The role of the speech and language therapist in the rehabilitation of speech, swallowing, voice and trismus in people diagnosed with head and neck cancer

Sinead Rothrie,*[1] Eavan Fitzgerald,[2] Grainne C. Brady[3] and Justin W. G. Roe[4]

Key points

- Speech and language therapists (SLTs) are key members of the multidisciplinary team.
- All individuals should see a SLT as part of their treatment pathway if there is an existing or likely treatment-related impact on communication and/or swallowing.
- SLTs use a combination of multidimensional assessment, education and rehabilitation interventions to optimise functional outcomes.

Abstract

Head and neck cancer (HNC) and its treatment can have a significant impact on physical and psychosocial wellbeing. A multidisciplinary team (MDT) approach is critical to reduce the potential acute, long-term and late effects of treatment by optimising function at baseline, supporting people during treatment and with rehabilitation post treatment. The key focus for speech and language therapists is to support the holistic needs of people with a focus on speech, swallowing, voice and mouth opening. Effective management is reliant on working with MDT members and interventions are implemented against the background of robust multidimensional baseline evaluation. There have been significant advances in treatment modalities for both primary and recurrent HNC. These include highly conformal radiotherapy modalities, including: image-guided radiotherapy; parotid-sparing and dysphagia-optimised intensity-modulated radiotherapy; and the introduction of intensity-modulated proton therapy, as well as immunotherapy, transoral robotic surgery and surgery with advanced reconstructive techniques. Such treatment advances coupled with a changing patient demographic means that people with HNC are now living longer. However, this is not always without consequences and late treatment effects are a new challenge facing MDTs, requiring high levels of support and rehabilitation.

Introduction

In the UK, approximately 12,500 people are diagnosed with head and neck cancer (HNC) annually and the incidence is rising.[1] The increase in human papillomavirus (HPV)-related cancers has resulted in a demographic shift, with many aged below 60 being diagnosed and treated.[2,3] Despite this, the rise in HNC cannot solely be attributed to HPV. Traditional risk factors, including alcohol consumption and tobacco use, continue to contribute to increasing incidence.[1]

The impact of diagnosis, treatment and aftercare on function (including communication, eating and drinking) is critical for individuals' ongoing quality of life (QoL).[4] Similarly, the impact on oral health is significant and there is a high proportion of dental disease on presentation within this cohort, at approximately 90%.[5,6] People may require multiple dental extractions before treatment, compromising articulatory precision and mastication. Individuals often present to speech and language therapists (SLTs) at baseline having made significant food texture modifications to compensate.[7]

With a focus on reducing treatment-associated morbidities, working with those affected on how to improve both speech and swallowing outcomes is critical and ongoing. Collaborative research is essential to develop the evidence base.[8] National standards state that all individuals who are undergoing treatment likely to disrupt communication or swallowing function should be seen by an SLT for pre-treatment counselling and a multidimensional assessment of speech, voice and swallowing, including clinician and patient-reported outcome measures.[9]

Part of the role of the SLT as a member of the multidisciplinary team is to ensure that people are assessed and counselled on the likely impact of treatment.[2] SLTs specialise in optimising function before commencing treatment. This includes establishing a baseline and educating the individual on potential functional deficits. Presentation at diagnosis can vary widely, depending on the site and size of the disease. SLT interventions are prophylactic, compensatory and/or rehabilitative from the outset. Identifying the safety and efficiency of swallowing function is particularly important to ensure timely addressing of aspiration risk, consequential respiratory compromise and nutritional deficits, in collaboration with our dietetic colleagues. Swallowing difficulties (dysphagia) in particular can arise secondary to surgical and non-surgical interventions, as surgery and (chemo)

[1]Highly Specialist Speech and Language Therapist, Department of Speech, Voice and Swallowing, The Royal Marsden NHS Foundation Trust, UK; [2]Clinical Lead Speech and Language Therapist, Department of Speech, Voice and Swallowing, The Royal Marsden NHS Foundation Trust, UK; [3]NIHR Clinical Doctoral Research Fellow, The Royal Marsden NHS Foundation Trust, UK; [4]Consultant and Professional Lead for Speech and Language Therapy and Associate Lead for Therapies: Head and Neck, Lung and Neuro-Oncology, Imperial College Healthcare NHS Trust, UK.
*Correspondence to: Sinead Rothrie
Email address: sinead.rothrie@rmh.nhs.uk

