

Effect of Removable Orthodontic Appliance on Taste and Flavor Perception – A Clinical Study

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Removable orthodontic appliances are known to be the cause of various complaints related to oral handling of food and beverages, phonation and vocalization. To evaluate the complaint regarding appliance and its effect on taste and flavor perception, 100 volunteers were selected for the study. Two groups (I and II) of 50 children each were divided as study and control groups between the age group of 8- 13 years. Selected volunteers were given taste and flavor stimuli and were asked to score as per their perception in different testing sessions. The overall results revealed that volunteers from both study and control groups, irrespective of the use of removable orthodontic appliances showed marked variation in the estimation of the taste and flavor stimuli in different testing sessions. However, the results obtained were statistically not significant.

Keywords – Removable orthodontic appliances, Taste, Flavor.

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INTRODUCTION

The word “Taste” is commonly used to describe the sensation produced by placing food in the mouth.¹ Taste refers to the sensation experienced during stimulation of oral chemo receptors and will include stimulation of specialized receptors cell in the taste buds and free nerve endings in the oral cavity.¹ The term “Flavor” is quality affecting the taste on odor of any substance.¹

In relation to humans the development of taste perception follows a well defined pattern¹ and the sense of taste is to some degree functional at birth. Research shows that taste sensitivity of 8-9 year old child although well developed, is not fully matured.² So anything which brings about a change in taste and flavor is repulsive to children.

Children in the developing period develop various types of malocclusion and hence needs occlusal guidance. Most of the orthodontic procedures are done using various forms of removable orthodontic appliances. The success of the treatment depends upon the continuous placement of these appli-

ances in the oral cavity. But children refuse to wear them or wear them according to their convenience as they feel these appliance interfere with phonation, vocalization, oral handling of food and beverages and alter the taste and flavor of the food.

When treating children or grown ups, pediatric dentists and orthodontists feel that these appliances do not interfere with oral function and prolong wearing is needed for maximum benefit of appliances. But children often refuses to wear the appliance complaining of change in taste and smell perception. So the present study was designed to analyze if there is any change in taste and flavor perception in children while using removable orthodontic appliances.

MATERIALS AND METHODS

100 selected volunteers for the study were divided into two groups (Groups I and II) of 50 children each as study and control groups, between the age groups of 8-13 years. All the selected volunteers were given different taste and flavor stimuli and were asked to score as per their perception. The verbal score was calculated on the basis of correct and incorrect taste and flavor stimuli given to them.

The volunteers for the study group consisted of 50 patients who included 25 patients with upper removable orthodontic appliances and/or 25 patients with lower removable orthodontic appliances. Control group consisted of 50 patients who did not require removable orthodontic appliances.

The samples were presented to all the selected volunteers in an individual, randomized sequence. The samples consisted of eight different taste stimuli in two different concentrations –concentrated sucrose(A), dilute sucrose(B), concentrated citric acid(C), dilute citric acid(D), concentrated sodium chloride(E), dilute sodium chloride(F), distilled

