Functional assessment testing for maxillofacial prosthetics

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Statement of problem. The health industry is now concerned with treatment outcomes and accountability to patients, payers, and referral sources.
Purpose. The purpose of this study was to identify the functional tests that are available to maxillofacial prosthodontists and to provide a list of those tests that are applicable in treatment and documentation.
Methods. Functional assessment may be used to justify reimbursement on the basis of payer guidelines, define eligibility for service, and judge quality and effectiveness of care. Currently, most maxillofacial prosthodontists do not use functional assessment. A literature search resulted in a list of 125 available tests. On the basis of that list a questionnaire was submitted to speech-language pathologists and occupational therapists to identify which tests are being used by them. This article discusses a historic overview of assessment testing and the need for functional assessment testing by the maxillofacial prosthodontist.
Results. Outcome measurements used by other members of the rehabilitation team are discussed and summarized, and those useful for the maxillofacial prosthodontist are suggested. (J Prosthet Dent 1997;77:388-93.)

CLINICAL IMPLICATIONS

Assessment instruments or tests designed to produce quantitative and qualitative data are suggested to improve clinical treatment and outcomes for patients treated by maxillofacial prosthodontists.

The health industry is now concerned with treatment outcomes and accountability to patients, payers, and referral sources. Other members of the rehabilitation team are using these tests, which are recognized or required by institutions and insurance companies. In addition, an interactive dialog is necessary with the insurance industry to establish guidelines for reporting improved functional outcomes for patients treated by the maxillofacial prosthodontist (MFP).

An investigation was conducted to review current assessment measures. The goal was to identify functional outcome measures for speech, swallowing, drooling, and issues of quality of life for patients being treated by the prosthodontist. The purpose of this article is to get the prosthodontist or MFP started using functional assessment testing.

THE NEED FOR FUNCTIONAL ASSESSMENT

There have been different answers over the years to the question of why we should do assessment. The answers have shifted during the years: 1920 to 1940, reimburse an impaired person for the loss of function; 1940 to 1960, provide more effective services to impaired people; 1960 to the present, demonstrate accountability within all levels of the health care network.

Assigning values to outcome measures became vital when patients with limited reimbursement resources needed several types of care.[1] In 1960 the cost of health care in the United States was 5.3% of the gross national product; in 1990 it was 12%. In the year 2000 health care is predicted to cost 18% of the gross national product. Contemporary interest in treatment outcomes is direct acknowledgment of rehabilitation providers' concern about "accountability" to patients, the various disciplines within rehabilitation, and its consequences for reimbursement.[1]

Maxillofacial treatment prostheses for patients with speech and swallowing disorders as a result of stroke, traumatic brain injury, cancer, congenital anomalies, or gunshot wounds will compete for reimbursement with physical medicine, occupational therapy, speech-language pathology, neuropsychology, counseling, and other forms of treatment. When third-party payers refuse to pay for all of these treatments, who decides which treatments are most important? Although the treatment success rate that constitutes a compelling argument for reimbursement is unknown, it stands to reason that functional outcome measures will validate the treatment and support reimbursement.

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Table I. Assessment testing for the maxillofacial prosthodontist

Oral impairment	Test	Quantitative	Qualitative	SLP	MFP
1. Tongue/palate pressure	Iowa Oral Performance Instrument	X		X	X
2. Tongue/palate contact	Palatometer	X		X	X
3. Tongue/palate contact	Indirect palatography		X	X	X
4. Tongue rate of movement	Diadochokinetic rates	X		X	X
5. Swallowing	Ultrasound imaging	X		X	
6. Swallowing	Videofluoroscopy	X		X	
7. Swallowing	Patient self-assessment		X	X	X
8. Swallowing	Frenchay Dysarthria Assessment, Part 1: Swallow		X	X	X
9. Swallowing	Rehabilitation Institute of Chicago Functional Assessment Scale (RICFAS) II		X	X	
10. Drooling	Patient self-assessment		X	X	X
11. Drooling	Frenchay Dysarthria Assessment, Part 1: Dribble/Drool		X	X	X
12. Nasal emission	Nasometer	X		X	X
13. Nasal emission	See-Scape device		X	X	X
14. Nasal emission	Sustained intraoral pressure		X	X	X
15. Nasal emission	Nasal occlusion test		X	X	X
16. Nasal emission	Cheek resistance test		X	X	X
17. Nasal emission	Mirror fogging test		X	X	X
18. Nasal emission	60 to 100 test		X	X	X
19. Intelligibility	Patient self-assessment		X	X	X
20. Intelligibility	Frenchay Dysarthria Assessment, Part 8: Intelligibility		X	X	X
21. Intelligibility	Functional Independence Measures		X	X	
22. Oral motor performance	Oral speech mechanism screening examination		X	X	X

