Research Article

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Comparison of Obturator Prostheses with & without Obturator: An Approach for Assessment of Speech Intelligibility

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ABSTRACT

Background: The primary concern in obturator fabrication is that the opening in the hard palate must be obturated. The maxillofacial prosthodontist focuses on optimizing the acquired defective function of speech and swallowing by providing static prosthesis to fill voids created by missing tissues or approximating structures with suboptimal function. The present study was designed to scientifically document the rehabilitation of speech in patients with acquired defects of the maxilla and to compare the efficacy of obturator prosthesis with nasal extension designs in restoring the speech intelligibility.

Keywords: Maxillectomy Defect; Prosthesis; Obturator; Speech intelligibility; Nasal extension.

INTRODUCTION

Cancers of the mouth, tongue, oropharynx, nasopharynx and larynx comprise approximately 5% of all the cancers. After the resection of the maxillofacial tumors, patients are left with severe functional problems, because these structures are required for mastication, deglutition and speech. Changes in appearance, psychosocial functioning and vocational status may also result after surgery[1] of oral cancers. Most patients who have undergone resection of the maxillae due to benign or malignant tumors in the palatomaxillary region present with speech and swallowing disorders. The most detrimental resections affecting the speech are those of the maxilla including the alveolar ridge, hard palate and soft palate[2]. Speech intelligibility is an important parameter which is frequently affected following maxillary resection[2].

These defects are tremendously inconvenient to the patient because of the loss of oronasal separation which substantially interferes with the important functions of speech and swallowing[3]. The undesirable coupling in the oral and nasal cavities reduces intraoral air pressure during speech production causing articulatory imprecision, hypernasal speech, nasal air emission and reduced vocal loudness. One of the main problems faced by them is the ***impairment of speech intelligibility***, which interferes with the quality of life.The measure of successful rehabilitation is, "improvement of the patient's quality of life". An in vivo study was conducted at govt. dental college, Jaipur to evaluate the differences in speech intelligibility on three different occasions:

1. When the patient was not wearing any prosthesis,
2. Patient wearing obturator prosthesis having low nasal extension and

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Seventeen patients were included in the study. Standardized procedures for obturator prosthesis fabrication as described by Chalian et al were followed[1]. Speech recordings were made with Sony Voice Recording Instrument (ICD-UX523F) on above mentioned by asking the patients to speak a set of eighty different words in Hindi Language. Each patient was also asked to describe him/ her for thirty seconds.

MATERIALS AND METHOD

The standardized technique of obturator fabrication as described by Chalian et al[1] was followed. The primary impression was made with irreversible hydrocolloid impression material after defect area build up with impression compound on dentulous perforated tray. The impression was disinfected with Glutaraldehyde 2% .The primary cast obtained was blocked out selectively in undercut areas. Then using auto polymerizing acrylic resin, custom tray was fabricated. The peripheral molding was done in the defect areas using low fusing impression compound. The peripheral molding was stopped when there was highest contact of green stick with the superior tissues and also on the lateral and medial sides of the defect. Final impression was made using light body elastomeric impression material. After disinfecting the impression, the impression was poured with type IV gypsum. The standardized technique of obturator fabrication was used to fabricate prosthesis on these master casts. Thus for each patient, prostheses were fabricated. Once the patient got accustomed to this prosthesis, speech recording was made.

Speech Recordings: The voice of each patient was recorded using Sony voice recording instrument on three different occasions:

1. Without any prosthesis labeled as 'A'
2. Wearing prosthesis having low nasal extension labeled as 'B'

Speech Sample: Each patient was asked to speak fifty words in Hindi Language as suggested by speech language pathologists including the vowel phonemes, the consonant phonemes and the blend phonemes. Also each patient was asked to count from one to twenty and from sixty to seventy in Hindi Language. Finally the patient was asked to describe himself/herself for about 30 seconds. Speech samples obtained were randomly ordered and shuffled so that the speech pathologists and audiologists did not know the sequence of samples. All the speech recordings i.e. A, B were amplified and analyzed by these experts. The ratings were given by three speech language pathologists and audiologists based on the number of words correctly identified out of a set of eighty words. Also, after listening to all the speech content (eighty words and description) of each patient's recording, the overall score was given by these experts which was based on two different scales.

Description of the Scales Used:

SCALE 1: Speech intelligibility scale **(Pegoraro-Krook, 1995)**[4]

1**. Normal**: normal speech.

2. **Mild**: intelligibility is mildly impaired, yet speech sound and meaning can be understood.

3. **Mild to moderate**: speech sounds can be partially understood, and meaning can be fully understood.

4. **Moderate**: some difficulty in understanding speech sounds, with some impaired understanding of meaning.

5.**Moderate to severe**: great difficulty understanding speech sounds, and understanding of meaning is very impaired.