Refereed Paper.
Submitted 22 July 2022
Revised 4 October 2022
Accepted 4 October 2022
https://doi.org/10.1038/s41415-022-5145-2

radiation can both cause damage to structures critical for communication and swallowing acutely, chronically and in the context of late-treatment effects. The need for high-quality advice around oral care and collaboration with the restorative dentistry team, who are core members of the MDT, is essential given the longer-term risks of dry mouth (xerostomia), trismus and osteoradionecrosis (ORN). Ongoing communication between HNC treatment centres and restorative dental specialists should be sought when planning dental interventions.

Establishing a baseline

Baseline SLT evaluation includes an assessment of speech, voice, swallowing and mouth opening, as well as noting any cognitive or language deficits due to co-morbidities. A thorough investigation of current function allows the wider MDT to understand any difficulties in advance of treatment and supports patients to maintain, where possible, current levels of swallowing and communication.[10] These initial findings may influence treatment recommendations made by the MDT.[11]

Multidimensional baseline measures of function can predict longer-term functional outcomes.[12] People can be provided with swallowing exercises and compensatory strategies to maintain range of jaw motion and to optimise swallowing function.[13] With trismus being a potential consequence of treatment, providing information and exercises to encourage early, pre-treatment adoption of strengthening muscles of mastication and range of motion are recommended.[14] SLT input is acknowledged to be key in the prevention of long-term trismus and working in partnership with surgical, dental and physiotherapy colleagues is a critical part of making the most appropriate treatment recommendations[6] (Table 1).

The presence of plaque, gingivitis, periodontitis and caries will alter the oral flora and could change the bacterial composition of aspirated saliva, thereby increasing the risk of aspiration pneumonia.[15] Oral health advice before and during treatment, including keeping the oral cavity clean and moist, is important in managing and reducing the risk for aspiration pneumonia,[16] especially in those with dysphagia. Oral health has been demonstrated to have a direct link to survival rates for people with HNC.[17] It should also be noted that this applies regardless of whether people are dentate or edentulous.

Table 1 Recommended SLT measures at baseline and 3- and 12-month follow-up[9]

Assessment tool	Assessment type
• Clinician-assessed measures (optimum minimum dataset)	• Performance Status Scale for head and neck cancer – normality of diet; place of eating; speech intelligibility • 100 mL water swallow test • GRBAS (grade, roughness, breathiness, asthenia, strain) perceptual voice evaluation • Maximum interincisor opening
• Patient-reported outcome measures (optimum minimum dataset)	• M.D. Anderson Dysphagia Inventory
• Patient reported outcome measures (additional measures as appropriate)	• Speech Handicap Index • Voice Handicap Index
• Instrumental evaluation and recommended measures	Flexible endoscopic evaluation of swallowing (FEES): • Dynamic Imaging Grade of Swallowing Toxicity (DIGEST) - FEES • New Zealand Secretion Scale • Patterson Oedema Scale • Penetration Aspiration Scale (PAS) • Yale Residue Scale Videofluoroscopy: • DIGEST MBS (Modified barium swallow) • PAS

Working closely with dietetic colleagues is a key component in the management of existing and anticipated dysphagia, particularly in relation to the need and timing of nutritional support, both orally and by way of tube feeding. In cases where premorbid nutritional status and swallow function compromise the ability to maintain sufficient intake during treatment, the most appropriate level of nutritional support should be agreed in partnership with not only the MDT, but also the person receiving treatment and their caregivers. Our experience is that with dedicated support during radiotherapy in on-treatment clinics, the majority of people can maintain successful outcomes without the need for prophylactic tube feeding[18] and in fact, it supports long-term functional gains back to more solid textures.[19,20] A comprehensive battery of multidimensional measures is recommended by the British Association of Head and Neck Oncologists guidance, which is largely based on the swallowing dashboards developed for the Postoperative Adjuvant Treatment for HPV-Positive Tumours and Dysphagia/Aspiration at risk structures trials.[21,22] Table 1 includes examples of such measures to inform dysphagia management for the HNC patient undergoing intervention. This supports comprehensive assessment before treatment, monitoring during radiotherapy, and follow-up as required in the longer-term post radiation and surgical management, and can be particularly useful in the setting of late effects and recurrent disease.[23]

People undergoing surgery benefit from engaging with SLTs beforehand to learn swallow strategies that may become useful in their rehabilitation. This may reduce aspiration risk, maximise swallow outcome and reduce the length of post-treatment tube feeding.[10] In people who undergo partial laryngectomy procedures, it is clearly recognised that rehabilitation begins in the pre-operative phase.[24] [4]pecialist SLTs educate patients[25] before surgery with information, support and counselling on expected outcomes and provide an opportunity to meet with a person who has undergone a similar surgery.

