Speech Effects of the Maxillary Retainer

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PURPOSE

This paper attempts to give information on the various aspects of the speech effects of the maxillary retainer: (1) frequency of retainer-caused speech changes, (2) speech effects of retainer shape and thickness, (3) time required for a patient to speech-adapt to a retainer, (4) retainer adjustments effective in minimizing speech interference, and (5) possibility of permanent adverse speech change from wearing a retainer.

LITERATURE REVIEW

Orthodontists have contributed greatly to the study of speech effects of malocclusion. Bruggeman,[2] Fymbo,[4] Rathbone,[7] Subtelny[10] and many others have written their observations in this field.

However, a review of the literature disclosed only two articles on the speech effects of orthodontic appliances. Feldman[3] surveyed 32 patients, age range nine to eighteen. Some wore bite planes or Hawley retainers and some wore labiolingual appliances. The patients were speech tested at insertion of appliance, one hour after insertion, and 2 to 3 weeks after insertion. Feldman found that patients with bite planes or retainers were more likely to have speech difficulty than patients with the labiolingual appliance. He stated that regardless of the appliance worn, any resulting articulatory difficulties were overcome, almost if not entirely, within a short time.

Koyoumdjisky[6] reported that after an 8-year old patient wore a retainer for five months her speech was normal with the retainer. However, without it her voice was hypernasal.

Prosthodontists have written volumes on the speech effects of their appliances. The prosthetic patient, because of his age, is not as adjustable to an appliance as the orthodontic patient and he tends to be more vociferous in his complaints. So the prosthodontist, of necessity, has learned to construct appliances that do not inhibit speech. It is convenient to take the observations of prosthodontists and retest and evaluate them with respect to the maxillary retainer.

But first let's review quickly the parts of the speech mechanism that could be affected by a maxillary retainer. As the air stream of speech passes through the oral cavity it is altered by musculoskeletal valves. They obstruct the passage of air, breaking up the tones and producing the individual speech sounds.

According to Sloan et al.[9] the valves most likely to be affected by a maxillary retainer are linguodental, linguoalveolar, and linguopalatal.

What have prosthodontists observed that might apply to a maxillary retainer? Allen[1] studied tongue-palate contact using palatograms of edentulous individuals who had normal speech. An acrylic palatal plate was constructed for each subject. It was dusted with non-scented talc and inserted. Tongue contact for different sounds showed as a glossy area on the plate. The only vowel without tongue-palate contact was "o". So "o" was used in combination with the different consonants to test them. Allen points out that it is impossible to pronounce a consonant that is not accompanied by a vowel. When one attempts to pronounce "t" he says "tuh" or "tee".

Figure 1, from Allen's paper, is a comparison of palatograms made on

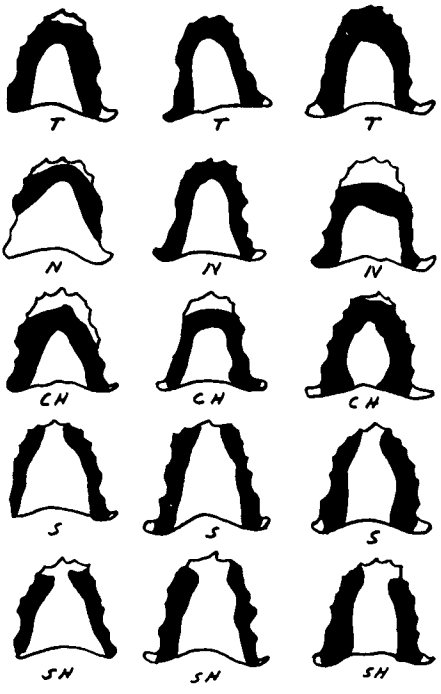

Fig. 1 A comparison of palatograms made on three subjects who pronounced the same sounds.

three subjects who pronounced the same sounds. The palatograms for a given sound were not identical for every subject, but they were similar and constituted a pattern. Allen found that denture patients with faulty speech had atypical palatograms. He recommends contouring dentures, to produce normal palatograms, as a means of improving speech.

