The Journal of Laryngology and Otology
July 1994, Vol. **108**, pp. 579–581

Short Communication

The 'Allan Johnson' voice prosthesis. A modification of the Bivona voice prosthesis for immediate post-fitting aphonia after secondary tracheo–oesophageal puncture

P. D. R. SPRAGGS, F.R.C.S.*, A. PERRY, PH.D., M.C.S.L.T.†, A. D. CHEESMAN, F.R.C.S.*

Abstract
The combination of a narrow oesophageal lumen and a hypertonic pharyngo–oesophageal (P–E) segment following laryngectomy and secondary tracheo–oesophageal puncture (TEP) can cause obstruction of a voice prosthesis and consequently prevent phonation. The 'Allan Johnson' modification of the Bivona voice prosthesis incorporates a stainless steel slide and has been successfully used to remedy such a circumstance.

Key words: Larynx, artificial; Tracheooesophageal fistula

Introduction

Tracheo–oesophageal puncture (TEP) and the use of a voice prosthesis is the preferred form of speech restoration following total laryngectomy in many units. Tracheo–oesophageal puncture can be performed at the time of laryngectomy (primary TEP) or as a secondary procedure, months or years after laryngectomy, usually as a result of failed oesophageal phonation. Primary TEP results in a higher proportion of patients with good fluent speech partly because of the controlled fashion of pharyngeal closure which can be accompanied by pharyngeal myotomy or pharyngeal plexus neurectomy.

The Blom–Singer voice prosthesis has been successfully used at Charing Cross Hospital since 1982 in over 300 laryngectomees. Three cases of immediate post-fitting aphonia have occurred in patients who have undergone secondary TEP as a result of the combination of a narrow oesophageal lumen and a hypertonic pharyngo–oesophageal (P–E) segment. In each case air was unable to be forced through the valved posterior aspect of the prosthesis because of obstruction by the posterior oesophageal wall mucosa, despite the use of a variety of prosthesis designs, sizes and lengths (Figure 1).

One of the three patients has subsequently designed a modification of the Bivona silicone voice prosthesis which has been used successfully without complication for over five years. The prosthesis has been named the 'Allan Johnson' prosthesis after its designer.

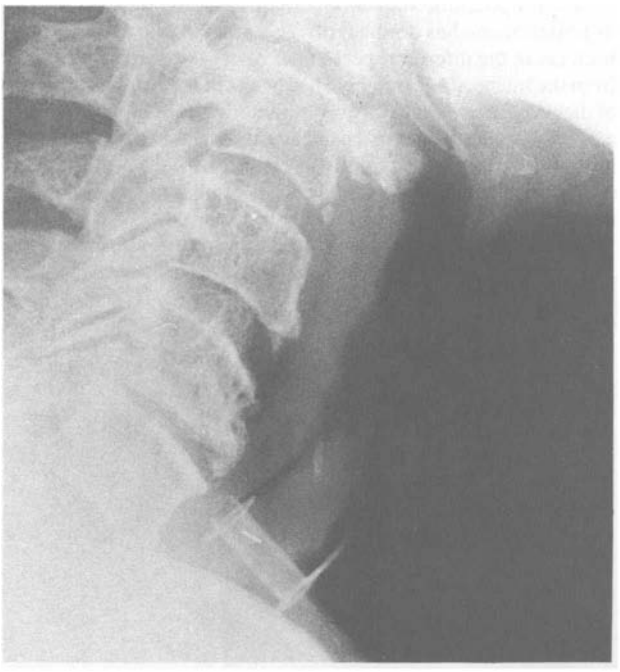

FIG. 1
Lateral soft tissue radiograph of a patient with immediate post-fitting aphonia after secondary tracheo–oesophageal puncture. The posterior end of a low pressure prosthesis is obstructed by the mucosa of a narrowed oesophagus. This, together with a hypertonic P–E segment resulted in total aphonia.

Design

The voice prosthesis consists of two components (Figure 2): a modified 2 cm FG (French Gauge) Bivona low pressure silicone prosthesis, and a constructed stainless steel slide which passes through the sleeve of the prosthesis. A closed head of the slide is

From the Department of Otolaryngology and Head and Neck Surgery* and Department of Speech and Language Therapy†, Charing Cross Hospital, Fulham Palace Road, London.
Accepted for publication: 8 March 1994.

