

The Influence of Palatine Rugae Duplication on Speech Quality of Complete Denture Wearers

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ABSTRACT

This study aimed to determine the effect of duplication of palatine rugae on the acrylic denture base on speech quality in patients with a complete denture. This study was conducted on ten subjects. All subjects used full denture with two kinds of maxillary dentures. The sound resulted from each subject taken before using complete denture, when using the denture without duplicating the palate rugae and when using the denture with duplication of palatine rugae. The values obtained were then processed and analyzed by the Kruskal Wallis and Mann-Whitney tests. The sound quality produced showed a significant value of 0.000 in the pronunciation of letters / t /, / d /, and articulation in the Kruskal Wallis test ($p < 0.05$) in each group assessed. The Mann-Whitney Post Hoc test also obtained a significant value (0.000 with p -value < 0.05) for comparison of the use of full denture without duplication of palatine rugae and a complete denture with duplication of palatine rugae. This study concluded that denture wearers' speech quality with duplication of palatine rugae was better than the one without palatine rugae.

Keywords: Complete Denture, Palatine Rugae, Quality of Speech

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INTRODUCTION

Dental rehabilitation of edentulous patients with complete dentures includes not only aesthetics and mastication of food, but also speech quality.¹ It is known that three factors play a significant role in the complete denture are esthetics, mechanics, and phonetics. Out of the three mentioned factors, phonetics is an essential factor that is mostly neglected. Neglect of this factor may be attributed to the fact that most of the complete denture patients tend to adjust and return to normal speech after a post-insertion practice period of several days to several weeks.²

Speech is a human activity that is often done, and it is essential to establish communication so that they can self-reflect. Speech is one of the determining factors that contribute to dental prostheses.³ Speeches carried out in everyday human life is the result of the following physiological processes: breathing, phonation, resonance, articulation of speech, auditions, neurological functions, emotional behavior. Each person's voice is different and unique. It is generally determined by the size of the resonator system (oral cavity, larynx, pharynx, vocal folds, nasal sinuses) vibrate at different frequencies, producing various sounds. Sound quality is characterized by speech clarity (the relationship between voice pitch, volume, timbre, and speed of speech).⁴ Changes in the oral cavity due to tooth loss and resorption of the alveolar process or the mandible alveolar process can cause defects in the voice and speech of the patient. One of the most frequent phonetic distortions is lisping.⁴ Therefore dentures can modify phonetics, although functionally and aesthetically well designed.⁵

Several authors investigated speech disturbances in complete denture-wearing patients. Stelzle *et al.* reported an increase in the quality of speech in full denture wearer.⁶ Gitto *et al.* reported that making palatal rugae on full dentures could reduce speech difficulties.⁷ Meshram and Adaki said that full dentures with palatal rugae's contour show better changes in acoustic analysis than conventional dentures.⁸ However, Patil *et al.* reported that the addition of palatal rugae's contour is not always the best solution in overcoming phonetic problems. This

is because the procedure can increase the thickness of the palate arch, which is not needed.⁹

Palatine rugae can facilitate the conversation in the consonant pronunciation that is in linguo-palatal. In this sound group formation, rugae palatine comes in contact directly to produce linguo-palatal. When palatine rugae and hard palate come into contact with denture bases, proprioceptive changes occur.¹⁰ Therefore, after the patient uses the complete maxillary denture, the patient usually experiences phonetic disorders and unclear pronunciation.¹¹

MATERIAL AND METHODS

This study was pre and post with a clinical trial control design. The subjects of the trial were selected from patients from the Department of Prosthodontics, Faculty of Dentistry, Hasanuddin University, who are currently being treated as outpatients. Inclusion criteria for experimental subjects were: never used partial dentures or full dentures, did not have a systemic disease that could affect neuromuscular behavior, had speech or hearing loss, and the patient did not suffer from palatoschisis or labio-schisis or both.

There are two types of dentures prepared for edentulous patients. Group I, dentures are made using conventional methods. The first impression on the maxillary and mandible was made in a stock tray that matches the irreversible hydrocolloid display material. After that, it is immediately inserted into the stone plaster to get a study mold where a special tray of maxillary and mandibular acrylic resin was built. The second impression was made with a rubber-based printing material with moderate consistency with finger pressure.

Impressions are packaged and put into dental stones to get the primary impression of the occlusion block. The maxillary circumference of the maxilla is adjusted for the aesthetic, occlusal, phonetic plane, and upper lip support. After proper adjustments and orientation to the occlusal plane, maxillary front arc notes are made to place the maxillary cast on the semi-adjustable articulator. The centric occlusion relationship was noted by the wax wafer method to attach the mandibular cast. Dentures are

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connected, with mandible teeth placed at the top of the ridge.

For Group II, the maxillary dentures were duplicated from conventional maxillary dentures in group II. The base covering the Palatine Rugae area was taken. Palatine rugae areas were made using elastomer putty material. The base was opened and then closed again using a wax. The next step was to move the palatine rugae area to the base of the wax. Then flasking and polish as conventional procedures.

