

## Speech Assessment after Use of Vacuum Formed Retainers vs. Conventional Hawley Retainer

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### ABSTRACT

Although many types of retainers are available, the Hawley retainer and the vacuum-formed retainer are the most commonly used clinical retainers.

**Aim:** To evaluate and compare the effects of Hawley retainer and vacuum formed retainer on frequency of vowels and consonants over a period of time.

**Methodology:** 30 subjects were included in this study. The subjects were divided in groups of the Hawley's retainer (Group 1) and vacuum formed retainer group (Group 2). The articulation abilities of subjects were evaluated before and after the initiation of retainer wear.

**Results:** Articulation of /d/ and /t/ is most affected in VFR group while /t/ and /m/ were the most affected by wearing of Hawley's retainer.

**Conclusion:** Patients experience articulation problems when wearing retainers initially, but these problems gradually decrease such that on the seventh day of appliance wear, disarticulation problems mostly disappear completely. Both VFR and Hawley's retainer affected the speech. The /t/ was most affected in both group but Hawley's retainer affected the most.

**Keywords:** Hawley retainer, vacuum formed retainer, speech assessment, vowels, consonants

### INTRODUCTION

Retention is a critical phase of orthodontic treatment. Currently, the influences of the periodontal and gingival tissues, unstable positions of teeth, and continued skeletal growth are considered to be the major causes of relapse after removal of fixed appliances. [1] To address this

problem, retainers are used to prevent the teeth from returning to their former positions until gingival and periodontal reorganization and skeletal growth are essentially completed. Although many types of retainers are available, the Hawley retainer and the vacuum-formed retainer are the most commonly used clinical retainers.

The Hawley retainer was designed by Charles Hawley [2] in 1919, has been used for nearly a century, and has become the most popular removable retention appliance. The alternative removable retainer is an invisible retainer that was designed in 1971 and has been referred to by the following names: vacuum-formed retainer, clear overlay retainer, and Essix retainer. [3]

Speech may be affected by any device that impairs the movements of soft and hard oral tissues. [4] Therefore, changes in articulation caused by retainers should be scrutinized during retention treatment. Haydar et al. [5] revealed the distortion of /t/, /n/, /k/, /g/, and /p/ sounds when wearing Hawley retainer for the first time. Kayikci et al. [6] performed a similar study and found that /i/ and /s/ sounds underwent substantial changes after wearing Hawley retainer. Little is known about the phonetic influence of orthodontic retention. [7]

### Aims & Objectives:

To evaluate and compare the effects of Hawley retainer and vacuum formed retainer on frequency of vowels and consonants over a period of time.

## METHODOLOGY

30 patients (15 in Hawley retainer group and 15 in vacuum formed retainer group) were examined to get the mean frequency difference of 150Hzs with standard deviation of 146Hzs at 80% power and 95% confidence after pronunciation of vowels post delivery of retainers.

## INCLUSION AND EXCLUSION

### CRITERIA:

#### ➤ Inclusion Criteria:

- Patients who have completed their orthodontic treatment
- Patients having age above 18 years of age.
- Patients who gave consent for the proposed study
- Patients who are systemically healthy

#### ➤ Exclusion Criteria

- Patients who have hearing and speech disorders
- Patients with Cleft lip or cleft palate
- Patients who had undergone surgical correction of the jaws
- Patients who are suffering from severe periodontitis

### Methodology:

30 subjects were included in this study. The subjects were divided in groups of the Hawley's retainer (Group 1) and vacuum formed retainer group(group 2). Subjects who had completed their orthodontic treatment were included in this study. At first, the articulation abilities of subjects were evaluated before the initiation of retainer wear. Hawley retainers were constructed with a cold cure acrylic base plate, Adams clasps, and a labial bow. The acrylic part of the retainer was maintained at a uniform thickness of 2 mm to 3 mm.

Vacuum formed retainers were constructed on vacuum former (Atxin, model AX-KZ). The patients were instructed to wear the retainers 24 hours a day for 6 months, excluding while eating and brushing their teeth. All participants were given a practice trial for each task by the clinician, in order to assure the individual's best pronunciation.

The subjects were instructed to pronounce vowels /a/, /e/, /i/, /o/, /u/ and consonants /t/, /d/, /n/, /s/, /z/, /m/, /n/, /c/, /h/, /g/ at a comfortable pitch and loudness at following time intervals:

- Before wearing retainers[T<sub>0</sub>]
- Immediately after delivering retainers[T<sub>1</sub>]
- At 24 hours[T<sub>2</sub>]
- At 1 week[T<sub>3</sub>]
- At 1 month[T<sub>4</sub>]
- At 3 months[T<sub>5</sub>]

The vowels and consonants which were pronounced by the subjects, recorded through microphone placed 15 cm away from the participants' mouths. Recorded data was analyzed later by using a frequency analyzing software WASP version 1.2(Vuche labs, India)

## RESULTS

In vacuum formed retainer group as showed in graph 1 a, e, i, z, n, m, c did not get affected much on wear of VFR but the frequency of /o/ decreased till 1 week after delivery of retainer and returned to original frequency after a month.

For /u/ frequency reduced by 20Hzs immediately after delivery of retainer and remains low even after 3 months.