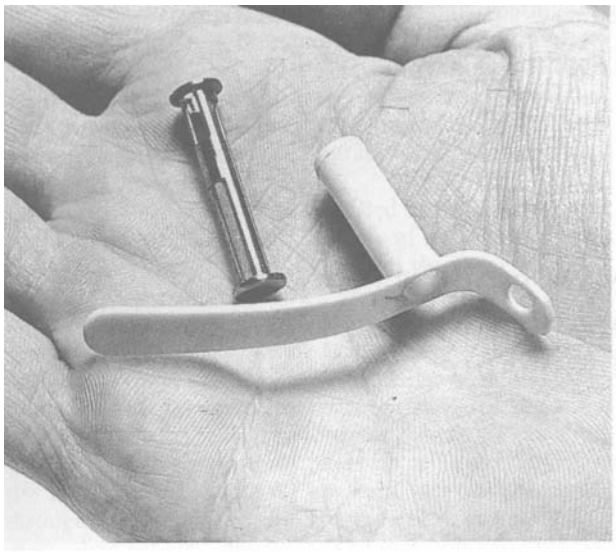

FIG. 2

The two components of the 'Allan Johnson' voice prosthesis. A modified Bivona low pressure silicone prosthesis and a constructed stainless steel slide.

held firmly in contact with the posterior end of the sleeve and forms a watertight valve (Figure 3). The body of the slide has a tab which, in the resting condition, closes an air portal on the inferior aspect of the sleeve of the prosthesis. The anterior end of the slide is marked with a groove which orientates the slide within the prosthesis and ensures the tab is in line with the air portal.

The low pressure 'trap door' valve of the Bivona prosthesis at its posterior end has been cut off. A 3 mm circular air portal has been cut in the inferior aspect of the barrel for the passage of air from the trachea. A 3 mm hole has been cut in the inferior flange of the prosthesis which fits over the anterior head of the slide and acts as a spring tab. This ensures that, in the resting state, the head of the slide is kept tightly in contact with the posterior end of the barrel and prevents the leakage of pharyngeal secretions through the prosthesis and into the trachea.

On digital occlusion of the tracheostoma for phonation, the thumb or finger applies pressure to the slide of the prosthesis (Figure 4). The slide passes through the silicone prosthesis and, by three actions, allows air to pass unimpeded into the P–E segment. Firstly, the tab of the slide opens the air portal on the inferior aspect of the sleeve allowing air to pass into the prosthesis from the trachea. Secondly, the prosthesis valve within the oesophagus opens and at the same time the head of the slide holds away the posterior oesophagus wall from the prosthesis, thus clearing any obstruction of the valve. On releasing pressure on the slide, the spring tab of the prosthesis snaps the slide back to its resting position and closes both the valve and the air portal, thus avoiding aspiration of secretions.

The rigidity of the stainless steel slide allows the prosthesis to be inserted and removed with ease to and from the tracheo–oesophageal fistula. The slide can be removed from the sleeve of the prosthesis and cleaned in warm water. The superior strap of the prosthesis may be taped to the pretracheal skin for stability if necessary.

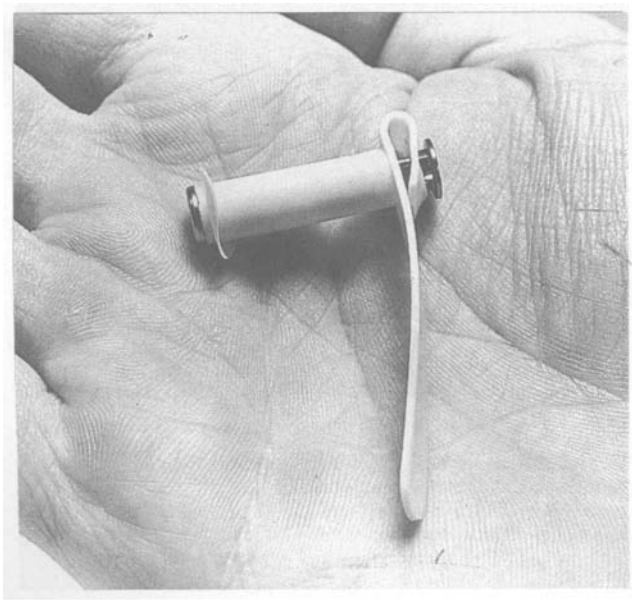

FIG. 3

In the resting condition the spring tab ensures the head of the slide forms a watertight seal with the posterior end of the prosthesis sleeve.

