

# Comparison of “Earplug and Temporal Tap Technique” with Standard Distraction Method on Gag Reflex Related to Maxillary Impression Making in 6–12-year-old Children: A Crossover Study

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## ABSTRACT

**Introduction:** Exaggerated gag reflex affects dental care. Few studies have reported effectiveness of earplug and temporal tap technique (E-TTT) in children.

**Aim:** To compare “earplug and temporal tap technique” with standard distraction method (control) on gag reflex (GR) related to maxillary impression-making in 6 to 12-year-old children.

**Materials and methods:** A maxillary impression with standard distraction method, followed by another impression with E-TTT after a 10 minute washout, was made in group I ( $n_1 = 15$ ). The order was reversed in group II ( $n_2 = 15$ ). Gag prevention index (GPI) and five-point patient response scales were used to measure the GR.

**Result:** Mean differences in GPI at 2 minutes within groups I and II were 0.333 ( $p$  value = 0.399) and 0.267 ( $p$  value = 0.579); and between the groups were 0.333 ( $p$  value = 0.462) and 0.267 ( $p$  value = 0.532). The 95% confidence intervals ranged from –1.131 to 0.465 and –0.706 to 1.239 within groups I and II, whereas they were –1.248 to 0.581 and –0.597 to 1.130 between the groups. As per the 5-point patient-reported scale, 80% children with E-TTT (of group I) when compared to 46.6% with control (of group II) reported same to superior experience ( $p = 0.046^*$ ).

**Conclusion:** E-TTT did not mitigate the GR during impression making but led to a better experience.

**Keywords:** Earplugs, Gag, Gag reflex management, GPI index, Temporal tapping.

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## INTRODUCTION

The exaggerated gag reflex (GR) may pose a hindrance for performing routine dental practice in children. It is important for the pedodontist to understand GR and to find alternative methods to control it. The use of “Earplug<sup>1</sup> and Temporal Tap<sup>2</sup> Technique” (E-TTT) is simple and noninvasive. The material used in it is easily available, and skill involved can be acquired by any dentist quickly.

According to the current literature, there is merging of the sensations at the cortex and brainstem from the oropharynx and skin of the ear.<sup>3</sup> Oral referred pain to the ear (otalgia) is common via the trigeminal and its spinal nucleus, which may be due to the unique representation of the ear in the somatosensory cortex. This relates the oropharyngeal areas to the ear.<sup>1,4</sup>

Moreover, it is postulated that stimulation of the auricular acupuncture point may inhibit the muscular activity in GR. This point is the anti-gagging point<sup>5</sup> (Fig. 1) located on the ear corresponding with the skin of the external auditory canal (innervated by the auricular branch of the vagus nerve) and that adjacent to the auricle (innervated by the auriculotemporal branch of the mandibular division of the trigeminal nerve). Thus, it can be theorized that the stimulation via external auditory canal (EAC) triggered by an earplug may influence or block sensory pathways of the GR within the somatosensory cortex and/or at the brainstem and/or as an antidromic stimulation of the neuronal pathways of the oral referred pain (otalgia) over the EAC skin.<sup>1</sup>

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Temporal tap technique was developed by George Goodheart. It is performed by tapping (with palm surface of the fingertips) along the temporal–sphenoidal diagnostic line<sup>2</sup> (Fig. 2); starting in front of the ear, moving forward, up, and then along the line. Tapping is done firm enough to penetrate the hair and spring way from the skull after each light blow. Sensory input is given before, during, and immediately after temporal tapping. It helps the patient understand the given instructions better with creating the strength necessary for bringing about desired effect. It is most useful in controlling the involuntary functions such as gagging.<sup>2</sup>

\*Statistically significant.