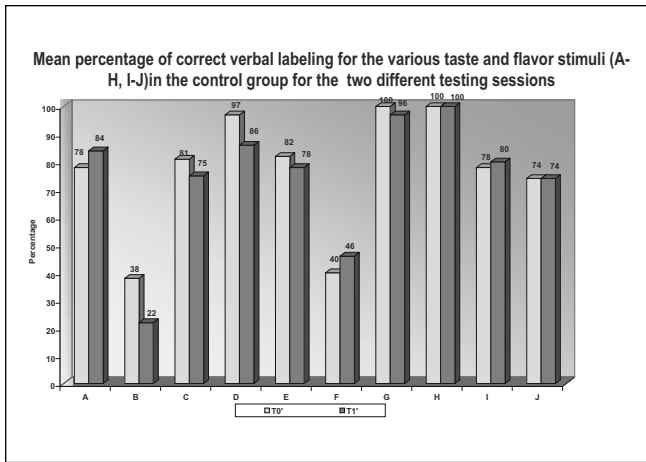
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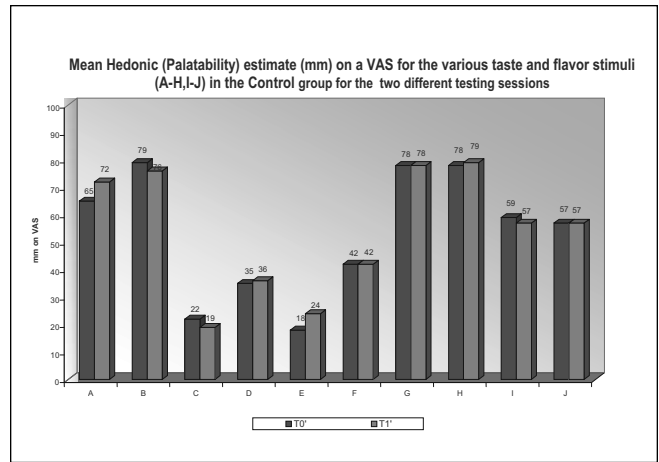
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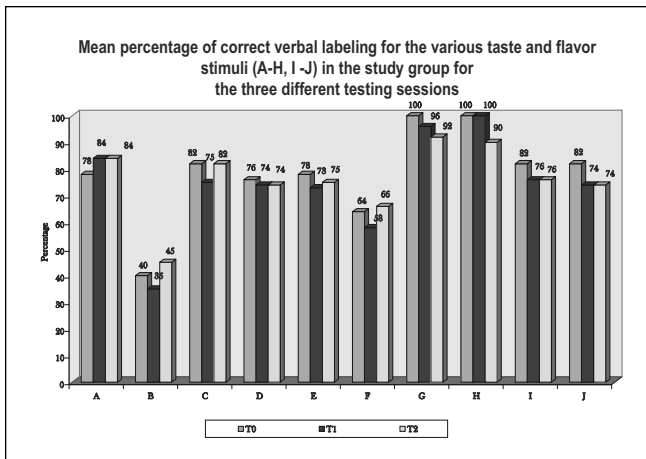
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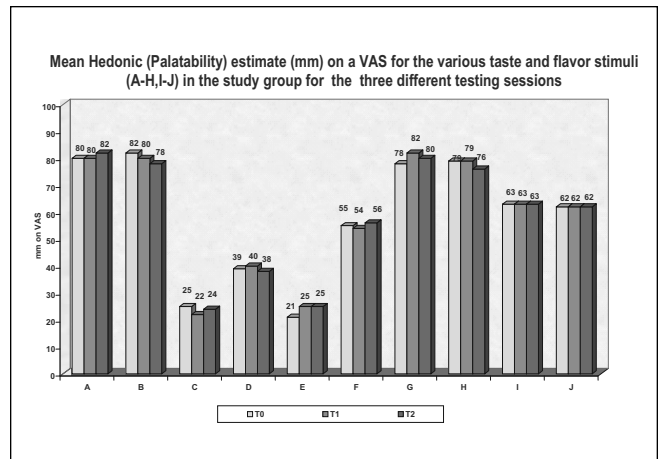
Graph 1(A). Mean percentage of correct verbal labeling for the various taste and flavor stimuli (A-H,I-J) in the control group for the two different testing sessions.



Graph 2(A). Mean hedonic (palatability) estimate (mm) on a visual analogue scale for the various taste and flavor stimuli (A-H, I-J) in the control group for the two different testing sessions.



Graph 1(B). Mean percentage of correct verbal labeling for the various taste and flavor stimuli (A-H,I-J) in the study group for the three different testing sessions.



Graph 2(B). Mean hedonic (palatability) estimate (mm) on a visual analogue scale for the various taste and flavor stimuli (A-H, I-J) in the study group for the three different testing sessions.

water(G and H).³ All intra oral stimuli were presented in disposable plastic cups of 5 ml each at room temperature.

As retro nasal stimuli, two samples of chewing gum were chosen. These were of identical texture and hardness. The samples differed only in their flavor: Mint (I), Strawberry (J).

The volunteers were instructed to keep the solutions or chewing gum samples in their mouth until the taste or flavor was identified. Between each of the samples the subjects rinsed their mouth with tap water. The mean duration of whole testing session was approximately 8 minutes.