Allen also studied how denture thickness affects speech. The plates constructed for palatogram study were used. Base plate wax was added to them to increase thickness. He found the area most sensitive to thickness was the anterior alveolar area from cuspid to cuspid. An addition of 1 millimeter thickness in this area made speech awkward and indistinct. A similar addition in the posterior alveolar area made speech awkward but not indistinct. The entire vault area could be thickened up to the tongue palatal line (from the palatograms) without affecting speech.

Kessler[5] states that the denture thickness just lingual to maxillary incisors is critical for speech. He adds that some artificial rugae on acrylic resin dentures make the area too thick and are a handicap to tongue placement. In constructing a partial denture Kessler avoids areas of tongue palate contact. He determines these areas from a palatogram made while the patient recites a sentence containing all sounds of the English language.

Rothman[8] also emphasized the importance of keeping the denture base thin in the anterior region. This, he claims, is necessary for the production of accurate linguoalveolar and linguopalatal consonant sounds and for the correct quality of the high vowel sounds formed in the front of the mouth.

Rothman describes a procedure for altering the denture to improve the "s" sound, the most commonly mispronounced sound of the English language. He explains that the essential factor of a correct "s" is the proper grooving of the tongue. As the depth of this groove is decreased, "s" is softened toward "sh"; as the depth is further decreased, toward "th" as a lisp. Where the groove of the tongue is too deep, the patient may whistle while making the sound "s". Lisping and whistling are opposite phenomena. It the patient whistles, the depth of the groove of the tongue should be decreased by thickening the denture base in the appropriate area.

Figure 4, from Rothman's paper, is a comparison of the palatograms of the sounds "s", "sh", and "th". It shows how the depth of the groove in the tongue is the critical factor in the differentiation between the three sounds.

Method

Seventeen orthodontic patients were

Fig. 2 Palatograms of "s", "sh", and "th". Note that an increase in the width of the channel corresponds to an increase in shallowness of the groove in the tongue, causing softening of "s" to "sh" and to "th".

selected as they were ready for retainers. An attempt was made to eliminate as many extraneous factors as possible and limit the study to the effects of the maxillary retainer. So only patients with ideal occlusion were selected. Each had a fixed cuspid to cuspid mandibular retainer or no mandibular retainer at all. It was thought that the cuspid to cuspid retainer would have little effect on speech. None of the selected patients was given speech training while participating in the study.

Each patient was speech-tested immediately before and after receiving a maxillary retainer. At the same appointment the retainer was altered with base plate wax. First the anterior area was thickened until it was 2 to 2.5 millimeters, and then a bite plane was added (Fig. 3). The patient was tested after each alteration.

Then the wax was removed from the retainer and each patient was again tested in two weeks, two months, and six months. For some patients adjustments were made to the retainer to encourage better speech. They consisted of grooving the retainer to increase the depth of the tongue for "s" and roughening the anterior area (Fig. 4) to give the tongue tip tactile indication of the place for forming "t", "d", "n", and "l".

The Templin-Darly Articulation Test was used for the following sounds: "t", "d", "n", "l", "s", "z", "ch", "sh", "j", "zh", "thl", and "th2". All tests