Radiotherapy (with or without chemotherapy)

Radiotherapy treatment, with or without chemotherapy, is administered as a stand-alone treatment or as an adjuvant following surgical resection.[6] Depending on the nature and location of malignancy, treatment fields may include the oral cavity, mucosal lining, salivary glands and jaw.[26] During treatment, many experience a range of side effects which impact on their oral health. These include mucositis, xerostomia, taste and salivary changes, trismus and odynophagia (pain on swallowing).[27,28] As part of an MDT, the role of the SLT is to counsel and guide people in optimising safe and efficient oral intake and mouth opening ability and to reduce the risk of long-term degradation to oral health and the consequences.[15]

A gold standard level of care provides patients with weekly access to a multidisciplinary on-treatment clinic alongside dietetic and specialist nursing colleagues. People are encouraged to be proactive in reporting onset of treatment effects so that they can be advised in ways to maintain their current levels of function. These will include recommendations for the use of analgesia, steam inhalations and mucositis management with topical mouthwashes and gels, as well as to ensure adequate hydration[29] and nutrition. Food texture modification may be recommended for odynophagia or dysphagia. The use of oral nutritional supplements may also be advised under guidance from dietetic colleagues and with support from the restorative dentistry team. It is well known that the aggregation of toxicities through treatment results in people experiencing acute mucosal toxicities and that these side effects continue after their last dose.[6] During this time, it may be difficult for individuals to maintain dental health with toothbrushing and other dental disease prevention methods. In this case, SLTs will work in partnership with the restorative dental team to encourage the continuation of measures that can be tolerated (for example, the use of interspace brushes, regular mouth rinses with Caphosol as well as salt water and advice around oral intake), with the resumption of normal preventive methods as symptoms subside. People will be encouraged to continue with oral intake throughout treatment, given the importance of maintaining swallow function and utilisation of swallow muscle activity with 'use it or lose it' being the premise of proactive swallowing therapy.[30] The PRO-ACTIVE trial is now underway to evaluate the benefit of prophylactic swallowing exercise protocols.[31]

Radiation treatment effects can result in hypofunction of the salivary glands due to direct damage within the radiation field,[6] causing people to experience xerostomia and this has a negative impact on appetite, caries prevention and the continuation of oral intake. SLTs work with people to find ways to add moisture to foods and textures, as well as encouraging lubrication of the oral cavity and tissues of the hypopharynx through steam inhalation and continued hydration.[26] Taste can also be affected at a result of radiation treatments.[32]

The use of intensity modulated radiotherapy and sparing of parotid glands has been demonstrated to reduce xerostomia.[33,34] Enhanced swallowing function can also have a positive impact on overall oral health,[35] as well as reducing the incidence of xerostomia in individuals with oropharyngeal and hypopharyngeal tumours.[36]

The advancement of immunotherapy drugs, often as a second line treatment, can also bring side effects; however, there is encouraging data from the KEYNOTE-048 trial suggesting less toxicity in the context of recurrent/metastatic HNC.[37] In these cases, people are also offered regular guidance and assistance to ensure optimal levels of nutrition and swallowing are continued, that any toxicities are managed and that treatment schedules are not interrupted. A recent commentary has reflected on progress made with immune checkpoint inhibitors and the potential to include these in the future as part of curative treatment regimes.[38]

SLT interventions following surgical interventions

Surgery may be used for diagnostic purposes as a primary treatment with or without adjuvant chemo-radiotherapy and as a salvage option with curative or palliative intent in the management of HNC cancer.

Communication and swallowing function following surgical intervention can change over time, with oedema and pain being more prevalent in the early post-operative period and atrophy or scarring being more common in the long term. Nerve damage can also occur resulting in motor and sensory deficits[8] which may be temporary or permanent in nature. Oral and maxillofacial surgeries may impact on the muscles of mastication and temperomandibular joint function.

