Objectives: To determine the tracheoesophageal speech results in a Third World medical practice; to examine the impact of socioeconomic status, literacy, and proximity to specialist services on tracheoesophageal speech; to assess whether these factors should affect patient selection for fistula speech; and to determine guidelines for voice prosthesis selection.

Design: Retrospective analysis.

Setting: Groote Schuur Hospital, Cape Town, South Africa, which serves a Third World community.

Patients: Ninety-seven consecutive patients who underwent total laryngectomy between January 1, 1996, and October 1, 1998. Patients who undergo total laryngectomy routinely have a primary tracheoesophageal fistula created for speech.

Main Outcome Measures: Speech outcomes after total laryngectomy; tracheoesophageal speech in relation to social class, literacy, and proximity to specialist services; and experience with removable and indwelling valves.

Results: Fifty-nine (81%) of 73 patients acquired useful speech. Speech outcome was not affected by employment status or proximity to specialist services. Although speech was affected by literacy and housing, several illiterate shack dwellers acquired good speech. Average device life of removable prostheses was 16 weeks (>4 months in 35% [64/183]). Indwelling prostheses had an average life of 28 weeks.

Conclusions: Tracheoesophageal speech results in a Third World community equate with those in the Developed World. All patients who undergo laryngectomy and have adequate manual dexterity and cognitive function should be given a trial of fistula speech. Removable voice prostheses can successfully be used as indwelling prostheses.

Tracheoesophageal Speech in a Developing World Community

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**PATIENTS, MATERIALS, AND METHODS**

A retrospective analysis was performed of the tracheoesophageal speech results of 97 patients who underwent total laryngectomy at Groote Schuur Hospital between January 1, 1996, and October 1, 1998. Data were obtained from hospital medical records and speech therapists’ records. Speech therapists responsible for patient rehabilitation subjectively assessed tracheoesophageal speech at the time of the initial fitting of the prosthesis, at 3 months, and at the last follow-up visit. Speech was considered “good” if tracheoesophageal speech was intelligible, fluent, and used daily as the primary means of communication. The Bartholomew test was used to determine significance.1

(n=66) surgery. In addition to total laryngectomy, 9 patients underwent partial pharyngectomy and 2 underwent total glossectomy. Eighty-eight patients underwent total pharyngolaryngoesophagectomy. Nineteen patients underwent pharyngeal reconstructive procedures by means of pedicled or free flaps or grafts (Table 1).

Voice prostheses were inserted into 87 patients (90%). Eighty-eight patients (91%) had primary punctures. Some patients with gastric pull-ups and jejunal interpositions underwent secondary punctures. Eight patients (8%) required repeated tracheoesophageal puncture for poorly placed fistulae or closure of the fistula due to loss of the voice prosthesis. One patient who initially had no voice because of spasm of the pharyngoesophageal segment gained excellent speech following pharyngeal myotomy 5 months after laryngectomy. Details about speech fluency and intelligibility were available for analysis in 84 patients.

**TRACHEOESOPHAGEAL SPEECH RESULTS**

Follow-up ranged from 4 to 38 months (mean, 12.5 months). Decline in good speech at 3 months correlates with the time when many patients would have been undergoing postoperative radiation therapy (Figure 2).

Twenty-five (30%) of the 84 patients available for analysis did not acquire fistula speech. Speech therapists attributed failure to acquire speech to impaired cognitive function, poor motivation, and limited learning ability (n=14); extrusion of the prosthesis with fistula closure (n=8); poor articulation (total glossectomy) (n=2); and inadequate pulmonary function (n=1). If patients who lost prostheses, had poor articulation, or had inadequate pulmonary function are excluded from the analysis, then 59 (81%) of 73 patients acquired useful speech.

**IMPACT OF LITERACY ON SPEECH**

Of 84 patients assessed for speech fluency and intelligibility, 17 were illiterate and 12 were partially literate. Literacy was not associated with speech outcome at the initial fitting of the prosthesis (P>0.05). Although there was a significant association between literacy and speech failure at final follow-up (P<0.002), 8 of 17 illiterate patients had good speech.

**IMPACT OF SOCIOECONOMIC STATUS ON SPEECH**

Housing was classified into unserviced shacks in squatter camps (Figure 1A), low-income houses (Figure 1B), and serviced homes. There was no association between housing and speech at the initial fitting of the voice prosthesis (P>0.05). Although there was a significant association between quality of housing and speech at last follow-up (P<0.002), all 3 shack dwellers had good speech. Only 22 patients had regular employment before surgery. There was no association between regular employment and speech (P>0.05).

**IMPACT OF PROXIMITY TO SPECIALIST SERVICES ON SPEECH**

Twenty patients lived more than 250 km and 6 patients lived 50 to 250 km from Groote Schuur Hospital. There was no association between distance from specialist services and speech outcome (P>0.05).

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Figure 1. A, Typical unserviced shack. B, Typical low-income houses.
VOICE PROSTHESES

We used Blom-Singer prostheses (InHealth Technologies, Carpinteria, Calif), principally because of cost. Device life could be calculated for 187 prostheses. Thirty-seven percent of voice prostheses were removable duckbill and 61% were removable low-pressure prostheses. Indwelling prostheses were inserted in only 2% of patients because indwelling prostheses are more expensive and patients living far from the hospital need to be able to replace prostheses by themselves should they malfunction or extrude. The average device life for removable valves was 4 months (range, 1-15 months); 35% lasted more than 4 months (Figure 3). The average device life for indwelling valves was 7 months (range, 5-15 months).