Articulation of /t/ is 2<sup>nd</sup> most affected in VFR group. Its frequency reduced immediately after delivery and after 24 hours, too (p<0.05). As the frequency was 250Hzs w/o retainer, its frequency remained low at 237Hzs even after 3months.

Articulation of /d/ was most affected. Its frequency reduced for 20Hzs immediately after 24 hours. The frequency reduced even more after 24hours and remained at 200Hzs even after 3 months (p<0.05).

**Table 1: Paired t test for frequencies of /t/ and /d/ in Vacuum formed retainer group**

	Value	F	P-value
Pillai's trace	.532	8.636 <sup>a</sup>	.000
Wilks' lambda	.468	8.636 <sup>a</sup>	.000
Hotelling's trace	1.136	8.636 <sup>a</sup>	.000
Roy's largest root	1.136	8.636 <sup>a</sup>	.000

For Hawley's retainer group, /t/ and /m/ were the most affected by wearing of Hawley's retainer. (Graph 2)

The frequency of /t/ was 225 w/o retainer, which reduced to 199Hzs immediately after delivery of retainer and after 3 months the frequency was 205Hzs( $p \leq 0.001$ )

For /m/, frequency was 235Hzs w/o retainer and reduced to 196Hzs after wearing of Hawley's retainer( $p \leq 0.001$ )

**Table 2: Paired t test for frequencies of /t/ and /m/ in Hawley's retainer group**

	Value	F	P-value
Pillai's trace	.317	4.830 <sup>a</sup>	.001
Wilks' lambda	.683	4.830 <sup>a</sup>	.001
Hotelling's trace	.464	4.830 <sup>a</sup>	.001
Roy's largest root	.464	4.830 <sup>a</sup>	.001

## DISCUSSION

Warren [8] stated that when speech is distorted by a defect in the oral cavity, a physical or psychological factor is usually also involved. Warren stated that when speech is distorted by a defect in the oral cavity, a physical or psychological factor is usually also involved. Laine [9] also concluded that subjects with a slightly narrower palate showed a tendency of /s/ sound distortion. Similarly, the upper and lower retainers may constrict the dimensions of the oral cavity and restrict the movement of tongue during articulation, resulting in distortions of various sounds.

Results of this study revealed that infrequent distortions occurred in some subjects in some sounds on the first day the retainer was worn. The most pronounced distortions were observed on the first day with /t/, /d/ sounds with wear of both retainers, which persisted even after 1 month.

As stated by Bloomer, [10] articulatory defects of speech may exist even though the dental occlusion is normal and vice versa. In our study /z/ and /s/ sounds appeared to be slightly distorted with no retainers worn. Although some articulatory problems existed with these sounds beforehand, wearing retainers did not seem to worsen the situation extensively except for the /s/ sound on the first day

when both retainers were worn, and these distortions declined to their original levels gradually.

Strutton and Burkland [11] tested the effects of various designs of maxillary retainers on the clarity of speech only at initial insertion and they concluded that the Crozat-type and modified horseshoe-type retainers are superior to the traditional Hawley design.

The thickness of acrylic was maintained 2-3mm. Thickness of the retainers seems to play an important role in the adaptation of patients' articulatory abilities. An average thickness of 2 to 3 mm of the acrylic part was obtained and this was kept at 1 to 2 mm on the upper retainer just behind the incisors. This area is distinctive because /t/, /d/, /n/, and /s/ sounds are produced by the tongue and alveolus act as a stop for tongue. A very thin acrylic coverage at this region probably played an important role for the articulatory adaptations in a short period.

Erb [12] in his study concluded that a thin retainer roughened in the anterior alveolar area will produce the least amount of speech interference and that most patients adapted to their retainers within 2 weeks. The findings of this study are parallel to ours that a thinly constructed appliance, which is used consistently for a given period, improves distortions of speech caused by retainers.

In studies concerning the effects of orthognathic surgery on speech, it was observed that speech was disrupted immediately after the surgery but in the long term, no perceptually discernible effects on speech were noted Despite the morphologic alterations to their vocal tracts, the subjects' speech remained unaltered. Patients in our study who wore retainers similarly adjusted their motor programming for speech during the observed period. Patients themselves indicated that after the first days of retainer wear, their relatives or close friends could not perceive a distortion in their speech, and nearly all patients expressed that they were

comfortable with their retainers worn during a conversation.

To reduce the influence of impairment in speech as much as possible, two measures should be taken. The first is to encourage retainer-wearing patients to practice distortion sounds, and the second is to change the structure of the retainer so that it will be less likely to influence speech. Stronger materials may be used to reduce the retainer thickness. In addition, grooving and roughening the anterior alveolar areas of retainer can help the tongue to find a suitable position in the oral cavity. [13]

Recently, clear aligners are gaining popularity. The most common speech impediment caused by clear aligners was a slight lisp, which subsided after a couple of weeks. Like any orthodontic appliance, patient must become accustomed to wearing aligners. Hodges [14] reported that during the first few days of treatment, aligners felt foreign in oral cavity no matter how comfortable they are.

## CONCLUSION

Patients experience articulation problems when wearing retainers initially, but these problems gradually decrease such that on the seventh day of appliance wear, disarticulation problems mostly disappear completely. Both VFR and Hawley's retainer affected the speech. The /t/ was most affected in both group but Hawley's retainer affected the most.

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