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Dysphagia Recovery Following Surgical Resection of Oral and Oropharyngeal Cancer via the Mandibular Lingual Release Approach

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ABSTRACT

Aims: Dysphagia is a common consequence of oral/oropharyngeal squamous cell carcinoma (OC/OPSCC) and its treatments. Preliminary evidence indicates that severe dysphagia may follow OC/OPSCC resection via the mandibular lingual release approach (MLRA), but further research is required. This prospective case series documents dysphagia presentation and outcomes up to 12-months post-treatment for OC/OPSCC involving the MLRA.

Material and Methods: Five consecutive patients with advanced OC/OPSCC (T3, N+) were planned for multi-modal treatment, including surgery via MLRA. Data was collected at five endpoints: baseline (pre-treatment), acute and 6-weeks post-operative, then 6 and 12-months post-treatment. Clinical and fluoroscopic swallowing assessments included the functional oral intake scale (FOIS), penetration-aspiration scale (PAS); dynamic imaging grade of swallowing toxicity (DIGEST), MBS impairment profile (MBSImp) and MD Anderson dysphagia inventory (MDADI).

Results: Pre-surgery mild-moderate impairment in swallowing efficiency was observed (FOIS moderate=3, mild=2). In the acute post-operative stage, all cases showed severely impaired swallowing efficiency and safety (FOIS severe=5; DIGEST life-threatening=4). Minimal improvements were observed at six-weeks (n=4), with persistent static impairments in swallowing efficiency and safety at six-months (FOIS severe=4; DIGEST moderate=4). At 12-months, the surviving cases (n=3), remained gastrostomy dependent (FOIS severe=3; DIGEST severe=1, moderate=2). MBSImp revealed significant deficits in oral and pharyngeal swallowing, while MDADI scores indicated severe early impacts followed by ongoing moderate effectors on swallowing-related quality of life.

Conclusion: Dysphagia is a severe and persistent complication of OC/OPSCC treated with a MLRA, significantly impacting quality of life. Comprehensive dysphagia management is essential from diagnosis through to survivorship for these patients.

Key words: Dysphagia; Mandibular lingual release approach; Head and neck cancer; Speech-language pathology

INTRODUCTION

Cancers of the oral cavity and oropharynx can alter normal swallowing behaviour [1]. Patients with early-stage oral and oropharyngeal squamous cell carcinomas (OC/OPSCC) typically exhibit minimal swallowing impairments, while those with advanced disease may experience significant oropharyngeal difficulties, requiring more extensive swallow rehabilitation [2,3]. The nature and severity of dysphagia are influenced by tumour burden, including size, location and regional involvement [3]. Swallowing dysfunction is further affected by oncological management [4]. In advanced OC/OPSCC, curative treatment typically requires a multi-modal approach, including primary surgical resection followed by adjuvant therapy [5,6]. Deficits contributing to dysphagia can arise at each phase of treatment, with impairments accumulating over time [7-10]. This leads to both acute and chronic impacts on the swallowing mechanism, caused by structural and muscular loss or alteration, sensory changes, surgical scarring, and radiation-induced toxicities such as fibrosis and xerostomia [3,11,12].

Due to the anatomical challenges of advanced OC/OPSCC, surgical access often requires an open approach to achieve en-bloc resection and, when needed, reconstruction [7]. The mandibular lingual release approach (MLRA) [13] is one such technique. Described by Hardingham et al [14], the MLRA involves dividing the suprahyoid musculature to expose the larynx and oral cavity. Studies comparing the oncological outcomes of the MLRA with the lip-split mandibulotomy (LSM), and other open approaches have shown comparable results in terms of access and achieving optimal surgical margins [15-19]. Studies further report that the MLRA offers superior mandible preservation, minimising the risk of osteoradionecrosis which can be a complication of the LSM [18]. Additionally, the MLRA avoids unfavourable cosmetic outcomes such as numbness in the lower lip and scarring which can also be common with the LSM [15-17]. As a result, several studies have concluded that the MRLA provides superior outcomes compared to the LSM and is the preferred surgical approach for managing advanced OP/OPSCC [15-19].

