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Effect of varying bulb height on articulation and nasalance in maxillectomy patients with hollow bulb obturator

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Abstract

Purpose: To evaluate the effect of bulb height of hollow bulb obturator prosthesis on articulation and nasalance.
Method: A total of 10 patients, who were to undergo maxillectomy falling under Aramany class-I and II, with normal speech and hearing pattern were selected for the study. They were provided 2 maxillary obturators, one extending full height of the defect and other with bulb height approximately up to inferior nasal concha. The patients were asked to wear each obturator for 6 weeks and the speech analysis was done to measure changes in articulation and nasalance at 6 different stages of treatment i.e. preoperative, postoperative (after complete healing), 24 h and 6 weeks after providing full bulb height obturator and reduced bulb height obturator. Articulation was measured objectively for distortion, addition, substitution and omission by speech pathologist and nasalance was measured by Dr. SPEECH software.
Result: Comparison between full and reduced bulb height for nasalance and articulation, showed that there was no statistical significant difference ($P > 0.05$) between the two for both the parametres.
Conclusion: Articulation and nasality improves after providing obturator. Articulation and nasalance both are independent of bulb height.
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Keywords: Speech analysis; Maxillectomy; Hollow bulb obturator; Nasalance

1. Introduction

Carcinomas of head and neck are the most frequent causes for surgical resection of palate. It leads not only to surgical trauma but also psychological trauma due to residual facial defect or improper speech production, mastication and articulation, which ultimately affects the quality of life of the patient [1–3].

These patients require prosthetic [4] or surgical obturation [5] of the defect, in order to improve speech, deglutition, aesthetics and mastication. Prosthetic obturation is preferred because of shorter operative time, shorter postoperative hospital stay and complete visualization of maxillectomy cavity which ease in oncologic surveillance [6]. The objectives of maxillofacial prosthodontic rehabilitation are restoration of missing teeth, surrounding tissue, restoration of functions,

aesthetic appearance, preservation of remaining teeth and physiological support to provide the potential for acceptable speech and swallowing [7–9]. Speech disorder in maxillectomy patients is an important clinical problem, as maxillectomy causes hypernasality [10] which affects articulation and speech intelligibility of an individual. Different types of definitive obturators used to close the defect are solid bulb obturator, hollow bulb obturator, and sectional obturator for people with reduced mouth opening. Definitive hollow bulb obturator is fabricated after complete healing of the defect i.e. around 3 months after surgery. Authorities have claimed that hollow bulb obturator is better and helps in rehabilitation with its reduced weight [11] and increased retention [12]. It is seen that there is significant improvement in speech after definitive obturator treatment [13,14]. Though acoustic characteristics associated with nasalance and nasal consonants are not completely eliminated, but significantly reduced with the prosthesis [1,10]. All the studies enlighten us regarding the importance and significance of obturator, but the data on the role of bulb height is still scarce. This study was designed to evaluate the effect of

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Table 1
distribution of sample.

S.No.	Location of defect	Sex/age	Type of defect (aramany)	No. of teeth in maxilla	Diagnosis
1	Left Maxillectomy	M/52	Class I	7	SCC
2	Right Maxillectomy	M/60	Class II	9	SCC
3	Left Maxillectomy	M/33	Class I	7	MEC
4	Right Maxillectomy	M/67	Class I	6	MEC
5	Right Maxillectomy	F/28	Class I	7	SCC
6	Right maxillectomy	M/40	Class I	5	Osteomylitis
7	Right Maxillectomy	M/48	Class II	10	SCC
8	Left Maxillectomy	M/40	Class I	6	ACC
9	Left Maxillectomy	M/35	Class I	6	SCC
10	Left Maxillectomy	M/28	Class I	7	ACC

SCC = Squamous Cell Carcinoma; MEC = Muco Epidermoid Carcinoma; ACC = Adenoid Cystic Carcinoma.

bulb height of hollow bulb obturator prosthesis on various speech parameters assessed before and after maxillectomy.

2. Method

10 cases (9 males, 1 female) that were to undergo maxillectomy were selected from E.N.T Department of All India Institute of Medical Sciences (AIIMS) in the age range of 15–75 with mean age 43 years irrespective of gender (Table 1). Patients who fall under Aramany class I or class II category were included in the study. The patients who had involvement of tongue or mandible, completely edentulous or had medical problems like neuromuscular disorder, damaged vocal cords, hearing defect. were excluded from the study. All the subjects were Hindi speaking and were deemed to be unaffected by any cognitive impairment. Ethical clearance from institutional ethical committee was taken before commencing the procedure.

3. Fabrication of obturator

The presurgical obturator plate was made from self cure acrylic (Trevlon, DENTSPLY India, Pvt Ltd). The presurgical plate was placed in each patient's mouth at the time of surgery. After a healing period of about 2 weeks, presurgical obturator was replaced by intermediate obturator, fabricated in heat cure polymethylmethacrylate (Trevlon, DENTSPLY India, Pvt Ltd). Definitive hollow bulb obturator was made after complete healing of the defect (3–4 months). The obturator was fabricated using conventional method, and intraoral adjustments were made. Two definitive obturators were made for each patient, one with full bulb height and other was made with height approximating up to the level of inferior concha of opposite side. The full bulb height of the obturator was achieved by covering the full defect during impression making. The achieved cast was used in fabrication of obturator with full bulb height. And for reduced bulb height, the cast was blocked with plaster approximately up to the inferior choncha. The obturators were cured using heat cure acrylic resin and were delivered after polishing. The patient was asked to wear each obturator for 6 weeks after which speech analysis was done.

Table 2
Scoring for speech intelligibility.

Description of speech sample	Point scale
Normal	0
Can understand without difficulty; however feel speech is not normal	1
Can understand with little effort occasionally need to ask for repetition	2
Can understand with concentration and effort specially by sympathetic listener	3
Can understand with difficulty and concentration by family but not others	4
Can understand with effort if content is known	5
Cannot understand at all even content is known	6

4. Speech analysis

4.1. Speech was analyzed for articulation and nasalance

Articulation was assessed by an Indian articulation test given by Pandit et al. [15]. All the parameters were assessed by speech pathologist which comprised of number of error patterns (substitution, distortion, omission or addition), number of sounds misarticulated (sum of distortion, substitution, addition and omission), most frequent position of error and consistency of error and speech intelligibility. These were calculated by careful listening of patient's speech using articulation test and calculating the number of errors. Speech intelligibility was measured on a 7 point scale [16] by speech pathologist (Table 2).

Nasalance was assessed by the nasal view of Dr. SPEECH software (Tiger DRS Inc, Seattle, USA). The patient is asked to phonate a vowel keeping the receiver at base of nose to get the percentage of nasalance.

Articulation and Nasalance both the parameters were assessed at six different intervals i.e. Pre operative recording, After complete healing before the placement of definitive obturator, 24 h and 6 weeks after placement of definitive obturator with full bulb height, 24 h and 6 weeks after placement of definitive obturator with reduced bulb height.

The data was entered on Microsoft excel data spread sheet and analyzed with the help of SPSS software version 15.0. A descriptive analysis was done with repeated measures ANOVA