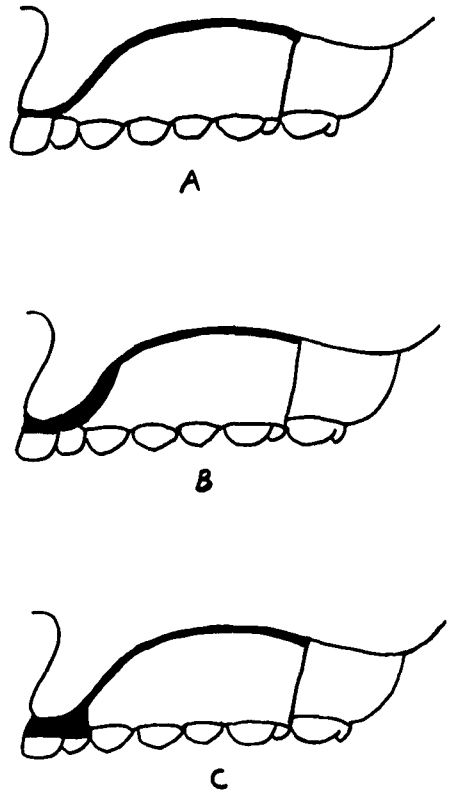

Fig. 3 Retainer alterations, A, maxillary retainer 1 to 1.5 millimeters thick, B, anterior area 2 to 2.5 millimeters thick, C, bite plane added.

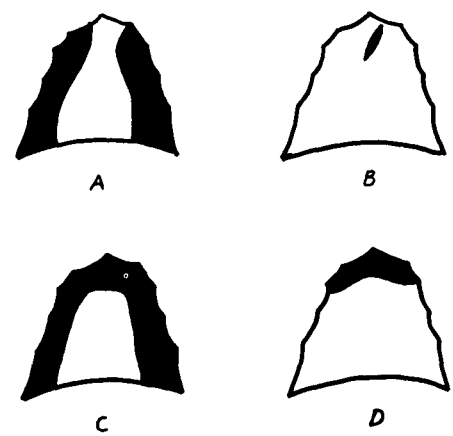

Fig. 4 Retainer adjustments to improve speech, A, tongue contact for "s", B, groove to improve "s", C, tongue contact for "t", "d", "n", or "l", D, roughened area to aid tongue tip placement for "t", "d", "n", and "l".

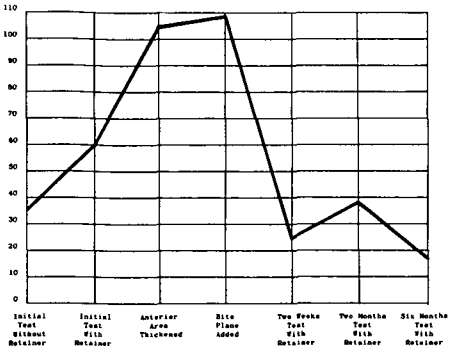

Fig. 5 Total speech errors for seventeen patients for the various tests.

were conducted by an experienced speech therapist.

Observations and Discussion

Figure 5 shows the total speech errors of all patients for the various tests. It is obvious that placing the retainer caused additional speech errors. Only two of the seventeen patients did not demonstrate errors caused by the retainer when it was initially placed. Thickening the anterior alveolar area greatly increased the errors. All patients demonstrated additional errors from the thickening. Yet, after two weeks there were fewer errors with the retainer than initially without it. Only three patients had more errors at this time with a retainer than initially without it.

One might conclude that wearing a retainer improves speech. However, he should consider other factors. The first one is the therapist's inconsistency. Detecting speech errors is somewhat subjective and can be influenced by the state of health and degree of alertness of the therapist. A cold might render her hearing less discriminating; being tired might make her less critical.

Another factor is the noise level of the testing room which might affect accuracy. Also another factor is the patients' familiarity with the test. The patients might make fewer errors after they have taken the test several times and can read it easily.

For the six months test there is still another factor and that is the maturation of the patients.

For the initial test, before the retainer was placed, most of the errors represented a learned pronunciation rather than a speech defect. For example many of the patients pronounced little as "liddle". Many pronounced garage as "garadge".

The additional errors produced by placing the retainer were mostly for sibilants. These are the sounds produced by directing an air stream over the teeth. They include two linguoalveolar sounds, "s" and "z"; and all the linguopalatal sounds, "ch", "sh", "j", and "zh".

When the anterior alveolar area was thickened and a bite plane was added even more errors occurred for sibilants, but many errors also appeared for the remainder of the linguoalveolar sounds, "t", "d", "n", and "l"; and for the linguodental sounds "th1", and "th2".