In some cases, it is necessary to use flap reconstruction, prostheses or obturators to compensate for the surgical defect and people often need time to adjust to such altered anatomy, sensation, physical appearance and the functional impacts. The SLT, head and neck surgeons, restorative dentistry consultants and reconstructive scientists must work closely together to optimise speech and swallow,[10] as well as mouth opening.

The extent of the functional deficit depends on a number of factors, including location of primary site, volume resected and the presence and type of reconstruction. Even in the era of advanced surgical techniques, such as transoral robotic surgery (TORS) used in the primary setting for the management of oropharyngeal cancer, functional deficits can ensue,[39] as well as the possibility of first bite syndrome, a rare but painful consequence for some of those treated.[40] Many people will go on to have adjuvant radiotherapy or may have had primary radiotherapy followed by salvage open or TORS surgery, adding to the detrimental effect on swallowing.[41]

The role of the SLT, in conjunction with the wider MDT, is to optimise communication and swallowing in the post-operative period, particularly if a tracheostomy is required. Intervention in the days immediately following surgery focuses on supporting effective communication with non-verbal supplementation as required, tracheostomy management if applicable, advice on secretion management, the promotion of rigorous oral care in conjunction with nursing colleagues, and a focus on early return to oral intake. Rehabilitation continues with surgical healing and introduction of appropriate exercises and compensatory strategies as agreed with surgical colleagues. Following surgery, the emergence of early post-operative feeding protocols[42] and the prevention of respiratory complications from aspiration are paramount with the use of compensatory swallow strategies and adherence to a strict oral care protocol.[43] Intensive SLT input in the weeks after surgery aims to optimise voice and swallow safety with biofeedback techniques using flexible nasendoscopy.

Total laryngectomy surgery involves significant anatomical changes and therefore complex rehabilitation of both speech and swallowing functions.[10] SLTs with specific expertise in the management of the neck stoma and tracheoesophageal puncture are required in all head and neck MDTs.[10] Together with the MDT, the SLT supports the laryngectomy patient in self-care of their permanent neck stoma. SLTs have a unique and essential role to help facilitate a laryngeal voice restoration post laryngectomy. Working closely with people and their families, the most accessible and beneficial method of voicing and communicating can be facilitated. Swallow exercises provided in the pre-operative phase can be continued following surgery, especially in those experiencing issues with swallow efficiency. Diagnostics and problem solving is carried out in close collaboration with surgical colleagues to determine appropriate intervention and management.

Interventions after radiotherapy

While the impact of odynophagia and mucositis resolves usually within the first ten weeks following radiation treatment,[44] other

side effects can be more enduring for people. The impact in particular of taste changes, xerostomia and trismus are well documented from chemoradiotherapy and individuals continue to experience issues well beyond the initial 12-week recovery period.[18] In a dedicated SLT and dietetic follow-up clinic, people are guided to continue with oral intake where possible and provided with recommendations which can help them to progress through food textures and find ways to manage alterations in taste, which may otherwise be preventing them from progressing. With taste changes in particular, some may need support with finding ways to supplement or alter foul tasting items to make them more palatable.

Oral candida infections are common during and post chemoradiotherapy and often require antifungal medications to ensure it does not prevent people from beginning or advancing oral intake.[45] While the use of supplements for dietary and nutritional requirements is sometimes necessary, it is always the goal of all members of the MDT to, if able, return the person to oral intake at a level that is satisfactory to them. It is acknowledged that for some this goal is difficult and consideration of long-term supplement use is needed; however, close consultation with dentistry colleagues and regular advice to people is required to reduce reliance due to their cariogenic nature.[6]

