

Functional Outcomes in a client with Hemiglossectomy and Segmental mandibulectomy: A Case Report

by Author Author

Submission date: 16-Aug-2021 10:22AM (UTC+0530)

Submission ID: 1631898553

File name: Manuscript-2.docx (1.03M)

Word count: 2426

Character count: 14208

Title of the article: Functional Outcomes in a client with Hemiglossectomy and Segmental mandibulectomy: A Case Report

Abstract

Glossectomy and mandibulectomy are one of the most common surgical procedures carried out to remove oral tumors. To date, only a few studies have been published regarding the functional outcomes in an individual who have undergone both glossectomy and mandibulectomy. It is crucial to document detailed changes in speech subsystems, swallowing, and QoL in them So, the present study highlights the nature of speech impairment, swallowing difficulties, and quality of life in a 58-year-old male who has undergone hemiglossectomy and segmental mandibulectomy secondary to a cancerous oral tumor. A detailed speech evaluation (perceptual and objective), oral peripheral mechanism examination (OPME) along with swallowing and quality of life evaluation was carried out. Oromotor functions were found to be severely affected. Speech evaluation indicated the presence of misarticulations, compensatory articulation errors, affected voice quality and prosody, ultimately affecting the understandability as well as acceptability of speech. In addition, the swallowing assessment revealed a moderate degree of dysphagia. The 'health-related QoL of the patient compared to the month before the development of the cancer' was somewhat worse, whereas the 'health-related QoL during the last 7 days' was fair, furthermore, the overall 'QoL during the past 7 days' was reported to be good. This knowledge is often used for rehabilitation, employment, participation in the community, and to inform the role of family members in the betterment of an individual with glossectomy/mandibulectomy.

Keywords: Glossectomy, Mandibulectomy, Speech Characteristics, Swallowing, Quality of life

Introduction

² Oral cancer, which includes cancers of the lip and all subsites of the oral cavity and oropharynx, represents the 16th most common malignancy and the 15th leading cause of death worldwide (Al-Hebshi, Borgnakke, & Johnson, 2019). To get rid of this malignancy in the oral cavity, surgical procedures like glossectomy (surgical removal of all or a part of the tongue) and mandibulectomy (surgical removal of all or a part of the mandible). Closure of the surgical defect caused by glossectomy/mandibulectomy can be achieved through primary closure or using reconstructive methods. Even after the reconstructive surgery, patients possess problems in swallowing and speech, as the coordination of the muscles and nerves are impaired. This might vary based on the size, location, and the extent of surgery (Laaksonen et al 2009).

Individuals with glossectomy/mandibulectomy face changes in oral peripheral mechanism, like, deviated lips and jaws with restricted movements, trismus, missing tooth, partial tongue, deviated tongue, restricted tongue movements to right (Meyerson, Johnson & Weitzman, 1980; Naik, Zacharia, & Kuniyil, 2013). Respiratory difficulties are common in the initial postoperative period of glossectomy and not mandibulectomy, where the tongue can swell to a size larger than the preoperative size leading to respiratory and upper airway obstruction (Nargozian, 2004).

Voice problems might be seen in them as a complication of the surgery (Meyerson et al, 1980). A 43 years old individual who underwent segmental mandibulectomy was reported to

have a severe hoarse voice. The objective evaluation results revealed normal Fo, increased jitter, shimmer, NNE, and reduced HNR (Naik et al, 2013).

Acoustic analysis of speech sounds in individuals with glossectomy had significantly higher F1 values in vowel /i/ and /u/ (Knuuttila, Pukander, Määttä, Pakarinen & Vilkman, 1999; Takatsu et al, 2017), whereas significantly lower F2 values for vowel /i/ (Meyerson et al, 1980; Whitehill, Ciocca, Chan & Samman, 2006). Even in mandibulectomy, significant shifts in the formants and reduction in articulatory working space area were reported as a consequence of insufficient movement and altered position of articulators (Krause & Braidă, 2004; Neel, 2008; Ghosh & Ghosh, 2010).

Misarticulation is another major concern in individuals with glossectomy/mandibulectomy. In individuals with glossectomy, the most prevalent errors reported are substitutions and distortions in linguodental, linguopalatal, and linguovelar sounds. The most frequently distorted consonants documented are /t/, followed by /ʃ/, /tʃ/, /g/, and /r/, ultimately reducing the speech intelligibility (Saravanan et al, 2016). Whereas, in individuals with mandibulectomy highly affected sounds found were dental, alveolar, and palatal (Premalatha and Tara, 2012). Deviations/alterations in resonance characteristics as a consequence of surgery modifying the oral cavity have also been reported (Aramany, 1982).