6. **Severe**: speech sounds and meaning cannot be understood.

SCALE 2: Intelligibility Rating Scale suggested by speech pathologists and audiologists [5]

0. Normal

1. Can understand without difficulty, however feel speech is? Normal.
2. Can understand with little effort, occasionally need to ask for repetition.
3. Can understand with concentration and effort especially by sympathetic listeners.
4. Can understand with difficulty and concentration by family but not by others.
5. Can understand with difficulty and efforts if content is known.

6. Cannot understand at all even when content is known.

Speech intelligibility was judged as per the percentage of the correct words that the speech experts were able to identify immediately after hearing speech stimulus. The ratings given by speech pathologists and audiologists were statistically analyzed based on speech intelligibility percentage, mean number of words identified, Scale-1 and Scale-2 using various tests including one factor ANOVA, Tukey HSD, Repeated measures ANOVA, Friedman test, Wilcoxon Signed Rank Test and Kendall's Coefficient of Concordance.

RESULTS

Mean number of words identified out of a set of eighty words when the patient was not wearing any prosthesis: 48.59 (SD 16.17). Mean number of words identified out of a set of eighty words when the patient wearing prosthesis having low nasal extension: 73.06 (SD 7.98).

Table 1: Comparison of Mean Number of Words Identified at Different Recordings.

Recording	N	Mean	Std. Deviation	One Factor ANOVA		'p' Value* <0.05 from
				F	'p' Value*	
Without Obturator	17	48.59	16.17	24.101	0.000	2,3
Low Nasal Extension	17	73.06	7.98			1

*Tukey HSD

Table 2: Comparison of Speech Intelligibility Scale-1 at Different Recordings.

Recording	Mean	Std. Deviation	'p' Value*
Without Obturator	3.88	1.65	<0.022

*Wilcoxon Signed Rank Test

Table 3: Comparison of Speech Intelligibility Scale-2 at Different Recordings.

Recording	Mean	Std. Deviation	'p' Value*
Without Obturator	4.29	1.31	<0.022
Low Nasal Extension	2.41	0.80	

*Wilcoxon Signed Rank Test

DISCUSSION

An in vivo study was conducted to evaluate the differences in speech intelligibility on three different occasions: Speech recordings were analyzed by two independent speech language pathologists and audiologists. Based on above recordings and by individual evaluation of each patient by two independent speech pathologists and audiologists, ratings were given.

The correct number of words identified out of a set of eighty words,

The overall speech intelligibility score based on Scale-1 and

The overall speech intelligibility score based on Scale-2

The first phase of this study was designed to assess the speech intelligibility of patients who have undergone maxillary resection and not wearing any prosthesis for the defect. The mean percentage of speech intelligibility for recordings when patient was not wearing any prosthesis was 60.74%.The mean number of words identified was 48.59 out of eighty with standard deviation of 16.17.The speech intelligibility ratings based on Scale-1 had a mean of 3.88 with standard deviation of 1.65 when patient was not wearing any prosthesis. Also, the speech intelligibility ratings based on Scale-2 had a mean of 4.29 with standard deviation of 1.31 under the same phase of the assessment.

The second phase was the assessment of speech intelligibility when the patient was wearing obturator prosthesis having low nasal extension. The mean percentage of speech intelligibility score with low nasal extension obturator prosthesis was 91.32% with standard deviation of 9.98 showing an increase of 30.58% when compared to first phase of assessment i.e. without any prosthesis. The mean number of words identified was 73.06 with standard deviation of 7.98 showing an increase of 24.47 when compared to the first phase of assessment. The speech intelligibility ratings based on Scale-1 had a mean of 1.59, which shows a low score on the scale in comparison to the first phase of assessment indicating improvement in speech intelligibility. Also, the speech intelligibility ratings based on Scale-2 had a mean of 2.41, which shows a low score on the scale in comparison to the first

phase of assessment indicating improvement in speech intelligibility.

Various literatures show that the prosthetic obturation of maxillary defects improved speech intelligibility[6-10]. Maxillary obturator prosthesis is efficient to improve the speech intelligibility and resonance in patients who had undergone maxillectomy. The listeners preferred the voice quality of speech produced with prosthetic obturation to that produced without obturation. Prosthodontic restoration significantly reduced the nasal resonances in all patients by completely eliminating the resonances, reducing the amplitude of the resonances or changing the frequency of the resonances to more nearby regions of the vowels[8].

CONCLUSION

Each patient, without obturator prosthesis had *poor speech intelligibility* and there was *statistically significant* improvement in speech intelligibility when the same patient was wearing obturator prosthesis. Speech intelligibility was improved significantly when the patient was wearing obturator prosthesis having low nasal extension as compared to the same patient when not wearing obturator prosthesis.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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