How to calculate sound quality intensity:

1. Perform sound checks using the Manner of Articulation (MOA)
2. Carried out an articulation examination with a form that is prepared, then judged by the speech therapies.
3. After the sound and articulation checks, then assessed by the inter-achievement score.

The data obtained were then analyzed statistically using the Kruskal Wallis and Mann-Whitney test to determine the comparison of speech quality after the use of denture by duplicating palatine rugae and without duplicating palatine rugae.

RESULTS

Table 1 showed a significant difference in speech quality produced on /d/, /t/, and articulation consonants ($p < 0.05$). It was seen that the average full denture wearer score by duplicating palatine rugae was higher than complete denture wearers without duplicating palatine rugae on /t/ consonant test, increasing in wearers of the complete denture by duplicating palatine rugae on the test consonant/d/. Similarly, with articulated tests, full denture wearer scores were higher than those that did not use complete denture and use full denture without duplicating palatine rugae.

Table 2 showed differences in speech quality with the /t/ consonant test between-group no denture and group of wearer denture by duplicating palatine rugae and between the full denture wearer with or without the duplication of palatine rugae. There was a difference in speech quality with the consonant /d/ test between the complete denture wearer with duplicating the palatine rugae and without duplicating palatine rugae.

DISCUSSION

Phonetics, aesthetics, and function were the most important treatment objectives in prosthodontic. After full denture insertion, the patient's tongue must be adapted from untoothed conditions to conditions in the presence of denture elements. Boucher.¹² stated that the use of new dentures would affect the function of speech. At the time of closed palate, there was a change in airflow passing through the oral cavity in certain letters articulation or pronunciation. Factors causing speech disorder were the vertical dimension, curved tooth arrangement, anterior tooth position against lips, habit pattern of tongue movement, motion limitation of the tongue, and others.

One way to reduce the speech disorder after full denture insertion was by creating palatine rugae contour on the surface of the replica base palatal. The lack of texture in this part could affect proper articulation.

The production of linguo-palatal sound involved the contact of the tongue and palate. The tongue was in contact with batrachus alveolar and the palate of durum, thus creating the music of certain letters. Palatine rugae were on the posterior of the incisive papilla extending to

the palate area of durum. Therefore, the palatine rugae and papilla incisive were often used as tactile guides and turbulence of airflow when producing a precise articulation sound in the pronunciation of the letters.¹³

The analysis of the speech quality produced by the samples in this study was done by a speech therapist based on speed, accuracy, and strength at the time of pronunciation. The examples were asked to follow the sounds and words spoken by the appraiser and were given figures based on the assessment by a speech therapist. The raw standard of hearing-based evaluations and observations of speech therapist and numbers were based on predefined scoring indicators. In this assessment, the form and evaluation indicators were adapted to the forms and indicators used as a speech therapy section in Wahidin Sudirohusodo Hospital. Those indicators were based on the assessment book in speech-language pathology.

The production of palatine rugae was done to mimic the condition of the patient's palate. The use of complete dentures caused the tongue could lose important guidance in the articulation position during sound production. Articulation changes in the maxillary full denture wearer talk pattern due to adjustments or adaptations of the counterfeit tooth, one of which was a complete surface contour of the base palatal tooth. Palmer said that the function of the articulate organ became inefficient because of the imposition of palatine rugae and papilla incisive since they were definitive guidelines of the tongue.¹⁴ Failure to duplicate both might lead to loss of guidance and caused a less precise movement of the language. Kaufman also supports that the formation of palatine rugae in full dentures can add value to pronunciation.¹⁵

In this study, the full denture production, both without duplicating palatine rugae and a complete denture with duplicating palatine rugae, was performed by the same technique to obtain the results of which the full denture was utterly different only in part Palatine Rugae. The techniques used were deliberately modified so that the materials used to make the duplication of dentures were precisely the same. It was expected that with the same denture, a fair outcome could be obtained. The procedure of duplicating denture that was supplemented by the addition of palatine rugae was the difference between this study and previous studies. In this study, we tried to create two completely identical dentures, both in terms of size, selection, and preparation of dentures and the materials.

CONCLUSION

The presence of duplicate palatine rugae on a full maxillary denture base can improve speech function in edentulous patients. The creation of complete denture could also improve speech function in patients with complete edentulous.