The risk of developing trismus (which is widely accepted based on the work of Dijkstra[46] as a maximum mouth opening of 35 mm or less), while seemingly dose dependent,[47] is a common result of treatment in both chemoradiotherapy and surgery. Working with our restorative dentistry colleagues on both preventative and post-treatment outcomes is critical. Fibrosis secondary to surgical scarring and/or radiotherapy of the masticatory muscles[10] impacts on mouth opening and consequently on people's diet choices, as well as on access for oral care. Pre and immediately post treatment, people are often counselled to engage in both active jaw stretches and, when appropriate, the use of passive rehabilitation devices, such as Therabite (Atos Medical), Dynasplint (Dynasplint Systems Inc) and the Orastretch Press (Craniorehab). A randomised feasibility study examining the use of a Therabite versus wooden tongue depressors in people with trismus found that mouth opening generally increased in both groups and described the economic implications of both interventions.[48] A further randomised feasibility study has just completed recruitment examining the benefit of pentoxifylline and tocopherol alongside dysphagia and trismus rehabilitation for the treatment of post-radiotherapy fibrosis in HNC patients.[49] In addition to the medical management of trismus, further research regarding behavioural management of the condition would be welcomed regarding the optimal timing, dosage and type of exercises for treating acute and long-term trismus given the impact of established fibrosis on this population.

It is known that maintaining and using the full range of mandibular mobility is key to reducing the risk of long-term trismus and its resultant issues, which include difficulties with eating, speaking, yawning, laughing, sexual intimacy, access to the oral cavity for oral care and anaesthesiology, as well as the resulting adverse impact on QoL.[50] Patients with ORN require careful management and it is only through direct and regular contact with both treating surgical and dentistry colleagues that any active treatment is considered. The use of rehabilitation devices may not be recommended due to the risk of jaw fracture and in these cases other methods are used, including the use of wooden tongue depressors to slowly increase jaw opening. When working with these groups, the SLT chooses the most appropriate intervention in close collaboration with surgical and dental colleagues. When working with restorative dentistry colleagues, it is possible for people to be counselled, treated and managed to minimise the likelihood and impact of trismus and late-stage issues such as ORN.

Management in the context of late effects and recurrent disease

When a patient with HNC presents with a change in their communication and/or swallowing after a period of relative functional stability, recurrent disease must be ruled out in the first instance via immediate surgical or oncological review. When disease recurrence has been ruled out, careful evaluation of function, including instrumental evaluation of swallowing undertaken in consultation with the wider MDT, can result in a diagnosis of late-radiation-associated dysphagia (late-RAD).Late-RAD can be very difficult to remediate and is often refractory to traditional dysphagia rehabilitation methods.[51] However, pathways for management continue to emerge, including the use of intensive 'bootcamp type' interventions[52] and more novel therapies, such as expiratory muscle strength training.[53] Referral to an SLT for suspected late-RAD is essential so that swallowing function can be optimised to maximise ongoing QoL. As in the case of primary disease, close working with our MDT colleagues is paramount to identify the complex and potential varying needs of the individual dealing with long-term treatment toxicity.

In the context of recurrent disease, patient-centred, MDT decision-making is required regarding the potential treatment modalities available. People with recurrent disease often present with a baseline swallowing difficulty on a background of previous radiation treatment.[41] Further curative or non-curative treatment for recurrent disease will likely compound such functional deficits and careful consideration is required to balance disease cure with overall QoL. Inherent in this is a thorough baseline assessment of function to guide treatment decisions and ongoing rehabilitation.[41]

Conclusion

SLTs are key members of the MDT caring for people diagnosed with HNC across treatment modalities and in the context of curative, supportive and palliative care. Joint working with the individual affected, the MDT and the caregivers/family unit is integral to successful management.

Ethics declaration

The authors declare no conflicts of interest.

Author contributions

Justin W. G. Roe developed the concept for the paper and along with Sinead Rothrie. Eavan Fitzgerald and Grainne C. Brady contributed material to the manuscript with multiple rounds of comments and revisions, with Sinead Rothrie coordinating the process. Sinead Rothrie wrote the initial draft which was revised by Justin W. G. Roe, Eavan Fitzgerald and Grainne C. Brady. Sinead Rothrie coordinated the final versions for print publication.

References

1. Schache A G, Powell N G, Cuschieri K S *et al.* HPV-Related Oropharynx Cancer in the United Kingdom: An Evolution in the Understanding of Disease Etiology. *Cancer Res* 2016; **76:** 6598–6606.
2. Butterworth C, McCaul L, Barclay C. Restorative dentistry and oral rehabilitation: United Kingdom national multidisciplinary guidelines. *J Laryngol Otol* 2016; DOI: 10.1017/S0022215116000414.
3. Evans M, Knott S, Hurt C *et al.* PATHOS: A phase II/III trial of risk-stratified, reduced intensity adjuvant

treatment in patients undergoing transoral surgery for Human papillomavirus (HPV)-positive oropharyngeal cancer. *J Clin Oncol* 2018; **36:** 15.