Currently, all disciplines in the rehabilitation teams that treat speech and swallowing problems are required to document the outcome of treatment by use of objective measures. There is no organized literature or system of objective functional outcome measures for maxillofacial prosthetic treatments. Consequently, prosthetic treatment service results cannot be verified by other members of the rehabilitation team, and third-party payers are reluctant to provide reimbursement for prosthodontic services. This significantly reduces the probability that maxillofacial prosthetic services will be used.

ASSESSMENT TESTING RESULTS IN ACCOUNTABILITY

1. Accountability in the treatment process. To decide which prosthetic approach will generate the most successful outcomes, the maxillofacial prosthodontist requires continual involvement with the treatment process. Functional changes of the patient as a result of treatment require assessment to make prosthetic adjustments during treatment.
2. Accountability to the patient and the referral source. Assessment testing of prosthetic management outcomes should include specific, documented improvement of the oral components treated by the maxillofacial prosthodontist. This may generate increased referrals to the prosthodontist.
3. Accountability to third-party payers. Assessment of functional improvement after prosthetic management may improve the insurance reimbursement mechanism. In addition to testing for improvement of oral motor function treated by the MFP, the patient self-assessment tests that relate to the quality of life issues are important in outcome documentation. This includes concern about functions of speech, feeding, and swallowing with the intent of decreasing the patients' disabilities and allowing them to return to work and enjoy an improved quality of social life.

METHODS AND MATERIAL

To identify currently used assessment measures, a literature review of 1000+ abstracts was conducted on the basis of eight categories of functional assessment currently used by other rehabilitation specialists that could be used by prosthodontists:

1. Total body functions including an oral motor component
2. Oral motor functional mechanisms
3. Speech intelligibility or articulation
4. Nasal emission
5. Swallowing: oral preparatory and transit phase of swallowing
6. Muscle movement: nonspeech oral motor maneuvers
7. Presence of drooling
8. Patient self-assessment of functional improvement

A total of 125 assessment tests from the 1000+ abstracts that might be applicable were identified. A questionnaire was then designed with a checklist of the 125 tests speech-language pathologists (SLPs) or occupational therapists (OTs) might use in their treatments. A

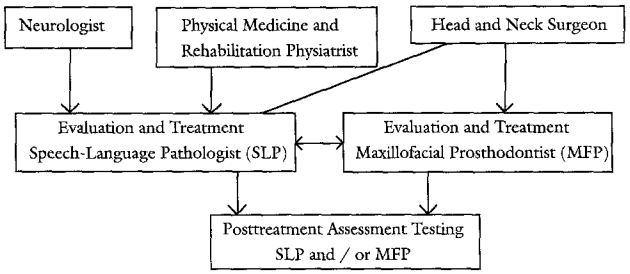

Fig. 1. Routing of patient with oral disabilities in treatment process.

second questionnaire requested information about the practice setting (private, hospital, municipal or government systems), preference for instrumental or perceptual tests, and requirements for functional assessment status pretreatment and posttreatment for both patient records and insurance payments.

One hundred professionals responded to the questionnaires: 92 were SLPs, seven were OTs, and one was a physiatrist. In addition, national, state, and local meetings of SLPs were attended. In informal interviews information was gathered about assessment (for example, perceptual vs instrumental testing) and third-party payers' requirements for information on the patient's functional improvement after treatment. These informal interviews supported the data obtained in the questionnaires.

RESULTS

On the basis of results of the first questionnaire, a list of tests were designed that were useful for SLPs and OTs and could be used by MFPs. The list is discussed below and displayed in Table I.

The results of the second questionnaire provide information about demographics and types of tests used. In the sample population interviewed, 43% practice in hospital settings, 37% in government or schools, and 20% in private practice.

SLPs reported using perceptual testing 100% of the time to rate the subject's speech production in assessment of speech. They also reported that perceptual testing was faster and easier to use than the instrumental approaches. Perceptual testing refers to the therapist listening and recording the subject's speech production by use of word or picture stimulus tests. Instrumental testing was reported by 13%. The only instrument widely used is videofluoroscopy for evaluation of swallowing relating to problems of aspiration. The MFP is aware that coughing may be a symptom of aspiration.