After two weeks, the distribution of the errors with the retainer was much the same as the initial distribution of errors without the retainer. That is, the errors were those consistent with normal speech of the individual patients.

Adjusting the retainer as an attempt to improve speech was accomplished for the first three patients tested. It was done the same day as the initial test. The procedure seemed to be successful. However, the question arose, "Was the adjustment necessary?" It might have only speeded up the patients' speech-adaptation to the retainer. So for the next fourteen patients, adjustments were made only for the three who showed need at the time of the two weeks test. All six patients, whose retainers were adjusted, immediately demonstrated speech improvement.

At the time of the six months test only four of the seventeen patients thought the retainer affected speech at that time. All of these were content to wear it if they could take it out to recite and for a foreign language class. None felt the need to remove it for normal conversation.

The therapist thought only two of the four sounded different with the retainer. Each of these patients was questioned thoroughly about retainer wear. Each had a retainer that continued to fit well which was an indication that it was worn. Yet, each admitted leaving it out of the mouth one or two days a week throughout the study. Possibly even these two would have speech-adapted to the retainer if they had worn it more.

The therapist was of the opinion that none of the patients had a permanent adverse speech change from wearing the retainer. During the study none of the seventeen developed speech errors that persisted when the retainer was not worn.

Summary

Seventeen treated orthodontic patients were observed to determine the speech effects of the maxillary retainer. Information was obtained on the various aspects of these speech effects: (1) frequency of retainer-caused speech changes, (2) speech effects of retainer shape and thickness, (3) time required for a patient to speech-adapt to a retainer, (4) retainer adjustments effective in minimizing speech interference, and (5) possibility of permanent adverse speech change from wearing a retainer.

The author holds the following opinions concerning the various aspects listed above. Observations are cited to support these opinions. (1) Retainer-caused speech changes are likely to occur when a maxillary retainer is initially placed. Fifteen of the seventeen patients showed these changes.

(2) Retainer thickness in the anterior alveolar area greatly affects speech. The retainer should be as thin as possible in this area (1 to 1.5 mm). All patients demonstrated additional speech errors when the anterior alveolar area was thickened.

(3) Most patients speech-adapt to a retainer within two weeks. Only three of the seventeen patients still demonstrated retainer-caused speech errors after this time. However, two continued to demonstrate these errors after six months. It seems that a few patients may experience difficulty in speaking with a retainer even though they have worn it for months.

(4) Adjusting the retainer, grooving it, and roughening it in the anterior alveolar area appears to improve speech. At least it accelerates speech-adaptation to the retainer. All six patients whose retainers were adjusted immediately demonstrated speech improvement.

Roughening the retainer in the anterior alveolar area seems to allow the patient to find the correct tongue placement for speech. The grooving allows a sharper quality to the sibilants. It helps correct a substitution of "sh" or "th" for "s".

(5) It appears that a permanent adverse speech change from wearing a thin retainer is unlikely. None of the patients after six months of retainer wear had developed speech errors that persisted when the retainer was not worn.

This paper represents a limited clinical study. The observations, which are somewhat subjective, do not lend themselves to statistical analysis. However, generalizations are apparent. It is gratifying that these generalizations did coincide with "common sense". Orthodontists generally follow procedures that

these generalizations suggest in constructing retainers, and in prescribing retainer wear.

This study indicated that a thin retainer that is roughened in the anterior alveolar area will produce the least amount of speech interference. When the retainer is constructed in this manner most patients will readily speech-adapt to it.

However, a few patients may experience difficulty in speaking with the retainer, even after they have worn it for months. A few others will only think they experience difficulty. In either case, these patients probably will not be embarrassed to wear the retainer during normal conversation. They may, however, want to remove it for reciting and for a foreign language class. They should be allowed to do so.

Even a thin retainer may continue to cause speech difficulty. But the retainer does not appear to produce a permanent adverse speech change. The speech difficulty disappears when the retainer is not worn.

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