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REVIEW

The relationship between salivary flow rate and masticatory performance in hypertensive and nonhypertensive complete denture wearers

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ABSTRACT

Edentulism is the complete loss of natural teeth, leading patients to rely on complete dentures to restore masticatory function. The success of denture use is influenced by salivary flow rate, which affects retention and stability. Salivary flow may be altered by systemic conditions such as hypertension, potentially reducing masticatory performance. This study aimed to determine the mean salivary flow rate and masticatory performance, and to analyze their relationship in hypertensive and nonhypertensive complete denture wearers at the Dental and Oral Hospital of Universitas Sumatera Utara. This analytic cross-sectional study involved 20 subjects (10 hypertensive and 10 non-hypertensive). Salivary flow rate was measured using the spitting method with sugar-free chewing gum, while masticatory performance was assessed using color-changeable chewing gum and the Visual Analog Scale (VAS). Data were analyzed using Spearman's correlation test ($p<0.05$). The mean salivary flow rate was 0.36±0.11 ml/min in hypertensive patients and 0.86±0.15 ml/min in nonhypertensive patients. The mean masticatory performance scores were 2.8±0.78 and 3.9±0.99, respectively. A significant correlation was found between salivary flow rate and masticatory performance in both hypertensive ($p=0.0001$) and nonhypertensive groups ($p=0.001$). (IJP 2025;7(1):14-19)

Introduction

Edentulism is defined as the loss of one or more teeth from their sockets, while the complete loss of all natural teeth is referred to as complete edentulism. This condition may result from various factors, including dental caries, periodontal disease, trauma, and tooth extraction. According to the Indonesian Health Survey (2023), the prevalence of tooth loss in Indonesia is 21%. Tooth loss, particularly complete edentulism, can significantly affect masticatory function, esthetics, phonetics, and overall quality of life.[1,2]

Mastication is the mechanical process of breaking down food into a bolus to facilitate digestion and nutrient absorption.[3] This function involves the coordination of teeth, the temporomandibular joint, masticatory muscles, and the central nervous system, and can be objectively assessed through masticatory performance as an indicator of chewing efficiency.[4] Masticatory performance is influenced by several factors, one of which is saliva. Saliva plays a crucial role in lubrication, bolus formation, and in supporting the retention and stability of complete dentures. Salivary flow rate is an important parameter, as its reduction may impair masticatory efficiency.[5]

Systemic conditions such as hypertension are known to affect salivary gland function. Hypertension not only impacts the cardiovascular system but also causes alterations in saliva, including decreased pH, increased viscosity, and reduced salivary flow rate, either due to the disease itself or the use of antihypertensive medications. These changes may lead to xerostomia and affect oral function.[6]

Complete dentures are used to restore masticatory function in edentulous patients; however, their success largely depends on retention and stability, which are influenced by saliva. A decreased salivary flow rate, as observed in hypertensive patients, may compromise denture stability and reduce masticatory performance.[6]

Studies investigating the relationship between salivary flow rate and masticatory performance in hypertensive complete denture wearers remain limited. Therefore, this study aims to analyze this relationship in both hypertensive and nonhypertensive patients.

Methods

In this study, a total of 20 subjects were included and divided into two groups: 10 hypertensive patients and 10 nonhypertensive patients.

The first stage involved blood pressure measurement. This was performed by instructing the subjects to sit in a resting position, with their feet flat on the floor, back supported, and arm positioned at heart level. Subjects were instructed to avoid caffeine intake, smoking, and physical exercise for at least 30 minutes prior to the measurement, which was preferably conducted in the morning. The cuff was placed on the upper arm approximately 2 cm above the antecubital fossa, with the tubing positioned along the midline of the arm, and tightened to allow the insertion of two fingers. The measurement was initiated by pressing the "start" button while ensuring the subject

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Table 1A. Salivary flow rate values of hypertensive patients using complete denture.

Age (Years)	Sex	Salivary Flow Rate (ml/min)
57	Male	0,5**
70	Male	0,4
75	Female	0,33
72	Female	0,4
80	Female	0,23*
77	Female	0,33
69	Female	0,5**
80	Female	0,23*
64	Female	0,5**
80	Female	0,23*
x±SD		0,36±0,11

Notes: *Lowest value **Highest value

Table 1B. Salivary flow rate values of nonhypertensive patients using complete denture.

Age (Years)	Sex	Salivary Flow Rate (ml/min)
72	Male	0,83
72	Male	1
67	Male	0,83
65	Male	1
69	Female	0,7
68	Female	0,67*
64	Female	0,83
52	Female	1,1**
60	Female	1
74	Female	0,7
x±SD		0,86±0,15

Notes: *Lowest value **Highest value

Table 2A. Masticatory performance scores of hypertensive patients using complete denture.

Age (Years)	Sex	Salivary Flow Rate (ml/min)
57	Male	4**
70	Male	3
75	Female	2*
72	Female	3
80	Female	2*
77	Female	3
69	Female	3
80	Female	2*
64	Female	4**
80	Female	2*
x±SD		2,8±0,78

Notes: *Lowest value **Highest value

Table 2B. Masticatory performance scores of hypertensive patients using complete denture.