Whilst the MLRA has shown positive oncological and cosmetic outcomes, recent data suggests a potential negative impact on functional swallowing associated with this approach [14,20]. Since the MLRA involves the division of the suprahyoid musculature, it can feasibly damage the suprahyoid complex which plays a key role in airway protection and cricopharyngeal opening during the pharyngeal phase of swallowing [21]. Some authors have hypothesised that this damage could further harm swallowing function in addition to the resection and/or reconstruction itself [13,18,22]. However, the literature on the biomechanical impacts and functional outcomes of the MLRA remains limited [20].

A recent scoping review published in 2020 (20), found that only four studies reported on swallowing outcomes post-MLRA. These studies provided limited low-quality data, with all but one focusing on mid to long term (>six months) outcomes. As a result, the acute stage of swallowing deficits and the expected trajectory of early recovery was unavailable. Although a link between division of the suprahyoid musculature and impaired post-operative swallowing has been hypothesised, the review concluded there was insufficient clinical evidence to support this

premise. Overall, the available evidence was deemed inadequate to inform dysphagia management in this population [20].

In 2022, a retrospective cohort study (n=28) on the acute post-operative swallowing outcomes post-MRLA revealed that dysphagia is a common and often severe complication in the early post-operative period [14]. Within the cohort 75% presented with severe dysphagia, many requiring prolonged gastrostomy feeding, and participants experienced extended hospital stays (mean 27.9 days). By the time of discharge, all participants required diet modifications, and 43% (n=12) were still classified with severe dysphagia, with seven remaining nil by mouth (NBM). The study concluded that this population experiences significant swallowing impairments in the acute phase, necessitating early intervention and long-term support from speech-language pathology services for swallow rehabilitation.

While the 2022 study provided the first detailed data on the significant acute swallowing impacts associated with the MLRA, several limitations were identified including the absence of longitudinal data and limited availability of specific biomechanical findings [14]. As a result, further prospective studies are needed to better understand the physiological changes, severity, and anticipated trajectory of recovery in swallowing function following surgical resection of advanced OC/OSPCC involving the MLRA, and any associated adjuvant therapy.

To understand the nature of the dysphagia in this population, it is necessary to examine which deficits are created by each component of treatment, enabling clinical teams to anticipate the severity and extent of treatment effects on swallowing. This will allow for better prediction of outcomes and timely prophylactic interventions, rehabilitation supports, and patient education on potential swallowing impacts and lifestyle changes. Therefore, the aim of this case series is to prospectively examine the nature, severity and recovery patterns of dysphagia, using both clinical and instrumental assessments, over a 12-month period following surgical resection of OC/OPSCC involving the MLRA. The outcomes from this study will enhance understanding of the clinical presentation of dysphagia following MLRA surgery and guide the development of appropriate care pathways and interventions to optimise swallowing outcomes.

MATERIALS AND METHODS

This study reports the prospective collection of detailed swallowing outcomes for a consecutive series of five participants treated for OC/OPSCC with primary surgical resection via the MLRA. Data relating to swallowing outcomes were collected from diagnosis through to 12-months (post-cancer treatment). A prospective observational case series methodology was chosen due to the relatively low incidence of this population and the longitudinal nature of the study design. Ethical clearance was provided by St Vincent's Hospital Human Research Ethics Committee (HREC/17/SVH/345). This case series is reported following the Equator Strobe guidelines [23].

Selection Criteria

Participants were recruited prospectively between October 2019 and April 2021. Potential participants were identified through the Head and Neck Tumour Board by the principal investigator [NH]. Inclusion criteria included adults (>18 years) diagnosed with primary OC/OPSCC and planned for curative treatment with primary surgical resection via the MLRA. Exclusion criteria included salvage procedures or palliative treatment intent. During the study period, 647 patients with various diagnoses were presented to the tumour board at the study site, of which only five participants met all inclusion criteria and consented to enrol in the study. This sample size is

consistent with prior five-year retrospective data which indicated between 5-6 patients per year underwent primary surgical resection via the MLRA from this same study centre [14].