4. Goldsmith T A, Roe J W G. Human papilloma virus-related oropharyngeal cancer opportunities and challenges in dysphagia management. *Cur Opin Otolaryngol Head Neck Surg* 2015; **23:** 185–190.
5. Brennan M T, Treister N S, Sollecito T P *et al.* Dental disease before radiotherapy in patients with head and neck cancer: Clinical Registry of Dental Outcomes in Head and Neck Cancer Patients. *J Am Dent Assoc* 2017; **148:** 868–877.
6. Restorative Dentistry UK. Predicting and Managing Oral and Dental Complications of Surgical and Non-Surgical Treatment for Head and Neck Cancer. 2016. Available at https://www.restdent.org.uk/uploads/RD-UK%20H%20and%20N%20guideline.pdf (accessed May 2022).
7. Van der Molen L, van Rossum M A, Burkhead L M, Smeele L E, Rasch C R N, Hilgers F J M. A randomized preventive rehabilitation trial in advanced head and neck cancer patients treated with chemoradiotherapy: feasibility, compliance, and short-term effects. *Dysphagia* 2011; **26:** 155–170.
8. Patterson J M, Brady G C, Roe J W. Research into the prevention and rehabilitation of dysphagia in head and neck cancer: a UK perspective. *Curr Opin Otolaryngol Head Neck Surg* 2016; **24:** 208–214.
9. Schache A, Kerawala A, Ahmed O *et al.* British Association of Head and Neck Oncologists (BAHNO) standards (2020). *J Oral Pathol Med* 2021; **50:** 262–273.
10. Clarke P, Radford K, Coffey M, Stewart M. Speech and swallow rehabilitation in head and neck cancer: United Kingdom National Multidisciplinary Guidelines. *J Laryngol Otol* 2016; DOI: 10.1017/S0022215116000608.
11. National Institute for Clinical Excellence. Improving Outcomes in Head and Neck Cancer. 2004. Available at https://www.nice.org.uk/guidance/csg6/resources/improving-outcomes-in-head-and-neck-cancers-update-pdf-773377597 (accessed June 2022).
12. Kalavrezos N, Cotrufo S, Govender R *et al.* Factors affecting swallow outcome following treatment for advanced oral and oropharyngeal malignancies. *Head Neck* 2014; **36:** 47–54.
13. Barbon C E A, Peterson C B, Moreno A C *et al.* Adhering to Eat and Exercise Status During Radiotherapy for Oropharyngeal Cancer for Prevention and Mitigation of Radiotherapy-Associated Dysphagia. *JAMA Otolaryngol Head Neck Surg* 2022; DOI: 10.1001/jamaoto.2022.2313.
14. Karsten R T, van der Molen L, Hamming-Vrieze O *et al.* Long-term swallowing, trismus, and speech outcomes after combined chemoradiotherapy and preventive rehabilitation for head and neck cancer; 10-year plus update. *Head Neck* 2020; **42:** 1907–1918.
15. Langmore S E, Terpenning M S, Schork A *et al.* Predictors of aspiration pneumonia: how important is dysphagia? *Dysphagia* 1998; **13:** 69–81.
16. Kawashita Y, Morimoto S, Tashiro K *et al.* Risk factors associated with the development of aspiration pneumonia in patients receiving radiotherapy for head and neck cancer: retrospective study. *Head Neck* 2020; **42:** 2571–2580.
17. Farquhar D R, Divaris K, Mazul A L, Weissler M C, Zevallos J P, Olshan A F. Poor oral health affects survival in head and neck cancer. *Oral Oncol* 2017; **73:** 111–117.
18. Roe J W G, Drinnan M J, Carding P N, Harrington K, Nutting CM. Patient-reported outcomes following parotid-sparing intensity-modulated radiotherapy for head and neck cancer. How important is dysphagia? *Oral Oncol* 2014; **50:** 1182–1187.
19. Bhayani M K, Hutcheson K A, Barringer D A *et al.* Gastrostomy tube placement in patients with oropharyngeal carcinoma treated with radiotherapy or chemoradiotherapy: factors affecting placement and dependence. *Head Neck* 2013; **35:** 1634–1640.