Seventy-two percent of the SLPs reported that documentation of functional improvement is required in the medical record and for insurance claims. SLPs in private practice reported that insurance companies send follow-up letters that request functional improvement assessment if it was not included in the patient report.

Medicare guidelines specify "that a plan of care must include the functional goals for each beneficiary, . . . SLPs must document the initial and present functional communication status of the patient."[2]

FUNCTIONAL ASSESSMENT TESTS FOR MAXILLOFACIAL PROSTHETICS

The routing of the patient with oral disabilities in the treatment process is suggested as a new model for the MFP (Fig. 1). This model is based on discussions with the SLPs interviewed in this study. In the posttreatment assessment of maxillofacial prosthetic management, traditionally conducted by the SLP, the MFP can participate by using many of these tests. The MFP can also verify that tests for prosthetic management are used appropriately. For example, one test frequently used by the SLPs is speech intelligibility testing to evaluate prosthetic management outcome. This measures function of the entire speech mechanism including pulmonary, laryngeal, oral components of resonance and speech articulation, auditory feedback, and cognitive factors. Prosthodontic management treats the oral components. There may be an improvement of oral components, but intelligibility scoring may not reflect it because of decreased function of other components that masks the MFP's contribution to oral improvement. The MFP must understand the complexity of this important outcome measure to ensure that prosthetic treatment is evaluated accurately.

Two types of assessments will be reviewed, quantitative and qualitative. The first group consists of quantitative instrumentation that costs less than $3000 (U.S.). This includes input devices, analysis circuits, and software programs that can be installed in the clinician's microcomputer system. More expensive systems such as ultrasound imaging and videofluoroscopy are found in hospital systems and require the services of the SLP. The MFP could either purchase a microcomputer system or network with hospital or speech pathology programs. The second group consists of qualitative assessment tests that act as a screening process for prosthetic management. Some of these are perceptual tests that can only be done by the SLP. The MFP is not trained to do perceptual tests but should be informed about them. They are included so that the MFP is aware of them. I look on the list below in Table I as the beginning of an assessment system for the MFP.

Nonspeech motor maneuvers are tested by speed, strength, endurance, and accuracy of placement of the tongue. Muscle coordination and rate are tested by diadochokinetic rates with use of simple speech tasks. Velopharyngeal inadequacy is tested by the presence of nasal emission. The oral phase of swallowing will be tested by the speed of swallow and tongue elevation. In addition, I designed a questionnaire for patient self-assessment for quality of life issues. The questionnaire includes information about functional changes perceived in speech, drooling, and swallowing.

Table I presents assessment tools selected on the basis of frequency of use, expressed preference (by SLPs and OTs), and my experience in a maxillofacial practice.

ASSESSMENT INSTRUMENTS AND TESTS YIELDING QUANTIFIED DATA

Tongue pressure and endurance

The Iowa Oral Performance Instrument (Breakthrough: 131 Technology Innovation Center, Oakdale, Ia.)[3] measures improved elevation and pressure of the tongue tip against the anterior hard palate and endurance of contact. The instrument is a hand-held, battery-operated device that works by measuring the pressures that can be exerted on a small bulb placed against the anterior portion of the hard palate. These nonspeech tasks are valuable to assess the integrity of sensory and motor functions.[4]

Tongue/palate placement and range of motion

The Palatometer (Kay Elemetrics Corp., Pine Brook, N.J.)[5] is a computer-assisted system that uses electropalatography for articulation assessment and treatment. The Palatometer instrument provides real-time visual feedback of lingual-palatal contact. An artificial palate, custom made for each patient, with an array of 96 sensors detects tongue contact. It is displayed as a graphic image.

Tongue rate of movement

Diadochokinesis is useful in characterizing speed and coordination that involves the lips, anterior and posterior tongue, and soft palate. Normative data have been established.[6] Slowness in the amount of time required to produce a given number of repetitions of the test utterances is an indicator of neuromuscular abnormality. Single and trisyllable repetitions are tape recorded to permit accurate measurements of the rates. The patient performs rapid spoken syllables for a given time period (5, 10, or 20 second periods).

