph salivaire	30	4.56	8.94	6.58	1.02

A significant difference was observed between T1 and T2 ($p < 0.001$), whereas the difference between T1 and T3 was not statistically significant ($p = 0.45$). These results show a significant drop in salivary pH immediately after acid application (T2), followed by a return to near-neutral values at T3.

DISCUSSION

Zogakis *et al*., [1] reported a significant decrease in salivary pH one hour after bracket bonding, attributed to the use of 37% orthophosphoric acid for enamel etching. Our findings align with their results, showing a statistically significant drop in salivary pH between T1 and T2 ($p < 0.001$). Similarly, L. Zhang *et al*., [2], found a temporary decrease in salivary pH following acid application, with values returning to normal over time. Our study also demonstrated the transient nature of this pH change, as values returned to near-baseline levels within 10 minutes post-application.

CONCLUSION

This study revealed a temporary decrease in salivary pH, indicating an increase in oral acidity immediately following the application of orthophosphoric acid for orthodontic bracket bonding. However, salivary pH tended to return to neutrality within 10 minutes.

An acidic salivary environment may lead to complications involving oral tissues (e.g., allergic reactions and toxicity) [3, 4]. This clinical and epidemiological study confirms that orthophosphoric acid influences salivary pH, though the effect is transient.

Overall, our research contributes to existing literature by providing insights into pH fluctuations in orthodontic patients following acid application. These findings can aid dental professionals in refining clinical protocols.

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Cite This Article: R. Dahmas & S. Meddah (2025). Impact of Orthodontic Treatment on Salivary pH Variation. *EAS J Dent Oral Med*, *7*(2), 97-99.