Discussion

The concept of tracheo–oesophageal fistulization following total laryngectomy for speech restoration is not new, but early attempts were complicated by leakage with aspiration, infection and stenosis. Tracheo–oesophageal puncture and voice prosthesis has become the most common form of speech restoration following the work of Blom and Singer in 1978 (Singer and Blom 1980). Success rates of 88 per cent have been reported in the American literature (Singer and Blom, 1983) and our figures have resulted in 89 per cent of patients with clear and fluent voice six months following laryngectomy and primary TEP and 70 per cent in the secondary state (Milford *et al.*, 1988).

Immediate post-fitting aphonia can occur as a result of prosthesis failure, over-forceful stoma occlusion or the combination of a narrow oseophagus and hypertonic P–E segment. Assessment of the anatomy and function of reconstituted pharyngo–oesophagus in these patients is achieved by the combination of lateral radiographs and by transnasal insufflation via a red rubber catheter with or without fluoroscopy (Blom *et al.*, 1985). A qualitative classification of the dynamic state of the P–E segment using videofluoroscopy has been devised in which the radiologi-

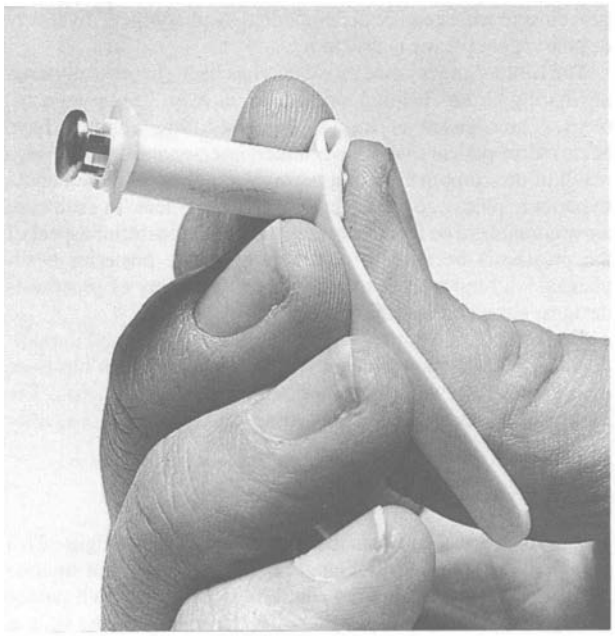

FIG. 4

Pressure on the stainless steel slide results in both the posterior head of the slide holding back the posterior oesophageal wall and the opening of the valve thus allowing the passage of air to the P–E segment for phonation.

https://doi.org/10.1017/S0022215100127471 Published online by Cambridge University Press

cal appearance of the P–E segment in poor speakers is classified as hypotonic, hypertonic, spastic or strictured (McIvor *et al.*, 1990). Such a classification allows poor speakers to be placed into treatment groups. Stricture and spasm usually requires pharyngeal constrictor myotomy or pharyngeal plexus neurectomy. The use of the 'Allan Johnson' voice prosthesis is a successful conservative treatment for P–E segment hypertonicity particularly in the presence of a narrow oseophageal lumen which avoids the need for surgical intervention.

Conclusion

In the patient who has not undergone myotomy, the 'Allan Johnson' voice prosthesis may have a useful function in voice restoration where the problems of (a) a narrow oesophageal lumen and (b) hypertonicity of the P–E segment coexist.

Acknowledgements

The authors would like to acknowledge Dr James McIvor, Consultant Radiologist at Charing Cross Hospital, for his work in the field of voice rehabilitation after laryngectomy and the Medical Illustration department of Charing Cross Hospital for the preparation of the photographs.

References

Blom, E. D., Singer, M. I., Hamaker, R. C. (1985) An improved oesophageal insufflation test. *Archives of Otolaryngology* **111:** 211–212.

McIvor, J., Evans, P. F., Perry, A., Cheesman, A. D. (1990) Radiological assessment of post-laryngectomy speech. *Clinical Radiology* **41:** 312–316.

Milford, C. A., Perry, A., Mugliston, T. A., Cheesman, A. D. (1988) A British experience of surgical voice restoration as a primary procedure. *Archives of Otolaryngology, Head and Neck Surgery* **114:** 1419–1421.

Singer, M. I., Blom, E. D. (1980) An endoscopic technique for restoration of voice after laryngectomy. *Annals of Otology Rhinology and Laryngology* **89:** 529–533.

Singer, M. I., Blom, E. D., Hamaker, R. C. (1983) Voice rehabilitation after total laryngectomy. *Journal of Otolaryngology* **12:** 329–334.

Address for correspondence:
Paul D. R. Spraggs, F.R.C.S.,
6 Dunstable Mews,
London W1N 1RQ.