Clinical outcome rates have been established for the following:

1. Closure of lips (puh): 15 repetitions in 5 seconds
2. Elevated tip of tongue (tuh): 15 repetitions in 5 seconds
3. Elevated back of tongue (kuh): 15 repetitions in 5 seconds
4. Coordination of tongue and lips (puh/tuh/kuh): 8 to 12 repetitions in 5 seconds

Speed of swallow

Ultrasound imaging[7] is a hospital facility procedure that provides a noninvasive and harmless method of monitoring tongue surface motion and provides a technique to investigate speech and the oral phase of swallowing. It uses a real-time scanner to measure the speed of swallow through the oral space. A transducer is placed submentally, with the beam aimed cephalad toward the tongue.

Videofluoroscopy is a radiologic hospital procedure. The test is "[a] modified barium swallowing procedure with a videofluoroscopic assessment of the oropharyngeal mechanism."[8,9] Of importance to the prosthodontist is the assessment of the oral preparatory and transit phases of swallowing. The assessment includes viewing the speed of swallow and observations of oral spill resulting from lip incompetency, difficulty in chewing, and aspiration of food.

Nasal emission

The Nasometer (Kay Elemetrics Corp.)[10] is used to quantify nasal resonance before and after prosthetic management. Hypernasality with the resultant symptom of nasal emission is generally the result of inadequate velopharyngeal closure. The instrument consists of two directional microphones and a nasal-oral separator. As the client speaks, each microphone collects data, which is translated into a nasal to oral ratio and displayed instantly on the screen. The nasal/oral ratio is assessed with two special speech passages: one containing no nasal phonemes and the other heavily loaded with them. Software calculates statistical information such as mean nasality, SD, and range for screen display, filing in a database or for hard copy printout. The instrument is also useful in therapy by providing clients with biofeedback.

ASSESSMENT TESTS AND INSTRUMENTS YIELDING QUALITATIVE DATA

Quality of life

The patient may provide a self-assessment of quality of life as related to speech, drooling, and swallowing. Feedback from the subjects relates to issues of a handicap of communication and feeding in social and work settings. Self-assessment has become an important tool that can be obtained by a questionnaire from the patient or the patient's caretaker at baseline and at the end of the treatment period. The author developed a composite questionnaire that meets the specific concerns and needs of the MFP on the basis of three swallowing questionnaires used by other professionals (Scheib, personal communication).[11,12] It also addresses coping with oral disabilities in social and vocational settings: communication, coughing, eating, swallowing, and drooling. There are 18 items divided into six categories. Each item is rated on a four-point severity scale.[13]

Testing for nasal emission

The See-Scape device (Pro-Ed, Austin, Tex.) is a visual feedback device for nasal emission. This instrument is widely used by SLPs to assess nasal emission and intraoral pressure. One method is to insert a disposable nasal tip into a nostril.[14] It is connected to a plastic tube inserted into a cylinder that contains a plastic piston. Any airflow entering the cylinder through the plastic tube causes the piston to rise. The device is extremely sensitive to airflow. The number of times that nasal air-

flow occurs during baseline and after treatment is compared. A second method is similar to the first. It uses a disposable mouth tube attached to the plastic tube and the phonemes /p/, /p/, /p/. With decreased intraoral pressure the piston will not rise to the top of the cylinder.

Clinical tests of performance

1. Sustained intraoral pressure. Use high friction sounds such as /f/ or /s/ to test nasal emission for a "speech bulb" or palatal lift extension. The prosthetic velopharyngeal extension can be shaped until the patient can produce a sustained /f/ or /s/ without nasal escape.[15]
2. Nasal occlusion test. Ten vowels are tested in a /b—t/ context: beet, bit, bait, bet, bat, bought, boat, boot, but, Bert. With normal velopharyngeal closure there is no nasal emission and the nose, occluded or unoccluded, sounds the same.[16]
3. Cheek resistance. Push on puffed cheeks to check ability to maintain intraoral pressure. In addition, the patient can stick out tongue into closed lips and puff up cheeks. The clinician then holds patient's nostrils. If no air escapes when nostrils are released, it is assumed that velopharyngeal closure is adequate.[17]
4. Mirror fogging. A mirror is placed under each nostril. If fogging occurs after the speaker produces plosives or high friction sounds, nasal emission is indicated. Decreased fogging on the mirror indicates decreased nasal emission.[18]
5. Repetition of extended lists of numbers (60 to 100 test for perception of hypernasality).[19] The patient counts aloud from 60 to 100. For example, the 60 series of numbers may reveal velopharyngeal inadequacy and nasal emission resulting from the frequent occurrence of the /s/ phoneme. The 90 series should sound normal when produced by a patient with hypernasality because of the frequent production of nasal consonants.