In each session the participants were requested:

1. To write down in their own words the description of the taste (verbal labeling).³
2. To mark the hedonic estimation (palatability) of the taste and flavor stimulus on a visual analogue scale.³
3. To make the intensity estimation of the taste and flavor stimulus on a visual analogue scale (VAS).³

The study groups were tested on three different sessions

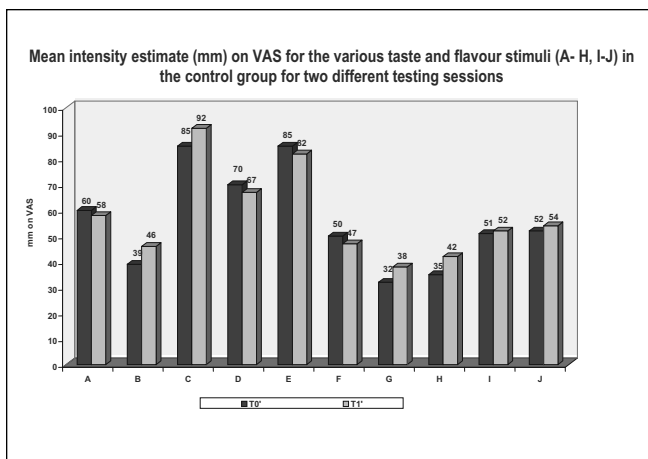
i.e. 10 days before, on the day and one month after removable orthodontic appliance delivery respectively, where as control group volunteers were assessed twice with in a gap of 10 days respectively.

RESULTS

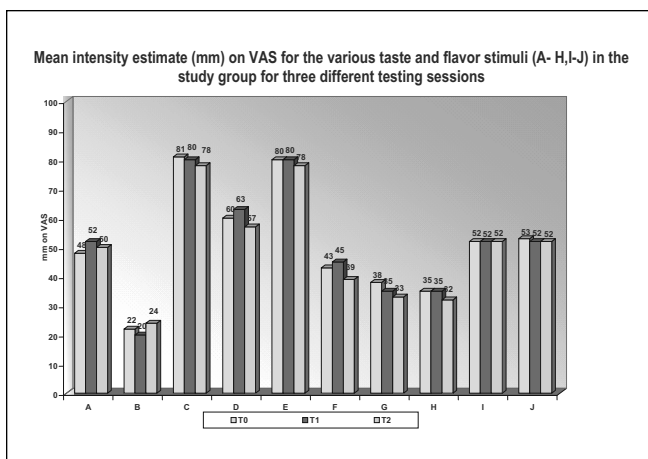
Initially when the volunteers were assessed separately for upper and lower removable orthodontic appliances for verbal labeling, hedonic and intensity estimate for taste and flavor stimuli they did not show any marked variation. Hence the observation was done on the entire study group.

Verbal labeling of the taste and flavor stimuli

The result of taste and flavor stimuli obtained from all the volunteers of both study and control groups showed varied results, irrespective of the presence of removable orthodontic appliances in different testing sessions. The majority of stimuli were labeled correctly by both groups. The most accurate identification was for distilled water (G and H) for both the groups. (GRAPH – 1(A) and 1(B).



Graph 3(A). Mean intensity estimate (mm) on a visual analogue scale for the various taste and flavor stimuli (A-H, I-J) in the control group for the two different testing sessions.



Graph 3(B). Mean intensity estimate (mm) on a visual analogue scale for the various taste and flavor stimuli (A-H, I-J) in the study group for the three different testing sessions.

Hedonic estimates of the taste and flavor stimuli

An individual variation was found for the hedonic (palatability) rating of taste and flavor stimuli. Volunteers from both study and control groups scored better for flavor stimuli than taste stimuli. That is between 62–63mm for study group and 57–59 mm for control group on the VAS. (GRAPH – 2(A) and 2(B).

Intensity estimates of the taste and flavor stimuli

The volunteers from both study and control groups scored different values for intensity estimation of taste and flavor stimuli. The majority of stimuli were estimated correctly by both groups. Both the groups scored better for flavor stimuli than taste stimuli in all testing sessions. Both the groups found concentrated citric acid (C) and concentrated saline (E) more intense than other taste stimuli in the range of 78–92 mm on VAS. (GRAPH – 3(A) and 3(B).

The results showed that at times an appliance made a transient alteration in taste and flavor perception both in inter and intra group comparison among the study group, but was not statistically significant.