Dysphagia is another major area of concern where individuals with glossectomy have difficulty in the oral phase, i.e., in propelling the food bolus, resulting in limitation of oral intake (Hey, 2013). Glossectomy cases with tongue resection greater than 50% are also reported to have aspiration while swallowing (Huang et al, 2016). Whereas, individuals with mandibulectomy have difficulty during mastication, limitation of lip and jaw movements leading to poor bolus

preparation and subsequent slowing of the oral stage of swallowing due to the loss of mandible and dentition (Logemann, Bytell, 1979; Miyuki Takahashi,1999).

Glossectomy/mandibulectomy will ⁷ have an immense impact on the quality of life (QoL) of individuals who have undergone it. Previous studies have reported poor scores and decrements in multiple domains of QoL in them (Dizoiba et al, 2017; Dholam et al, 2019).

A very few studies have discussed the speech characteristics of glossectomy with mandibulectomy patients in detail. It is crucial to document detailed changes in speech subsystems, swallowing, and QoL in them. Rarely case reports have been published on functional outcomes in individuals with glossectomy associated with mandibulectomy. Hence, the present study aimed to investigate and report the subjective and objective measures of speech outcomes in a Kannada-speaking individual with hemiglossectomy and segmental mandibulectomy in detail. The present study also documented the swallowing problems and the QoL which is lacking in most of the previous literature.

Case History

A 58 years old male came with the complaint of unclear speech and swallowing difficulty. Medical history revealed an ulcero proliferative lesion over ¹⁵ the right lateral border of the tongue involving the floor of the mouth. CT scan results revealed the presence of a mass lesion in the right half of the tongue. So, the client had undergone Hemi glossectomy and right segmental mandibulectomy along with reconstruction with a single flap surgery on 5/5/2017.

On 16th February 2021, a detailed speech evaluation along with an OPME was carried out. The speech evaluation included both perceptual and objective assessment, where the patient's voice was perceptually ⁶ evaluated using Consensus Auditory-Perceptual Evaluation of Voice

(CAPE-V, Kempster, Gerratt, Verdolini Abbott, Barkmeier-Kramer, & Hillman, 2009) assessing for overall severity of the voice problem, roughness, breathiness, strain, pitch and loudness in the voice. In addition, GRBAS (Hirano, 1981) was also done to assess vocal quality using a four-point rating scale (Grade, Roughness, Breathiness, Asthenia, and Strain).

Objective evaluation of voice was done using Dr. Speech Software Version 4 (Tiger DRS, Inc., Seattle) which measured: fundamental frequency (Fo), intensity (dB), jitter percentage, shimmer percentage, harmonic-to-noise-ratio (HNR), and Normalised noise energy (NNE). Acoustic analysis was done using PRAAT software (version 5.3). Articulation was assessed using 'Kannada Diagnostic Photo Articulation Test (KDPAT)' (Deepa & Savithri, 2010). Resonance, speech understandability, and speech acceptability were assessed using 'Henningsson's four-point rating scale' (Henningsson et al, 2008).

'Sydney swallow questionnaire' and 'Dysphagia Handicap Index' were also administered to check the swallowing abilities. QoL was measured using the 'University of Washington Head and Neck Quality of Life (UWQoL - version 4; Hassan & Weymuller, 1993)' which consists of 12 domains: pain, appearance, activity, recreation, swallowing, chewing, speech, shoulder function, taste, saliva, mood, and anxiety. It also assesses the 'health-related QoL compared to the month before had cancer', 'health-related QoL during the past 7 days', and 'overall QoL during the past 7 days'.

Results

OPME revealed deviated lips with asymmetrical lip closure. On movement, protrusion and lateral movements of the lips were affected. The client was found to have an overbite anteriorly, and a skeletal crossbite posteriorly. He had two upper incisors, canines, and one lower molar on

the left side. The jaw appeared to be deviated towards the right side, with trismus. Tongue examination revealed abnormal and restricted movements specifically concerning tongue protrusion, retraction, and lateral movements.



Figure a

Figure b

Figure 1. The client presented: asymmetrical mandible, anterior overbite, and posterior skeletal crossbite (figure a); irregular and limited opening of the mouth (figure b).