Tongue elevation—indirect palatography

Palatography is the recording of contacts made by the tongue and palate during speech. The pictorial record of a single contact is called a palatogram. This technique requires the fabrication of an artificial palate for each subject.[20,21] The prosthesis is dried and dusted with unscented talcum powder. Tongue-palate contact is made on one phonemic utterance (/t/, /s/, or /k/), and the prosthesis is removed. Evaluation is made of the ability of tongue to elevate to the palate. The artificial palate may be photographed for analysis. More precise evaluation can be done by developing the photograph into a slide and projecting it on graph paper. When comparisons are made before and after treatment of the number of squares covered by the "palatal wipe," functional changes can be evaluated as a quantitative measure.[20,21]

Oral speech performance examination

Assessment with an oral speech mechanism screening examination[22] consists of a systematic examination of the complete oral peripheral components, both structures and functions. This assessment includes normal or abnormal maxillomandibular relationships; tooth deviations in arch, gross decay, missing teeth, presence of diastemas, and prosthetic replacements; gross deviations of the hard palate in width or height and presence of clefts; the soft palate observed during rest and during phonation; the oropharynx by viewing the anterior and posterior faucial pillars and palatine tonsils; excessive mouth breathing; diadochokinesis, which refers to a speaker's motor coordination and control of the major articulators (lips and tongue), is assessed through determination of maximum rates for diadochokinetic speech movements.

Swallowing

The test used for observation of swallowing performance is the Frenchay Dysarthria Assessment.[12] To measure the patient's swallowing performance, the patient is observed drinking one half cup of water and eating a cookie. The patient is asked to do this as quickly as possible. In addition, the patient is asked if there is any difficulty with swallowing. To score the patient's performance, the range of normality for drinking this quantity of water is between 4 and 15 seconds with an average of 8 seconds.

Any time longer than 15 seconds is abnormally slow.

The grading of swallowing performance is as follows:

1. No abnormality
2. Patient reports having some difficulty, notices that eating, drinking slower. Pauses more than usual when drinking.
3. Eating is markedly slow. Some foods and or liquids avoided.
4. Patient able to swallow a special diet only, such as pureed foods.

Observation of acceptable food and liquid textures and densities is observed. From the RICFAS the test used is RICFAS II,[23] Chewing/Swallowing. This test is used as part of the patient evaluation conference system[24] for oral motor evaluation for departments of rehabilitation medicine. The intake of liquids and solids is affected by motor and sensory function and cognitive status. The test uses a seven scale test from 1 (severe impairment: all nourishment by alternate [nonoral] feeding method, trial oral intake with physician orders to SLP only) to 7 (normal: safe and efficient chewing and swallowing of all food consistencies).

Drooling

The test used to measure the scale for the degree of drooling is the Frenchay Dysarthria Assessment,[12] Part 1: Dribble/Drool. The MFP asks the patient if there is

any difficulty in this area and then observes the patient. The scale is as follows:

a. No difficulty
b. Occasionally dampness at the corners of the mouth. Patient may report that pillow is damp at night. (Only note this if there has been a change in status—some normal people have slight dribbling or drooling at night). Drools slightly when drinking.
c. Dribbles or drools when leaning forward or not concentrating—some degree of control.
d. Very obvious dribbling or drooling when at rest, but not continual.
e. Continual excessive dribbling or drooling that is not controlled.

Speech intelligibility

Rating scales completed by listener-clinician are under the Frenchay Dysarthria Assessment,[12] Part 8: Intelligibility. The clinician engages the patient in conversation for about 5 minutes about jobs, hobbies, relatives, and so on. The rating scale is as follows:

1. No abnormality
2. Speech abnormal but intelligible: patient occasionally has to repeat.
3. Speech severely distorted, can be understood half the time. Very often has to repeat.
4. Occasional words decipherable.
5. Patient totally unintelligible.

The Functional Independence Measures[25] test consists of functional communication measures: speech production disorders. It uses a 7-scale test from 1 (production of speech is unintelligible) to 7 (production of speech is normal in all situations).