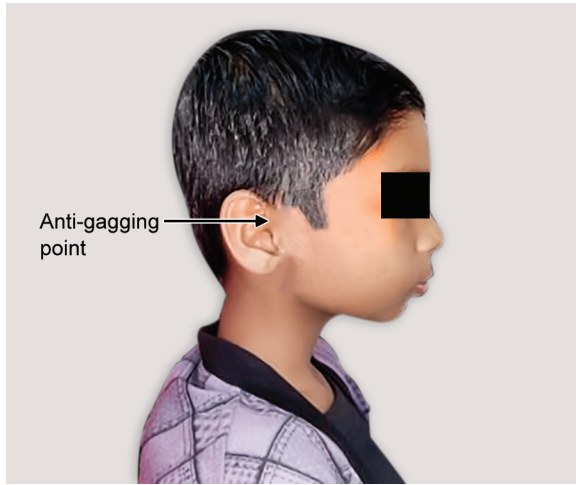


Fig. 1: Anti-gagging point<sup>5</sup>



Fig. 2: Temporal-sphenoidal line<sup>2</sup>

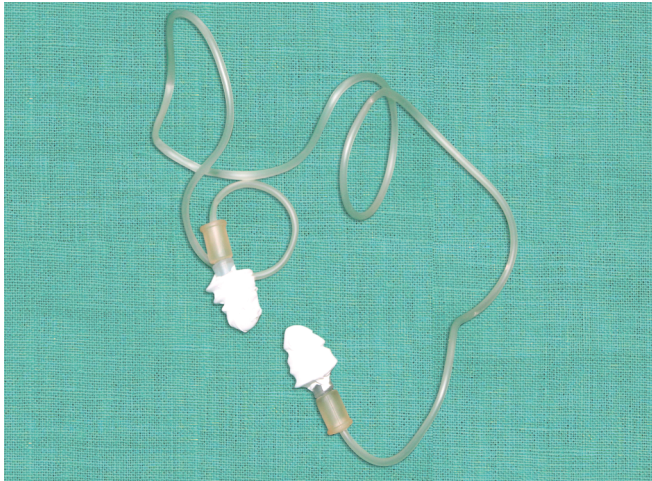


Fig. 3: Earplugs



Fig. 4: Teflon tape

## AIM AND OBJECTIVES

The study aimed at evaluating the use of E-TTT while making impression of the maxillary arch in children aged 6–12 years old. The objectives were:

- To assess the changes in GR measured as gag prevention index (GPI) score before and during impression making with standard distraction method (control) and to assess the same with E-TTT.
- To compare the changes in GR measured as GPI score and 5-point patient-reported scale, before and during impression-making of E-TTT with that of control.

## MATERIALS AND METHODS

The children reporting to the department of pediatric and preventive dentistry of a dental college and hospital from July 24, 2018, to August 6, 2018, were enrolled in the study. Ethical approval was obtained by the Institutional Research Board. Parental consent and a verbal assent were taken for every participant. A pilot study was performed on five patients after which it was decided to include patients aged older than the age 6 years so

that sensitization of the patient to the first impression would have less impact on the results.

## Eligibility Criteria

- Children with GSI score  $\geq$  grade II
- 6 to 12-year-old children
- Children with no systemic illness
- Children with no history of dental impressions previously made.

## Materials Used

Impression trays, alginate impression material (Zhermark-Tropicalgin), ear plugs, teflon tape. Earplugs wrapped with teflon tape were used to prevent cross-contamination (Figs 3 and 4).

## Procedure

Gagging severity index (GSI) (Table 1) and GPI (Table 2), both pre-validated tools, developed by Dickinson and Fiske<sup>6</sup> were used to score gag intensity. Children with GSI score  $\geq 2$  as screened by the (trained) senior investigator were enrolled in the study. This being a preliminary study a sample size of 30 was found to be adequate for statistical comparison. Two groups of 15 each were randomly

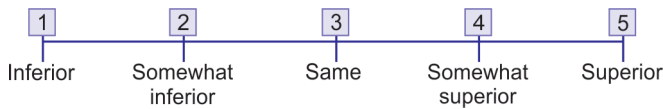
**Table 1:** Gagging severity index (GSI)<sup>5</sup>

Grade	Gagging severity index (GSI)
I	Very mild, occasional and controlled by the patient
II	Mild, and control is required by the patient with reassurance from the dental team
III	Moderate, consistent and limits treatment options
IV	Severe and treatment is impossible
V	Very severe; affecting patient behavior and dental attendance and making treatment impossible.

**Table 2:** Gag prevention index (GPI)<sup>5</sup>

Grade	Gag prevention index (GPI)
I	Obtunded GR; proposed treatment successful.
II	Partially controlled GR; treatment possible but occasional gagging.
III	Partially controlled GR but frequent gagging; treatment was part completed.
IV	Inadequately controlled GR; gagging occurred regularly; treatment unable to be completed.
V	GR severe; no treatment possible.


**Fig. 5:** Maxillary impression being made after E-TTT

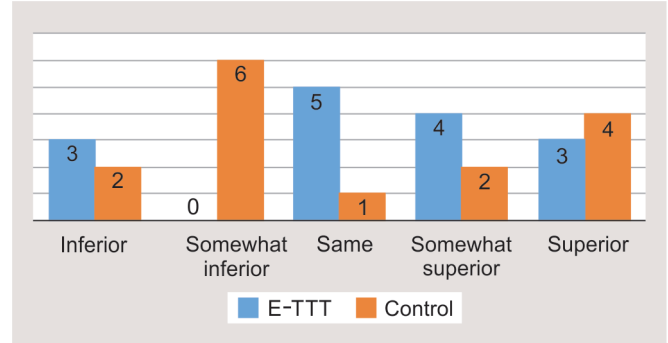
**Fig. 6:** Temporal tap being performed by the primary investigator

**Fig. 7:** 5-point patient-reported scale

allocated by odd–even method. The odd patients were included in the group I and even patients were included in group II.