Our tracheoesophageal speech results compare favorably with those of studies from developed countries (Table 2). This demonstrates that successful speech can be achieved in a Third World medical practice. Only 5% to 30% of patients acquire esophageal voice. Our results, therefore, support use of tracheoesophageal speech in a Third World setting. We attribute our favorable results to attention to surgical technique and a committed speech therapy service.

Our surgical technique comprises the following. A horizontal or T-shaped pharyngeal closure is used to ensure maximal capacity of the pharyngoesophageal segment. Should the pharyngeal mucosal remnant be deemed insufficient, a pectoralis major flap is used to increase the capacity of the pharyngoesophageal segment. A myotomy is performed to the level of the tracheoesophageal fistula. A size 12 Foley catheter is inserted through the fistula by which the patient is initially fed. When oral feeding is established and the tracheotomy stoma has healed (day 7-10), the Foley catheter is removed and open-tract voicing is assessed. The fistula tract is measured, and an appropriate Blom-Singer voice prosthesis is inserted by the speech therapist. Patients who do not achieve voicing are subsequently assessed by videofluoroscopy to exclude the presence of a pharyngoesophageal segment stricture or spasm. Patients with spasm undergo pharyngeal myotomy from the level of the fistula to the base of the tongue. In the event of a stricture, widening of the pharyngoesophageal segment by means of a free or pedicled flap is considered.

Voice prosthesis selection, placement, and maintenance are performed by the speech pathologist. The choice of removable duckbill and low-pressure Blom-Singer prostheses has been determined by budgetary constraints. Despite the benefits of indwelling prostheses, such as reduced extrusion, the cost of indwelling prostheses has precluded its routine use. However, we

| Table 1. Surgical Details of 97 Patients Who Underwent Total Laryngectomy (TL) |
|---------------------------------|-----------------|-----------------|-----------------|
| Surgery                        | Patients, No.   | Tumor resection |                  |
|                                |                 | TL alone        | 78               |
|                                |                 | TL with partial pharyngectomy | 9 |
|                                |                 | TL with total glossectomy | 2 |
|                                |                 | Pharyngolaryngoesophagectomy | 8 |
| Neck dissection                |                 | Unilateral      | 36               |
|                                |                 | Bilateral       | 32               |
| Reconstruction                 |                 | Pectoralis major flap | 5 |
|                                |                 | Latissimus dorsi flap | 2 |
|                                |                 | Radial free forearm flap | 2 |
|                                |                 | Gastric pull-up | 8                |
|                                |                 | Small bowel interposition | 2 |

| Table 2. Published Tracheoesophageal Speech Results |
|---------------------------------|-----------------|-----------------|-----------------|
| Study                          | Tracheoesophageal Speech, % |
| Present study                  | 81               |
| GuilY et al,2 1992            | 75               |
| Jacobson et al,3 1997         | 70               |
| Kerr et al,4 1993             | 59               |
| Hamaker et al,5 1985          | 75               |
| Singer et al,6 1989           | 80               |

Figure 2. Speech fluency and intelligibility in 84 patients.

Figure 3. Device life of removable voice prostheses.
use removable prostheses as “indwelling” prostheses. The prosthesis is not removed for cleaning, and patients clean the prosthesis in situ with a cytobrush and tweezers. The prosthesis is removed only when it malfunctions (ie, when it leaks or fails to provide adequate voice for speech).

The speech pathologist replaces all prostheses except for those in patients who live far from the hospital. Should the voice prosthesis become dislodged, patients are taught to maintain patency of the fistula tract by inserting a Foley catheter into the tract. Antifungal prophylaxis is not used because of the expense.

Our prosthesis policy has been successful, with many removable voice prostheses lasting longer than 6 months (Figure 3). The average device life of removable prostheses (4 months) is similar to that reported for indwelling Blom-Singer and Provox (ATOS Medical AB, Milwaukee, Wis) prostheses. Although the number of indwelling valves used was small, the lifespan (7 months) is similar to that reported by Leder and Erskine. We rarely encounter problems of inadvertent fistula closure or granuloma formation, which may suggest that granuloma formation is a consequence of frequent or traumatic prosthesis replacement.

Jacobson et al reported poor speech outcome in a cross-cultural situation in which the patient could not converse in the language of the therapist. We use interpreters (including family members) and nonverbal demonstration to communicate with patients and do not consider this to be a contraindication to using tracheoesophageal speech.

CONCLUSIONS

Based on the results of our study, we conclude the following:

1. Tracheoesophageal speech results in a Third World medical practice are comparable to those of First World centers of excellence.

2. Tracheoesophageal speech results are unaffected by employment status or proximity to specialist services.

3. Although literacy and quality of housing may affect speech outcome, many illiterate patients and patients living in squalor acquire good speech.

4. Traditional duckbill and low-pressure voice prostheses can successfully be used as indwelling voice prostheses.

RECOMMENDATIONS

To remove a patient’s larynx without providing an opportunity to acquire speech is unacceptable practice. Tracheoesophageal speech is currently the best method of alaryngeal communication. All patients who undergo laryngectomy and have adequate dexterity and insight, regardless of social and educational status and proximity to specialist care, should be afforded a trial of tracheoesophageal speech.

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