CONCLUSION

A list of assessment instruments or tests that produce quantitative and qualitative data were suggested and organized for the MFP. Some of the instruments and tests are easy to use, some require further training in speech science and oral motor dynamics, and others will require the services of SLPs. It is hoped that their use results in improved clinical treatment management, an increase in rehabilitation team referrals, and a verification of outcome results for prosthetic management to third-party payers.

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REFERENCES

1. Banja JD. Ethics, outcomes, and reimbursement. Rehabil Management 1994;Dec/Jan:61-5.
2. Fratelli CM. Functional assessment of communication: merging public policy with clinical views. Aphasiology 1992;6:63-83.
3. Luschei ES. Development of objective standards of nonspeech oral strength and performance: an advocates's view. In: Moore C, Yorkston K, Beukelman D, editors. Dysarthria and apraxia of speech: perspective on management. Baltimore: Brookes, 1991:3-15.
4. Kent RD. Summary of the speech assessment issues. In:Cooper JA, editor. Assessment of speech and voice production: research and clinical applications. Proceedings of a conference; September 27-28, 1990. Bethesda: U.S. Dept of Health and Human Services, National Institutes of Health, 1990:210-3.
5. Fletcher SG. Articulation: a physiological approach. San Diego: Singular, 1992.
6. Fletcher SG. Time-by count measurement of diadochokinetic syllable rate. J Speech Hearing Res 1972;15:763-70.
7. Shawker TH, Sonies BC, Stone M. Sonography of speech and swallowing. In: Sanders RC, Hill M, editors. Ultrasound annual 1984. New York: Raven Press, 1984:237-60.
8. Logemann JA. Evaluation and treatment of swallowing disorders. 2nd ed. San Diego: College Hill Press, 1991.
9. Logemann JA. Manual for the videofluoroscopy study of swallowing. 2nd ed. Austin: Pro Ed, 1993.
10. Fletcher SG, Adams LE, McCutcheon MJ. Cleft palate assessment through oral-nasal acoustic measures. In: Bzoch KR, editor. Communicative disorders related to cleft palate lip and palate. 3rd ed. Boston: Little, Brown, 1987:246-57.
11. Miller R. Clinical examination for dysphagia. In: Groher ME, editor. Dysphagia: diagnosis and management. 2nd ed. Boston: Butterworth-Heinemann, 1992:146-63.
12. Enderby PM. Frenchay dysarthria assessment. San Diego: College Hill Press, 1983.
13. Light J. Functional assessment testing for maxillofacial prosthodontists. Washington: National Institute on Disability and Rehabilitation Research, U.S. Department o Education, 1995; project No. H133F40009.
14. Shprintzen RJ, McCall GN, Skolnick ML. A new therapeutic technique for the treatment of velopharyngeal incompetence. J Speech Hearing Disorders 1975;40:69-83.
15. Millard RT. Training for optimal use of the prosthetic speech appliance. In: Bzoch KR, editor. Communicative disorders related to cleft lip and palate. Boston: Little, Brown, 1971:257-63.
16. Bzock K. Communication disorders related to cleft lip and palate. Boston: Little, Brown, 1979.
17. Fox D, Johns D. Predicting velopharyngeal closure with a modified tongue-anchor technique. J Speech Hearing Disorders 1970;35:248-51.
18. Baken, RJ. Clinical measurement of speech and voice. Boston: Allyn & Bacon, 1987:407.
19. Mason RM, Grandstaff HL. Evaluating the velopharyngeal mechanism in hypernasal speakers. Language Speech Hearing Serv Schools 1971;2:53-61.
20. Light J, Silverman SI, Garfinkel MA. The use of an intraoral training aid in the speech rehabilitation of laryngectomy patients. J Prosthet Dent 1976;33:430-40.
21. Light J. A review of oral and oropharyngeal prostheses to facilitate speech and swallowing. Am J Speech Lang Pathol 1995;4:15-21.
22. St. Louis K, Ruscello DM. Oral speech mechanism screening examination, revised. Austin: Pro-Ed, 1981.
23. Heinemann AW. Rehabilitation Institute of Chicago Functional Assessment Scale–Revised (RICFAS II). Chicago: Rehabilitation Institute of Chicago, 1989.
24. Harvey RR, Jellinek HM. Patient evaluation conference system: PECS. Wheaton: Marianjoy Rehabilitation Center, 1979.
25. State University of New York at Buffalo Research Foundation. Guide for use of the uniform data set for medical rehabilitation: functional independence measure. Buffalo: State University of New York at Buffalo, 1993.

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