No respiratory difficulties were noted in the present client. Maximum phonation duration of /a/, /i/ and /u/ were 4 second, 5 second and 4 second respectively. Perceptual evaluation of voice revealed harshness and reduction in loudness. GRBAS scores were: G-3, R-1, B-1, A-1, and S-2. The CAPE-V scores were: overall severity- '70/100', Roughness- '50/100', Breathiness- '20/100', Strain- '60/100', Pitch- '60/100', and loudness- '30/100'. In addition, the objective evaluation of voice using Dr.Speech revealed: F0- '130Hz', jitter- '0.74%', shimmer- '4.37%', HNR- '14.12', and NNE- '-8.53'. Formant frequencies of vowel /a/, /i/, and /u/ are tabulated below (Table 1).

Table 1: Formant frequencies of vowels /a/, /i/ and /u/

	/a/	/i/	/u/

Formant 1	904	473	452
Formant 2	1596	1712	1113

The articulatory assessment using KDPAT revealed the presence of distortions, omissions, substitutions, cluster reduction, and compensatory articulation errors like glottal stops, pharyngeal fricatives, and velar fricatives. Speech mechanism examination revealed the presence of short phrases, inappropriate silences, prolonged phonemes, and the rate of speech was found to be '70' words per minute. ¹⁴ Alternate motion rate (AMR) and sequential motion rate (SMR) were found to be '2.0' and '1.25', respectively. The client had mono-pitch, mono-loudness in connected speech. Also, the s/z ratio was found to be '0.66'. Perceptual assessment on Henningsson's rating scale revealed a score of '0' in resonance, and '3' in speech understandability and acceptability.

Sydney swallow questionnaire results revealed that the client had a moderate to severe degree of difficulty in swallowing hot, hard, dry, and solid foods followed by thick liquids and soft foods. The client had problems like choking and coughing consistently while eating solid food. Whereas, choking and coughing during a pureed diet were occasional. However, the time taken to swallow was longer. The client scored '6' in Dysphagia Handicap Index revealing moderate to severe dysphagia. Instrumental evaluation could not be conducted. UWQoL questionnaire results are ¹⁷ as follows: Pain- '100', Appearance- '0', Activity- '25', Recreation- '25', Swallowing- '30', Chewing- '0', Speech- '30', Shoulder- '70', Taste- '0', Saliva- '100', Mood- '75', Anxiety- '70', ¹ health-related QoL compared to month before had cancer- '25', health-related QoL during the past 7 days - '40', and overall QoL during the past 7 days - '60'.

Discussion

The speech articulators change the shape of the oral cavity and resonance characteristics while producing different consonants. In the present case, right composite resection of tongue lesion may have affected the tongue movements. Also, the right modified neck resection along with segmental mandibulectomy has caused trismus and restricted the movements of the mandible leading to speech production errors. The results of the present study agree with the previous findings (Meyerson et al, 1980; Naik et al, 2013).

Perceptual and objective assessments of voice revealed a moderate degree of harsh vocal quality with reduced loudness. This might be a complication of the surgery that the client had undergone, and, the history of smoking tobacco would have also contributed to this complication (Ayoub,2019). These findings agree with the previous findings reporting poor vocal quality secondary to tumor resection (Meyerson et al, 1980; Vieira, 2011). Likewise, the objective evaluation results agreed with the results of the previous studies revealing normal Fo with increased jitter, shimmer, NNE, and decreased HNR (Naik et al, 2013). The acoustic analysis post glossectomy showed an increase in F1 for all vowels, as there isn't enough tongue mass to get adequate tongue height for the vowels. This result is in harmony with the previous findings where the authors also found an increase in the F1 for the vowels (Knuutila et al, 1999; Takatsu et al, 2017). F2 was significantly decreased in vowel /i/, but not in vowel /a/ and /u/. This might be because of the structural change in the oral cavity requiring an extreme tongue advancement for vowel /i/ than other vowels. This result is also in consonance with ⁷ previous studies (Meyerson et al, 1980; Whitehill et al, 2006; Takatsu et al, 2017).

The articulatory assessment revealed the presence of imprecise consonant production, majorly distortions, omissions, substitutions, cluster reduction, and compensatory articulation errors. The lingua-palatal and lingua-alveolar sounds were the most affected followed by

bilabials, labiodentals, palatal and inter-dental sounds. This might be due to a reduction in the movement of the tongue and mandible. Speech mechanism examination revealed the presence of short phrases, inappropriate silences, prolonged phonemes, indicating a slow rate of speech. Also, the AMR and SMR were reduced, indicating a reduction in the speed, range, and accuracy of movements. These results agree with the results of several previously done studies on speech errors in a patient with glossectomy and mandibulectomy. (Premalatha & Tara, 2012; Saravanan et al, 2016; Kalfuss, 1968). Henningson's four-point rating scale indicated normal resonance whereas speech understandability and speech acceptability were severely affected.