Study Design

All study outcome measures were collected at five time points: baseline (diagnosis), acute (typically at 7-10 days post-operative once cleared for oral intake by the surgical team), six-weeks post-operative, and then at six and 12-months post-cancer treatment (surgical and non-surgical). Outcome data was collated during the provision of usual care at each timepoint by an experienced head and neck cancer (HNC) Speech-Language Pathologist (SLP) using a systematic procedure and unified reporting process. SLP management of all five cases commenced at time of diagnosis. During cancer treatment, interventions focused on swallow safety via minimising aspiration risk, optimising nutrition/hydration and maintaining oral hygiene. Following cancer treatment participants were referred to their local SLP services for rehabilitation supports, as clinically indicated. Records of what interventions may have occurred at these local services were not available for inclusion.

Demographic data collection

Patient characteristics were collected including demographics, cancer diagnosis and oncological treatments. Surgical data included method of approach, volume of tissue ablation, type of neck dissection/s, reconstruction and any placement of percutaneous gastrostomy tube (PEG).

Swallowing data collection

At each time point, a clinical swallow examination (CSE) was completed comprising of an oral motor assessment and fluid/food bolus trials. Consistencies determined to be safely tolerated on CSE by the SLP, were described using the International Dysphagia Diet Standardisation Initiative (IDDSI) Framework [24], an eight level scale with liquids classified as Level 0 = thin fluids to Level 4 = extremely thick fluids (most restrictive liquid), and foods from Level 3 = puree (most restrictive food texture) to Level 7= a easy to chew / regular diet. CSE findings were reported using the Functional Oral Intake Scale (FOIS) [25], a validated seven-point scale which rates dysphagia severity based on fluid/food texture and enteral feeding dependence (1=NBM/fully tube dependent, to 7=total oral diet). As described in Hardingham et al [14], to aid analysis, FOIS data was collapsed into four severity-categories: normal=7 (total oral diet), mild=6 (total oral diet, specific food limitations), moderate=5 (total oral diet, special preparation/compensations), and severe ≤4 (single consistency or tube dependent +/- some oral intake).

A Video Fluroscopic Swallowing Study (VFSS) was conducted at each study timepoint to provide an objective measure of dysphagia severity and document any biomechanical changes to swallowing. The VFSS was conducted by an experienced SLP, with imaging data collected in lateral and anterior-posterior view, with a standard protocol of bolus trials consisting of thin fluids (IDDSI=0), mildly thick (IDDSI=2) and moderately thick fluids (IDDSI=3) presented in teaspoon, single sips and continuous drinking. Food boluses included puree (IDDSI=4), minced and moist (IDDSI=5), soft and bite sized (IDDSI=6) and normal (IDDSI=7). Each consistency was administered three times (unless clinically contraindicated e.g., high risk of aspiration). Contrast agents were Omnipaque 300 for thin fluids and 20% w/v Barium (EZ-HD powder 98%w/w) mixed with all other consistencies. The Steele Swallowing Lab online tool was used to calculate barium recipes [26].

VFSS findings were analysed in terms of (a) overall severity and (b) biomechanical deficits. Overall severity was determined using the Dynamic Imaging Grade of Swallowing Toxicity [27] (DIGEST); a validated four-point

framework to assess pharyngeal dysphagia in HNC populations. The DIGEST combines a safety grade based on the frequency and amount of aspiration measured with the Penetration-Aspiration Scale (PAS) [28]; an eight-point scale of airway entry and volitional response (1=no airway entry, to 8=silent aspiration), with an efficiency grade (maximum % of pharyngeal residue) to calculate a rating of overall dysphagia severity. The overall worst score for each trial was recorded, ranging from mild (1) to life threatening (4).

Biomechanical deficits were assessed using a modified version of the Modified Barium Swallow Impairment Profile (MBSImP) [29], a 17-item standardised scoring metric that profiles biomechanical impairments in swallowing function. Due to the unanticipated impact of the COVID-19 pandemic on VFSS procedures during this study, the research parameters were adjusted to adopt a pragmatic and clinical approach. Components of the MBSImp were selected allowing for standardised scoring of individual elements, which is acknowledged in the data analysis. The modification to the MBSImp included a reduction in the number of times each consistency was administered and removal of the oesophageal sweep. Despite these unplanned adjustments, the 16-items recorded focused on the primary physiological features relevant to this study, specifically relating to swallow efficiency and safety. These features included tongue control, bolus preparation and oral transport (item 2-4), initiation of pharyngeal swallow (item 6), hyolaryngeal excursion and airway protection (items 8-11) and pharyngeal clearance (items 12, 14-15). Each parameter was scored using either a 3 (0-2), 4 (0-3) or 5 (0-4) level scale, where a 0 or 1 in each represents normal function. Scoring of the DIGEST and MBSImp was performed by two highly experienced and MBSImp trained SLPs specialising in dysphagia, both blinded to participant clinical and demographic details. Any discrepancies in scoring were discussed, and a consensus was sought.

