

Original Research Article

Do eyeglasses and palatal prostheses affect the results of the Weber test?

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ABSTRACT

Background: The aim of the study was to analyze the possible effects of eyeglasses and palatal prostheses on the results of the Weber tuning fork test.

Methods: We enrolled 96 patients diagnosed with unilateral conductive-type hearing loss. All were aged between 18 and 65 years. Group 1 was composed of 48 patients with eyeglasses and group 2 included 48 patients with palatal prostheses. All patients underwent the weber tuning fork test with and without their eyeglasses and prostheses, and the results were compared. Weber tests were performed using 256 Hz and 512 Hz tuning forks.

Results: No significant between-group difference was apparent (both $p > 0.05$).

Conclusions Neither eyeglasses nor palatal prostheses significantly affected the results of the Weber test.

Keywords: Tuning fork, Weber test, Rinne test

INTRODUCTION

The tuning fork was by Shore, Purcell, and Handel in 1711, while in 1825, Ernest Weber published the initial description of the tuning fork test that bears his name.^{1,2} The Rinne and Weber tests can be used clinically to evaluate hearing.³⁻⁵ In the Weber test, a tuning fork (usually 256 Hz) is activated and applied to the skull, forehead, chin, or upper incisors. Healthy subjects hear the fork equally in both ears; those with ear conditions may not. The test thus identifies the side of disease.

The vibrating fork is placed on the midline of the forehead and the patient is asked whether s/he hears the fork or not; if the answer is yes, the patient is asked to identify the ear in which s/he hears the fork better.^{1,2,6} If the sound is heard equally by both ears, the ears are in similar condition. However, if the sound is heard better in

one ear than the other, the latter ear may have sensorineural hearing loss (SNHL) or conductive-type hearing loss (CTHL).

Conversely, if the sound is heard better in the diseased ear, the patient may have a disease of the conducting apparatus. We investigated whether eyeglasses and dental prostheses change the sense of vibration; no such clinical trial concerning this question has yet been reported. Air conduction tests measure the integrity of the entire hearing apparatus, i.e., from the external ear to the auditory cortex. Bone conduction tests measure the integrity of sensorineural structures.

The aim of our present study was to analyze the possible effects of eyeglasses and palatal prostheses on diapasone tests, particularly the Weber tuning fork test.

METHODS

The study protocol was approved by the institutional ethics committee, Istanbul, Turkey. All patients referred to our Department of Otorhinolaryngology, Head and Neck Surgery, between January 2015 and May 2015. We enrolled 96 patients who admitted to outpatient clinic, aged 18–65 years, diagnosed with unilateral CTHL and also the eyeglasses or prostheses users. Of the 96 patients, 48 who wore eyeglasses were included in group 1. The remaining 48 patients had palatal prostheses and constituted group 2.

Detailed physical and otological examinations with audiological tests were performed on all patients. All patients underwent the Weber tuning fork test with and without the eyeglasses and prostheses, at 15-minute intervals, and the results were compared. The Weber tests were performed respectively using 256 Hz and 512 Hz tuning forks.

The study was performed in accordance with the ethical principles of the declaration of Helsinki. Study patients will be determined based on specific inclusion and exclusion criteria. Patients with CTHL and also the eyeglasses or prostheses users, who become age between 18-65 years and who signed informed consent forms were included. To reduce bias, we chose patients with equal to 15–25 dB pure tone audiometry score differences between the healthy and diseased ears. Patients with

SNHL, an obstructing cerumen, otosclerosis, or mixed-type hearing loss, and those who refused to co-operate, were excluded. To further reduce bias, each patient was tested three times: on the midline of the forehead, on the incisors, and on the chin (points A, B, and C, respectively).

Statistical analyses of the data were conducted using SPSS software (ver. 17; SPSS Inc., Chicago, IL). Data were analyzed using descriptive statistical methods (means and standard deviations). The Fisher’s exact test was used to compare two independent groups. Results were evaluated using 95% confidence intervals; the level of significance was set at $p < 0.05$.

RESULTS

In total, 96 patients diagnosed with unilateral CTHL were included in this study. The mean ages of groups 1 and 2 were 35.2 and 52.8 years, respectively. The mean female to male ratio was 0.7 for group 1 and 0.6 for group 2. The average air-bone gaps were 18.6 dB and 17.3 dB, respectively. Table 1 and Table 2 shows the Weber test results (at 256 and 512 Hz; points A–C) (respective $p=0.495$, $p=0.5$, $p=1.0$). The minimum accuracy rate was 95.8% and also two groups have same accuracy rates. When the two groups were compared, no difference was observed between them. No significant between-group difference was evident (both $p > 0.05$) (Table 1, 2).