Blinding of the examiner and patient was not possible, as it is usually the case with a crossover study. Variability in manipulation of alginate was reduced since a single operator (investigator) had made all the impressions. The investigator had been trained in using the GPI scale and the scores verbally told by the investigator were recorded by an assistant (intern), while the investigator made impressions. This was supervised by the senior investigator.

In group I, a maxillary impression without any intervention was taken (Fig. 5) followed by a second impression with E-TTT (Fig. 6), after 10 minutes of washout period to minimize the carryover effects. The sequence of procedure was reversed in group II. That is, a maxillary impression with E-TTT was done first and a second impression with control after a washout period of 10 minutes was made. Mechanically stimulated GR such as the one in impression-making persisted only until the stimulation persisted, and within minutes (less than 10) the children were considered normal. Hence 10 minute washout period was regarded as sufficient.

Verbal distraction was common to both the groups. The resultant GR was scored with E-TTT and with control using GPI index at 0 second, 30 seconds, 1 minute, and 2 minutes. Additionally, a 5-point patient-reported scale (Fig. 7) was also recorded after the second impression in both the groups. It had 5 scores as “Inferior,”


**Fig. 8:** Frequencies of 5-point scale

“Somewhat inferior,” “Same,” “Somewhat superior,” or “Superior” experience with the impression that was made with the second technique in both the groups in comparison to the impression that was made with the previous technique. Thus, patient response was recorded in relation E-TTT and control in group I and II, respectively.

The independent variables assessed were E-TTT vs control while maxillary impression making. And the dependable variables assessed were GR based on GPI scores (Figs 8 and 9).

Data obtained were compiled on a MS Office Excel Sheet (v 2010). Data were subject to statistical analysis using Statistical package for social sciences (SPSS v 21.0; IBM, USA). Comparison of mean age has been done using *t* test and frequencies of gender using Chi-square test. Intergroup and intragroup comparisons have been done using Mann Whitney *U* test (for ordinal scale) and Friedman’s test, respectively. Comparison of frequencies of 5-point patient-reported scale between interventions has been done

using chi-square test. For all the statistical tests,  $p$  value  $< 0.05$  was considered to be statistically significant, keeping  $\alpha$  error at 5% and  $\beta$  error at 20%, thus giving a power to the study as 80%.

## RESULTS

The demographic details such as age and gender were recorded and analyzed statistically. The Chi-square values of the mean age and gender distribution of the sample were not statistically significant (Tables 3 and 4). Thus, there was no confounding influence of these variables on the results.

The GPI score and 5-point patient-reported scale were used to assess the difference in the two groups, while maxillary impression was being made. We found that, as per the patient-reported scale, 12/15 cases (80%) with E-TTT showed same to superior

experience compared to 7/15 cases (46.6%) with control, and this was statistically significant ( $p$  value = 0.046) (Table 5). Mean differences in GPI at 2 minutes within Groups I and II, were 0.333 ( $p$  value = 0.399), and 0.267 ( $p$  value = 0.579) and between the groups were 0.333 ( $p$  value = 0.462) and 0.267 ( $p$  value = 0.532). The 95% confidence intervals ranged from -1.131 to 0.465 and -0.706 to 1.239 within groups I and II, whereas they were -1.248 to 0.581 and -0.597 to 1.130 between the groups. As the preliminary test for differential carryover were not significant, the data from both periods were analyzed in a usual manner.<sup>7</sup>

Additionally, the frequencies of patients showing increase or decrease in GPI at 1 and 2 minutes were recorded. However, their proportions were not found to be significant. Also, the mean differences in GPI at various time intervals were not statistically significant, whether within or between the groups.

## DISCUSSION

Clinically beneficial, simple, and noninvasive management of GR is much needed. Although several techniques have been employed previously, "there is no one size that fits all." This study was undertaken to assess the effectiveness of E-TTT on level of gag control in children.