Age (Years)	Sex	Salivary Flow Rate (ml/min)
72	Male	3
72	Male	5**
67	Male	4
65	Male	5**
69	Female	3
68	Female	2*
64	Female	4
52	Female	5**
60	Female	4
74	Female	4
x±SD		3,9±0,99`

Notes: *Lowest value **Highest value

Table 3. The relationship between salivary flow rate and masticatory performance in hypertensive and nonhypertensive patients using complete denture.

Group	x±SD		p
	Salivary Flow Rate (ml/min)	Masticatory Performance	
Hypertensive	0,36± 0,11	2,8±0,7 8	0,0001*
Nonhypertensive	0,86± 0,15	3,9±0,9 9	0,001*

*Significant (p<0,05)

remained still until the cuff deflated and the blood pressure reading appeared on the monitor, after which the result was recorded.

The second stage was the salivary flow rate measurement, measured using a measuring cup. The procedure was carried out by instructing the subjects to sit in a relaxed position for five minutes, followed by rinsing their mouth and swallowing any residual saliva. Subsequently, the subjects were asked to chew sugar-free chewing gum for three minutes using a timer. Saliva was allowed to accumulate in the floor of the mouth and was expectorated into the measuring cup every 60 seconds or whenever the subject felt the urge to swallow. The collected saliva volume was then measured without including foam, and the result was expressed in milliliters per minute (mL/min).

The third stage was the assessment of masticatory performance using color-changeable chewing gum. Subjects were instructed to sit and rinse their mouth prior to the procedure, then chew the colorchangeable chewing gum for 120 seconds. After chewing, the gum was removed from the mouth, placed into a plastic zip-lock bag, and flattened using a glass plate to a thickness of approximately 1.5 cm to evaluate the uniformity of color change. The degree of color change was subsequently assessed using the color scale provided on the product packaging.

Figure 1. A. Blood pressure measurement, B One of the blood pressure readings, C. Salivary flow rate measurement, D. Salivary flow rate value, E. The assessment of masticatory performance, F. One of the color result of the color-changeable chewing gum.

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Results

This study involved 20 complete denture wearers who were divided into two groups: 10 hypertensive patients and 10 nonhypertensive patients. The results showed that the mean salivary flow rate in hypertensive patients was 0.36±0.11 ml/min, whereas in nonhypertensive patients it was 0.86±0.15 ml/min. These findings indicate that the salivary flow rate in hypertensive patients was lower than that in nonhypertensive patients.

Furthermore, the mean masticatory performance score in hypertensive patients was 2.8±0.78, while in nonhypertensive patients it was 3.9±0.99. This result indicates that masticatory performance in the nonhypertensive group was better than that in the hypertensive group.

Statistical analysis using Spearman's correlation test revealed a significant relationship between salivary flow rate and masticatory performance in both groups. In hypertensive patients, the pvalue was 0.0001, while in nonhypertensive patients it was 0.001 ($p < 0.05$), indicating a statistically significant correlation.

Discussion

This study demonstrated that the mean salivary flow rate in hypertensive patients was lower than that in nonhypertensive patients, with the hypertensive group categorized as having hyposalivation. This condition can be explained physiologically, as hypertension induces changes in the vascular system, including thickening of blood vessel walls and reduced elasticity, which consequently decreases blood flow to the salivary glands.[7] In addition, the use of antihypertensive medications may contribute to reduced salivary secretion through autonomic nervous system mechanisms and alterations in body fluid balance.[8]

Furthermore, variations in salivary flow rate are also influenced by other factors such as age and sex. The aging process leads to degeneration of the salivary glands, resulting in decreased saliva production, while differences in gland size between males and females may contribute to variations in salivary secretion. In complete denture wearers, saliva plays a crucial role in maintaining denture retention and stability; therefore, a reduction in salivary flow rate can directly affect oral comfort and function.[9,10]

Masticatory performance in hypertensive patients was also found to be lower compared to the nonhypertensive group. This reduction is closely associated with decreased salivary flow, which functions as a lubricant, facilitates bolus formation, and enhances adhesion and cohesion between the denture base and the oral mucosa. When saliva production is reduced, denture retention and stability become suboptimal, leading to less efficient mastication.[11]

Correlation analysis revealed a significant relationship between salivary flow rate and masticatory performance in both groups. Physiologically, saliva acts as a lubricant, aids in bolus formation, and improves adhesion and cohesion between the denture base and the mucosa. Therefore, higher salivary flow rates are associated with better masticatory performance, whereas reduced salivary flow impairs denture retention and masticatory efficiency.[12]

Conclusion

Based on the results of this study, it can be concluded that: The mean salivary flow rate in hypertensive and nonhypertensive complete denture wearers was as follows: Hypertensive patients: 0.36 ± 0.11 ml/min; Nonhypertensive patients: 0.86 ± 0.15 ml/min; The mean masticatory performance in hypertensive and nonhypertensive complete denture wearers was as follows: Hypertensive patients: 2.8 ± 0.78; Nonhypertensive patients: 3.9 ± 0.99. There was a statistically significant relationship between salivary flow rate and masticatory performance in hypertensive patients ($p = 0.0001$; $p< 0.05$) and nonhypertensive patients ($p = 0.001$; $p < 0.05$) among.

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