Table 1: The results of the Weber test to understand the problem of transmission test according to the use of eye glasses.

C 512 Hz	C 256 Hz	B 512 Hz	B 256 Hz	A 512 Hz	A 256 Hz		
0/48 (0%)	0/48 (0%)	1/47(2.1%)	1/47 (2.1%)	2/46 (4.2%)	2/46 (4.2%)	Weber	Eye-glasses -
0/48 (0%)	0/48 (0%)	0/48 (0%)	0/48 (0%)	0/48 (0%)	0/48 (0%)	Weber	Eye-glasses +
1.000	1.000	0.5	0.5	0.495	0.495	p	

Fisher’s exact test; ** $p < 0.01$.

Table 2: The results of the Weber test to understand the problem of transmission according to the use of dental prosthesis.

C 512 Hz	C 256 Hz	B 512 Hz	B 256 Hz	A 512 Hz	A 256 Hz		
0/48 (0%)	0/48 (0%)	1/47 (2.1%)	1/47 (2.1%)	2/46 (4.2%)	2/46 (4.2%)	Weber	Dental prosthesis -
0/48 (0%)	0/48 (0%)	0/48 (0%)	0/48 (0%)	0/48 (0%)	0/48 (0%)	Weber	Dental prosthesis +
1.000	1.000	0.5	0.5	0.495	0.495	p	

Fisher’s exact test; ** $p < 0.01$.

DISCUSSION

We found that the reliability of the Weber test was $>95\%$.⁷ It is important to identify factors that might reduce test efficacy and safety. No specific means of patient preparation has yet been recommended. We found that the minimum accuracy rate was 95.8%. A 256 Hz tuning fork is preferred for the Weber and Rinne tests, because sound of intermediate frequency allows low-tone

hearing impairment to be evaluated; no excessive vibratory sensation influences the response.⁷⁻⁹ Use of a higher-pitched fork may cause early CTHL to be missed; a lower-pitched fork tests only vibration perception.

The best forks are those with insulated handles, such that the examiner’s hand does not touch the vibrating metal thereby eliminating the possibility of damping by the

hand, and of rust. The end of the handle should be smooth and fairly large, to avoid patient discomfort when the handle is laid on the patient's mastoid process. A doubly vibrating 256 Hz tuning fork is used in most tests.^{2,6,8,9}

It is also possible to compare the length of time over which the tone is heard between patients and normal individuals; this is similar to the Schwabach test, in which both ears are evaluated simultaneously. Classically, eyeglasses affect the Schwabach test results. However, the vibratory sensations perceived through dental prostheses may not lead to errors.³⁻⁷

CONCLUSION

The Weber test is very accurate and reliable. In this study, neither eyeglasses nor palatal prostheses had any significant effect on the results.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bickerton RC, Barr GS. The origin of the tuning fork. J R Soc Med. 1987;80:771-3.
2. Grant JD. Simplified method of determining percentage of actual hearing-power in Tuning-fork tests. Proc R Soc Med. 1934;27:419-24.
3. Burkey JM, Lippy WH, Schuring AG, Rizer FM. Clinical utility of the 512-Hz Rinne tuning fork test. Am J Otol. 1998;19:59-62.
4. Butskiy O, Ng D, Hodgson M, Nunez DA. Rinne test: does the tuning fork position affect the sound amplitude at the ear? J Otolaryngol Head Neck Surg. 2016;45:21.
5. Stevens JR, Pfannenstiel TJ. The otologist's tuning fork examination-are you striking it correctly? Otolaryngol Head Neck Surg. 2015;152:477-9.
6. Barnes WH. The tuning fork tests. J Natl Med Assoc. 1922;14:95-8.
7. Sunar O, Devranoglu I, Umul M. Weber testinin klinik degeri. Turk Arch Otorhinolaryngol. 1987;25:148-54.
8. John S, Turner JR. The ear and auditory system. In: Walker HK, Hall WD, Hurst JW, ed. Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd ed. Chapter 126. Boston: Butterworths; 1990.
9. McBride P. The Tuning-Fork in diagnosis of lesions of the internal ear. Br Med J. 1886;1:688.

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