Swallowing evaluation showed the presence of dysphagia in the oral phase. Sydney swallow questionnaire results showed moderate to severe dysphagia in hot, hard, and dry food, and Dysphagia Handicap Index showed moderate to severe dysphagia. These difficulties in swallowing can be because of the damage to the structures controlling swallowing during the tumor resection (Kikawada, 2005). These findings are in harmony with previous findings that also reported dysphagia with increased oral transit time (Pauloski, 1993), and problems in the oral preparatory phase causing difficulty during mastication (Miyuki Takahashi, 1999; Hey, 2013; Burtet, 2020).

UWQoL questionnaire results revealed that the patient had more issues in the ³ activity, recreation, swallowing, chewing, speech and taste. This is in support of a previously done study on the QoL of individuals with glossectomy and mandibulectomy showing more impact on swallowing and speech (Kazi, 2008). ³ The 'health-related QoL of the patient compared to the month before the development of the cancer' was somewhat worse, whereas the ⁸ 'health-related QoL during the last 7 days' was fair, furthermore, ⁵ the overall 'QoL during the past 7 days' was

reported to be good. The reason for the client's improvement in the overall QoL is the positive attitude and self-determination to be independent.

Conclusion

The present study highlights the nature of speech problems, swallowing problems, and the QoL of an individual with hemiglossectomy and segmental mandibulectomy. This knowledge is often used for rehabilitation, employment, participation in the community, and to inform the role of family members in the betterment of an individual with glossectomy/mandibulectomy.

Tables

Table 1: Formant frequencies of vowels /a/, /i/ and /u/

	/a/	/i/	/u/
Formant 1	904	473	452
Formant 2	1596	1712	1113

Figures

Figure 1. The client presented with: asymmetrical mandible, anterior overbite and posterior skeletal crossbite (figure a); irregular and limited opening of mouth (figure b).

Functional Outcomes in a client with Hemiglossectomy and Segmental mandibulectomy: A Case Report

ORIGINALITY REPORT

12%

SIMILARITY INDEX

8%

INTERNET SOURCES

9%

PUBLICATIONS

5%

STUDENT PAPERS

PRIMARY SOURCES

- 1 Christoph Becker, Anna Magdalena Becker, Jens Pfeiffer. "Health-related quality of life in patients with nasal prosthesis", Journal of Cranio-Maxillofacial Surgery, 2016
Publication 2%
- 2 www.mdpi.com
Internet Source 1%
- 3 "Handbook of Disease Burdens and Quality of Life Measures", Springer Science and Business Media LLC, 2010
Publication 1%
- 4 Zhang, B.. "Aesthetic and functional radical surgery in young patients with stage one or two tongue cancer: A preliminary report", Journal of Cranio-Maxillofacial Surgery, 201104
Publication 1%
- 5 D. Nemeth, L. Zaleczna, A. Huremovic, J. Engelmann et al. "Importance of chewing, saliva, and swallowing function in patients

with advanced oral cancer undergoing preoperative chemoradiotherapy: a prospective study of quality of life", International Journal of Oral and Maxillofacial Surgery, 2017

Publication

6	Submitted to Temple University Student Paper	1 %
7	www.scribd.com Internet Source	1 %
8	coek.info Internet Source	1 %
9	Tara L. Whitehill, Valter Ciocca, Judy C - T. Chan, Nabil Samman. "Acoustic analysis of vowels following glossectomy", Clinical Linguistics & Phonetics, 2009 Publication	1 %
10	Pankaj Kharade, Kanchan Dholam, Gurmit Bachher. "Appraisal of Function After Rehabilitation With Tongue Prosthesis", Journal of Craniofacial Surgery, 2018 Publication	<1 %
11	Submitted to Institute of Technology, Nirma University Student Paper	<1 %
12	Divya Seth, Santosh Maruthy. "Effect of phonological and morphological factors on	<1 %

speech disfluencies of Kannada speaking
preschool children who stutter", Journal of
Fluency Disorders, 2019

Publication

13	Submitted to Manipal University Student Paper	<1 %
14	www.languageinindia.com Internet Source	<1 %
15	www.ncbi.nlm.nih.gov Internet Source	<1 %
16	www.science.gov Internet Source	<1 %
17	link.springer.com Internet Source	<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On