It is speculated that earplug application may have a blocking effect for the GR mediated by the trigeminal nerve through auriculotemporal nerve and Arnold's branch going to spinal nucleus of the trigeminal nerve and acting by compression of the walls of the EAC.<sup>1</sup>

Temporal tapping helps in calming the patient by reducing the anxiety. It instills confidence in the patient by the sensory input (verbal instructions and support) and helps in breaking the old

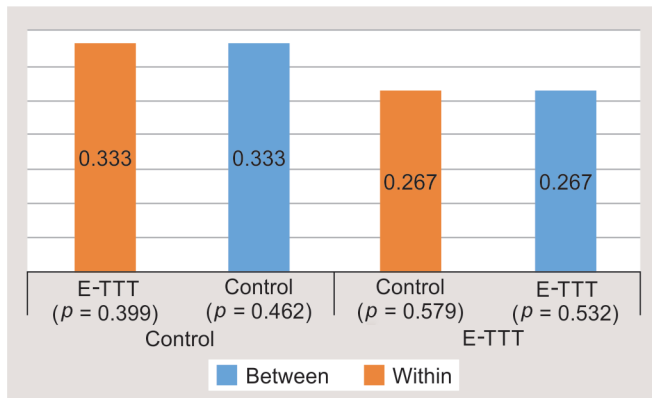


Fig. 9: Mean differences within and between groups for GPI scores

Table 3: Comparison of mean age

Group	n	Mean age (in years)	Std. deviation	Std. error mean	t value	p value of t test
I	15	9.0000	1.81265	0.46803	0.204	0.840 <sup>†</sup>
II	15	8.8740	1.55825	0.40234		

<sup>†</sup>Statistically non-significant difference;  $p > 0.05$

Table 4: Comparison of frequencies of males and females between groups I and II

Group	Gender (male-M/female-F)			Chi square value	p value of Chi square test
	F	M	Total		
I	7	8	15	0.133	0.715 <sup>†</sup>
II	8	7	15		
Total	15	15	30		

<sup>†</sup>Statistically non-significant difference;  $p > 0.05$

Table 5: Proportions in 5-point patient reported scale

Score	5-point patient reported scale	Group I: with E-TTT as compared to control	Group II: with control as compared to E-TTT	p value
5	Superior experience	3	4	
4	Somewhat superior experience	4	2	
3	Same experience	5	1	
2	Somewhat inferior experience	0	6	
1	Inferior experience	3	2	
Proportions of people showing same or superior experience		12/15 (80%)	7/15 (46.6%)	$p = 0.046^*$

\*Statistically significant

habits. It is effective in bringing suggestions into the nervous system for the control of involuntary functions of the body.<sup>2</sup>

Techniques used to reduce bias were:

- Crossover study was adopted so that the sequence effect would be diminished.
- Children with age less than 6 years were excluded from the study, since the less developed cognition of the child would have created bias in the results of 5-point patient-reported scale. By 6–7 years, the child has better cognitive development to reflect the experience. They start to interpret the questions and answer them accordingly.
- Standard questions (did you find any difference in the impressions making compared to the previous impression made? If so, was it superior/somewhat superior/inferior or somewhat inferior?) were asked to all the patients while recording the patient reported scale.
- Only patients with no previous history of impression being made were included in the study
- Single operator made the impressions thereby reducing inter-operator variability.

With reference to GPI score, we did not find any statistical significance. We offer the following explanation for the same. Possibility of sensitization and coping of the child when the second impression was made could have resulted in GR. Furthermore, the mean baseline GPI score not being high, marked reduction was not apparent. The awareness of the fact that some extra effort was put in by the operator with E-TTT might have affected the patient-reported scale.

Since there have not been any reported studies on children with the use of E-TTT evaluating GR, we could not compare our results to them. A study on adults by Cakmak et al.,<sup>1</sup> with earplugs being used to control GR, demonstrated that earplugs could suppress the GR mediated by auriculotemporal nerve of trigeminal and Arnold's nerve of vagus. However, it could not suppress the GR mediated by glossopharyngeal nerve.<sup>1</sup>

As GR is a chronic condition with no definite treatment and only alleviation of the condition is possible, a crossover study design was chosen which gives both the techniques an opportunity to demonstrate their effectiveness. It helps in reducing not only the influence of confounding covariates (such as patient behavior) because each patient serves as her or his own control but also the sequence effect of the techniques on the outcome can be reduced.<sup>8</sup> However, the crossover effects were not statistically significant.

The limitations of our study were a small sample size, non-probabilistic sampling and inherent limitations of the measuring

scales. Our study aimed at evaluating the mitigation of gag during the impression making and not while completing any other procedure.

## CONCLUSION

In 6 to 12-year-old children, the changes in GR measured as GPI score before and during impression making with control and with E-TTT showed no significant statistical difference. However, the 5-point patient-reported scale was improved and lead to a better patient experience. Therefore, we conclude that E-TTT could be used as an adjunct to the conventional gag controlling strategies. It again emphasized that GR is usually controlled by using a combination of techniques and not by a single technique alone. A more effective way to stimulate the EAC might show a significant result. This is the first study on children of its kind. Thus, merits attention to the techniques described for the mitigation of GR for further investigation in children.

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