20. Paleri V, Patterson J, Rousseau N *et al.* Gastrostomy versus nasogastric tube feeding for chemoradiation patients with head and neck cancer: the TUBE pilot RCT. *Health Technol Assess* 2018; **22:** 1–144.
21. Owadally W, Hurt C, Timmins H *et al.* PATHOS: a phase II/III trial of risk-stratified, reduced intensity adjuvant treatment in patients undergoing transoral surgery for Human papillomavirus (HPV) positive oropharyngeal cancer. *BMC Cancer* 2015; **15:** 602.
22. Petkar I, Rooney K, Roe J W G *et al.* DARS: a phase III randomised multicentre study of dysphagia-optimised intensity-modulated radiotherapy (Do-IMRT) versus standard intensity-modulated radiotherapy (S-IMRT) in head and neck cancer. *BMC Cancer* 2016; **16:** 770.
23. Paleri V, Hardman J, Brady G, George A, Kerawala C. Transoral Robotic Surgery for Residual and Recurrent Oropharyngeal Cancers. *Otolaryngol Clin North Am* 2020; **53:** 1091–1108.
24. Dawson C, Pracy P, Patterson J, Paleri V. Rehabilitation following open partial laryngeal surgery: key issues and recommendations from the UK evidence based meeting on laryngeal cancer. *J Laryngol Otol* 2019; **133:** 177–182.
25. Royal College of Speech and Language Therapists. Prosthetic Surgical Voice Restoration. Available at https://www.rcslt.org/wp-content/uploads/media/Project/RCSLT/surgical-voice-restoration-recommended-knowledge-and-skills.pdf (accessed May 2022).
26. Vissink A, Jansma J, Spijkervet F K L, Burlage F R, Coppes R P. Oral sequelae of head and neck radiotherapy. *Crit Rev Oral Biol Med* 2003; **14:** 199–212.
27. Anderson G, Ebadi M, Vo K, Novak J, Govindarajan A, Amini A. An Updated Review on Head and Neck Cancer Treatment with Radiation Therapy. *Cancers (Basel)* 2021; **13:** 4912.
28. Chiu Y-H, Tseng W-H, Ko J-H, Wang T-G. Radiation-induced swallowing dysfunction in patients with head and neck cancer: A literature review. *J Formos Med Assoc* 2022; **121:** 3–13.
29. Lalla R V, Bowen J, Barasch A *et al.* MASCC/ISOO clinical practice guidelines for the management of mucositis secondary to cancer therapy. *Cancer* 2014; **120:** 1453–1461.
30. Hutcheson K A, Bhayani M K, Beadle B M *et al.* Eat and exercise during radiotherapy or chemoradiotherapy for pharyngeal cancers: use it or lose it. *JAMA Otolaryngol Head Neck Surg* 2013; **139:** 1127–1134.
31. Martino R, Fitch M I, Fuller C D *et al.* The PRO-ACTIVE trial protocol: a randomized study comparing the effectiveness of PROphylACTic swallow InterVEntion for patients receiving radiotherapy for head and neck cancer. *BMC Cancer* 2021; **21:** 1100.
32. Gunn L, Gilbert J, Nenclares P *et al.* Taste dysfunction following radiotherapy to the head and neck: A systematic review. *Radiother Oncol* 2021; **157:** 130–140.
33. Nutting C M, Rooney K, Foran B *et al.* Results of a randomized phase III randomised multicentre study of dysphagia-optimised intensity-modulated radiotherapy (Do-IMRT) versus standard intensity-modulated radiotherapy (S-IMRT) in head and neck cancer. *J Clin Oncol* 2016; **38:** 6508.
34. Wang X, Eisbruch A. IMRT for head and neck cancer: reducing xerostomia and dysphagia. *J Radiat Res* 2016; DOI: 10.1093/jrr/rrw047.
35. Vainshtein J M, Moon D H, Feng F Y, Chepeha D B, Eisbruch A, Stenmark M H. Long-term quality of life after swallowing and salivary-sparing chemo-intensity modulated radiation therapy in survivors of human papillomavirus-related oropharyngeal cancer. *Int J Radiat Oncol Biol Phys* 2015; **91:** 925–933.
36. Kam M K, Leung S-F, Zee B *et al.* Prospective randomized study of intensity-modulated radiotherapy on salivary gland function in early-stage nasopharyngeal carcinoma patients. *J Clin Oncol* 2007; **25:** 4873–4879.