DISCUSSION

The reactions to taste and flavor stimuli can be determined objectively, using physiological indicators such as heart rate, blood pressure, saliva secretion, or the ‘gusto-facial reflex’ (Steiner *et al.*,⁴ Bellisle⁵). A different approach is the subjective psychophysical evaluation based on verbal description and semi quantitative rating of the hedonics and intensity of the stimuli. Since the principal requirements in the design of this study were sessions of short duration and simplicity of instructions appropriate to the situation of young patients, the latter approach was applied. The actual tool used in this study was the VAS, which has been used previously under similar circumstances (Steiner⁴ *et al.*, Beilisle,⁵ Matsui *et al.*⁶ Angelili *et al.*,⁷). The results indicate that the reactions elicited by similar stimuli were congruous for the majority of the subjects in both the groups.

The method of error was established based on the study by Raben *et al.*⁸ who found an 8 mm error in the scoring of various variables (among them one was palatability too) regarding food samples. In the present investigation, children for whom the intensity and palatability of identical stimuli differed by more than 7 mm were considered inconsistent and were not included in the study.

Removable orthodontic appliances represent foreign objects inserted in a physically and psychologically sensitive area of the body. When the removable orthodontic appliances are being worn it is often obvious to others and it is possible that susceptible children may be self conscious about wearing such devices. Pediatric patients, in particular, may be object to social ridicule from their peers (Stewart F N *et al.*⁹). Probably, to avoid this social ridicule, children may falsely complain of alteration in taste and flavor perception during appliance therapy in an effort to terminate it.

It was seen that volunteers showed varied result, among different testing sessions, with either an increase or decrease in taste and flavor perception for various taste and flavor stimuli with and without appliances in their oral cavity.

In general, the study and control groups displayed a higher consistency for labeling flavor stimuli than taste, which shows that a removable orthodontic appliance does not affect the natural airflow between the oral and nasal cavities.³ The results obtained for the study group showed that there was a transient alteration in flavor stimuli which could possibly be related to the late release of the self curing acrylic monomer which can affect the sensations directly (Baker *et al.*¹⁰).

Taste buds are confined to the taste areas of the tongue but may be extended to the anterior surface of the soft palate, uvula, the tonsils, the beginning of the gullet, the region of the arytenoid cartilage within the larynx, posterior wall of the pharynx, epiglottis (Strain,¹¹ Schiffman¹²). The absence of taste buds in the appliance bearing areas may be one of the reason for any permanent alteration in taste stimuli by the removable orthodontic appliance.

Hedonic estimation represents the palatability of the taste and flavor stimuli. Minimal alteration seen after appliance delivery could be attributed to the fact that the appliance acts

as foreign body in the oral cavity, hence there is an increase in salivation for a period of few weeks to months following the insertion of the appliance which may dilute the taste stimuli (Stewart *et al*⁹). A possible comparison can be made with the work of Shannon *et al*¹³ who found that there was no effect on salivary flow from the parotid gland in response to different liquid taste stimuli in patient's wearing a night guard which also covers the hard palate.

In tandem with the study by Anliker *et al* which concluded that the perception of bitterness and sweetness depends on one's genetic composition¹⁴ in the present study also, both the study and control groups showed nearly similar values for hedonic estimation, reflecting the fact that the appliance has minimal role in alteration of taste and flavor.

An individual variation was found regarding the reported intensity of the taste and flavor stimuli.

However, the majority of participants in both groups were able to differentiate between the low and high concentrations of three taste stimuli – sucrose, citric acid and saline. Similarly when the intensity score was analyzed for distilled water, it was of low intensity and ranged between 30–40 mm on VAS and that of strawberry and mint were of medium intensity with the range of 50–55mm on VAS. Citric acid and concentrated saline were perceived as strong stimuli and were scored between 70–90 mm on VAS. This shows that even though the volunteers were wearing removable orthodontic appliances it did not alter the intensity perception.

Hence, it can be concluded that minimal alteration perceived by the children with the removable orthodontic appliance regarding change in taste and flavor seems to be transient in nature and at times was observed even in control group. Hence, it is mandatory for the pediatric dentist to make the children and their parents understand this problem and motivate the children to wear the appliance including during meals, without fear of affecting taste and flavor sensations; giving emphasis on the positive benefits of wearing the appliance and its post treatment effects in particular.

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