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REFERENCES

1. Özbeki, M., Tulunoglu, İ., Özkan, S., & Öktemer, M. (2003). Evaluation of articulation of Turkish phonemes after removable partial denture

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- application. *Brazilian dental journal*, 14(2), 125-131. <http://dx.doi.org/10.1590/S010364402003000200010>
2. Naqvi, S., Dange, S. P., & Khalikar, S. A. (2014). A simple method for patients palatal rugae duplication in complete dentures. *International Journal of Prosthodontics & Restorative Dentistry*, 4(2), 46.
 3. Broka, K., Vidzis, A., Grigorjevs, J., Sokolovs, J., & Zigurs, G. (2011). The influence of the design of removable dentures on patient's voice quality.
 4. Muchtar, M., & Habar, I. D. (2018). The speech ability on maxillary denture wearer: a systematic review. *J Dentomaxillofac Sci*, 3, 1-4. <http://dx.doi.org/10.15562//jdmfs.v3i1.731>
 5. Balu, K., & Karthik, K. S. (2011). Speech in prosthodontics, type of literature: commentary. *JIADS*, 2(1), 79-81.
 6. Stelzle, F., Ugrinovic, B., Knipfer, C., Bocklet, T., Nöth, E., Schuster, M., ... & Nkenke, E. (2010). Automatic, computer-based speech assessment on edentulous patients with and without complete dentures—preliminary results. *Journal of oral rehabilitation*, 37(3), 209-216. <https://doi.org/10.1111/j.13652842.2009.02047.x>
 7. Gitto, C. A., Esposito, S. J., & Draper, J. M. (1999). A simple method of adding palatal rugae to a complete denture. *Journal of Prosthetic Dentistry*, 81(2), 237-239. [https://doi.org/10.1016/S00223913\(99\)70256-8](https://doi.org/10.1016/S00223913(99)70256-8)
 8. Adaki, R., Meshram, S., & Adaki, S. (2013). Acoustic analysis and speech intelligibility in patients wearing conventional dentures and rugae incorporated dentures. *The Journal of Indian Prosthodontic Society*, 13(4), 413-420. <https://doi.org/10.1007/s13191-013-0262-x>
 9. Patil, M. S., Patil, S. B., & Acharya, A. B. (2008). Palatine rugae and their significance in clinical dentistry: a review of the literature. *The Journal of the American Dental Association*, 139(11), 1471-1478. <https://doi.org/10.14219/jada.archive.2008.0072>
 10. Kong, H. J., & Hansen, C. A. (2008). Customizing palatal contours of a denture to improve speech intelligibility. *The Journal of Prosthetic Dentistry*, 99(3), 243-248. [https://doi.org/10.1016/S00223913\(08\)60049-9](https://doi.org/10.1016/S00223913(08)60049-9)
 11. Jethlia, H., Jethlia, A., Naveen, R. P., Meshram, A., & Sharma, N. (2013). Post insertion problems and their management in complete denture. *Journal of Evolution of Medical and Dental Sciences*, 2(3), 194-200.
 12. CO, B. (1970). Swenson's complete dentures. *St. Louis: Mosby*.
 13. Shetty, D., Juneja, A., Jain, A., Khanna, K. S., Pruthi, N., Gupta, A., & Chowdhary, M. (2013). Assessment of palatal rugae pattern and their reproducibility for application in forensic analysis. *Journal of forensic dental sciences*, 5(2), 106. <https://dx.doi.org/10.4103%2F09751475.119775>
 14. Kaufman, C., & Cardash, H. S. (1984). A method of restoring the palatal form in a complete maxillary denture. *The Journal of prosthetic dentistry*, 51(1), 126-128. [https://doi.org/10.1016/S00223913\(84\)80119-5](https://doi.org/10.1016/S00223913(84)80119-5)
 15. Sharry, J. J. (1974). *Complete denture prosthodontics*. McGraw-Hill Companies.

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Table 1. Comparison between the quality of speech of full denture wearers with and without duplicating palatine rugae.

Consonant	Group	n	Min	Max	Mean ± SD	p-value
/t/	without full denture	10	2.25	3.75	3.125 ± 0.517	0.000*
	full denture without duplicating palatine rugae	10	3.25	4.25	3.850 ± 0.316	
	full denture with duplicating palatine rugae	10	4.25	5.00	4.925 ± 0.237	
/d/	without full denture	10	2.25	3.75	3.075 ± 0.541	0.000*
	full denture without duplicating palatine rugae	10	3.25	4.25	3.850 ± 0.316	
	full denture with duplicating palatine rugae	10	4.25	5.00	4.925 ± 0.237	
Articulation	without full denture	10	2.33	3.67	3.066 ± 0.467	0.000*
	full denture without duplicating palatine rugae	10	3.33	4.67	4.017 ± 0.356	
	complete denture with duplicating palatine rugae	10	4.00	5.00	4.900 ± 0.316	

*Significant Kruskal Wallis test (p<0.05)

Table 2. The Mann-Whitney analysis of speech quality between full denture wearers with and without duplicating palatine rugae

Comparison		Consonant (t)	Consonant (d)	Articulation
Without full denture	Full denture without duplicating palatine rugae	0.002*	0.001*	0.000*
	Full denture with duplicating palatine rugae	0.000*	0.000*	0.000*
Full denture without duplicating palatine rugae	Full denture with duplicating palatine rugae	0.000*	0.000*	0.000*

*Significant by Mann-Whitney (p<0.05)