37. Burtness B, Harrington K J, Greil R *et al.* Pembrolizumab alone or with chemotherapy versus cetuximab with chemotherapy for recurrent or metastatic squamous cell carcinoma of the head and neck (KEYNOTE-048): a randomised, open-label, phase 3 study. *Lancet* 2019; **394:** 1915–1928.
38. Nenclares P, Rullan A, Tam K, Dunn L A, St John M, Harrington K J. Introducing Checkpoint Inhibitors Into the Curative Setting of Head and Neck Cancers: Lessons Learned, Future Considerations. *Am Soc Clin Oncol Educ Book* 2022; **42:** 1–16.
39. Nichols A C, Theurer J, Prisman E *et al.* Radiotherapy versus transoral robotic surgery and neck dissection for oropharyngeal squamous cell carcinoma (ORATOR): an open-label, phase 2, randomised trial. *Lancet Oncol* 2019; **20:** 1349–1359.
40. Tretiakow D, Skorek A. First bite syndrome: the complication to keep in mind. *Pol Otorhino Rev* 2019; **8:** 1–3.
41. Brady G C, Hardman J C, Paleri V, Harrington K J, Roe J W G. Changing paradigms in the treatment of residual/recurrent head and neck cancer: implications for dysphagia management. *Curr Opin Otolaryngol Head Neck Surg* 2020; **28:** 165–171.
42. Brady G, Leigh-Doyle L, Riva F, Kerawala C, Roe J. Early Post-operative Feeding: An Investigation of Early Functional Outcomes for Oral Cancer Patients Treated with Surgical Resection and Free Flap Reconstruction. *Dysphagia* 2022; **37:** 1008–1013.
43. Starmer H, Edwards J. Clinical Decision Making with Head and Neck Cancer Patients with Dysphagia. *Semin Speech Lang* 2019; **40:** 213–226.
44. Pauloski B R, Rademaker A W, Logemann J A *et al.* Relation of mucous membrane alterations to oral intake during the first year after treatment for head and neck cancer. *Head Neck* 2011; **33:** 774–779.
45. Lalla R V, Latortue M C, Hong C H *et al.* A systematic review of oral fungal infections in patients receiving cancer therapy. *Support Care Cancer* 2010; **18:** 985–992.
46. Dijkstra P U, Huisman P M, Roodenburg J L N. Criteria for trismus in head and neck oncology. *Int J Oral Maxillofac Surg* 2006; **35:** 337–342.
47. MD Anderson Head and Neck Cancer Symptom Working Group. Dose-volume correlates of the prevalence of patient-reported trismus in long-term survivorship after oropharyngeal IMRT: A cross-sectional dosimetric analysis. *Radiother Oncol* 2020; **149:** 142–149.
48. Lee R, Yeo S T, Rogers S N *et al.* Randomised feasibility study to compare the use of Therabite with wooden spatulas to relieve and prevent trismus in patients with cancer of the head and neck. *Br J Oral Maxillofac Surg* 2018; **56:** 283–291.
49. Fedele S. PentoxIfylline and Tocopherol for the treatment of poST radiotherapy fibrOsis in Head and Neck Cancer Patients: a feasibility study (PIT-STOP). 2022.
50. Scott B, Butterworth C, Lowe D, Rogers S N. Factors associated with restricted mouth opening and its relationship to health-related quality of life in patients attending a Maxillofacial Oncology clinic. *Oral Oncol* 2008; **44:** 430–438.
51. Hutcheson K A, Yuk M M, Holsinger F C, Gunn G B, Lewin J S. Late radiation-associated dysphagia with lower cranial neuropathy in long-term oropharyngeal cancer survivors: video case reports. *Head Neck* 2015; DOI: 10.1002/hed.23840.
52. Ciucci M, Jones C A, Malandraki G A, Hutcheson K A. Dysphagia Practice in 2035: Beyond Fluorography, Thickener, and Electrical Stimulation. *Semin Speech Lang* 2016; **37:** 201–218.
53. Hutcheson K A, Barrow M P, Plowman E K *et al.* Expiratory muscle strength training for radiation-associated aspiration after head and neck cancer: A case series. *Laryngoscope* 2018; **128:** 1044–1051.