The impact of dysphagia on participants overall functioning was assessed using the MD Anderson Dysphagia Inventory (MDADI) [30], a validated and reliable 20-item self-administered questionnaire that evaluates the impact of dysphagia on quality of life (QoL) in patients with HNC. The MDADI provides a global score of overall functioning, rated on a scale from 1 (extremely low functioning) to 5 (high functioning), and a composite score based on the subscales of emotional, functional and physical symptoms rated out of 100, rated from 20 (extremely low functioning) to 100 (high functioning). A composite score of 80 or above indicated optimal function, 60 or greater indicates adequate function, and a score below 59 indicates poor function [30]. A 20-point change in the composite score is considered clinically meaningful [31].

Data Analysis

Data was entered into Excel, and descriptive statistics were calculated using the Statistical Package for the Social Sciences (SPSS) version 24.0. Differences in individual participant swallowing outcome measures over time were tabulated and displayed graphically. Analysis was conducted for the entire case series (n=5) across each outcome, with comparisons made with published data sets on comparable cohorts.

RESULTS

Of the five recruited participants, full data up to 12-months was available for three. Partial data is presented for two: one participant (P1, Table 1) passed away at week five, and another (P5, Table 1) at 11-months post-treatment. Additionally, two participants were unable to undergo baseline VFSS assessments due to COVID-19 lockdowns, which prevented instrumental assessments from being conducted.

Participant characteristics

Demographic data is presented in Table 1. All five participants were Caucasian, consisting of four males and one female, mean age of 54 years (SD=11.56 years, range=33-63 years). Participants lived in regional (n=3) and rural (n=2) New South Wales, Australia and had travelled for management to the metropolitan cancer centre. All participants presented with a T3 locally advanced OC/OPSCC [32] with lymph node involvement (N2+). Primary tumour site was oral tongue (n=4) and tonsil (n=1). Planned treatment comprised of a multi-modal approach of surgery and adjuvant chemoradiotherapy [CRT] (n=4), or radiotherapy [RT] (n=1). Surgical resection involved neck dissection(s), followed by a MLRA to resect the tumour with closure via free flap reconstruction (radial forearm free flap [RFFF] n=3 and anterior-lateral thigh flap [ALT] n=2). The volume of tissue ablation from the primary tumour was mean 3.12 cm^3 (SD=0.5cm^3, range=2.4-3.5cm^3). At medical team discretion, two participants received prophylactic PEG placement at the time of surgery.

Table 1: Participant demographics.

Case	Gender	Age	Disease classification	Tumour location	HPV	Surgery using MLRA	Neck dissection	Flap type	Panned adjuvant	Prophylactic PEG	Data time
P1	M	63	T3N2M0	Tonsillar	+	Oropharyngectomy	Bilateral	RFFF	CRT *	Y	1-2
P2	M	54	T3N2bM0	Oral tongue	-	Hemiglossectomy	Bilateral	ALT	CRT	N	1-5
P3	M	53	T3N2bM0	Oral tongue	-	Hemiglossectomy	Bilateral	RFFF	RT	N	1-5
P4	M	59	T3N2cM0	Oral tongue	+	Subtotal glossectomy	Bilateral	ALT	CRT	N	1-5
P5	F	33	T3N2cM0	Oral tongue	-	Subtotal glossectomy	Bilateral	RFFF	CRT	Y	1-4

P = participant; M = male; F = female; T = tumour, N = node, M = metastasis, HPV = human papilloma virus; RFFF = radial Forearm Free Flap; ALT = anterolateral lateral thigh flap; CRT = chemoradiotherapy; RT= radiotherapy; PEG = percutaneous gastrostomy; * denotes CRT planned but patient deceased prior to commencement.

Functional swallowing outcomes

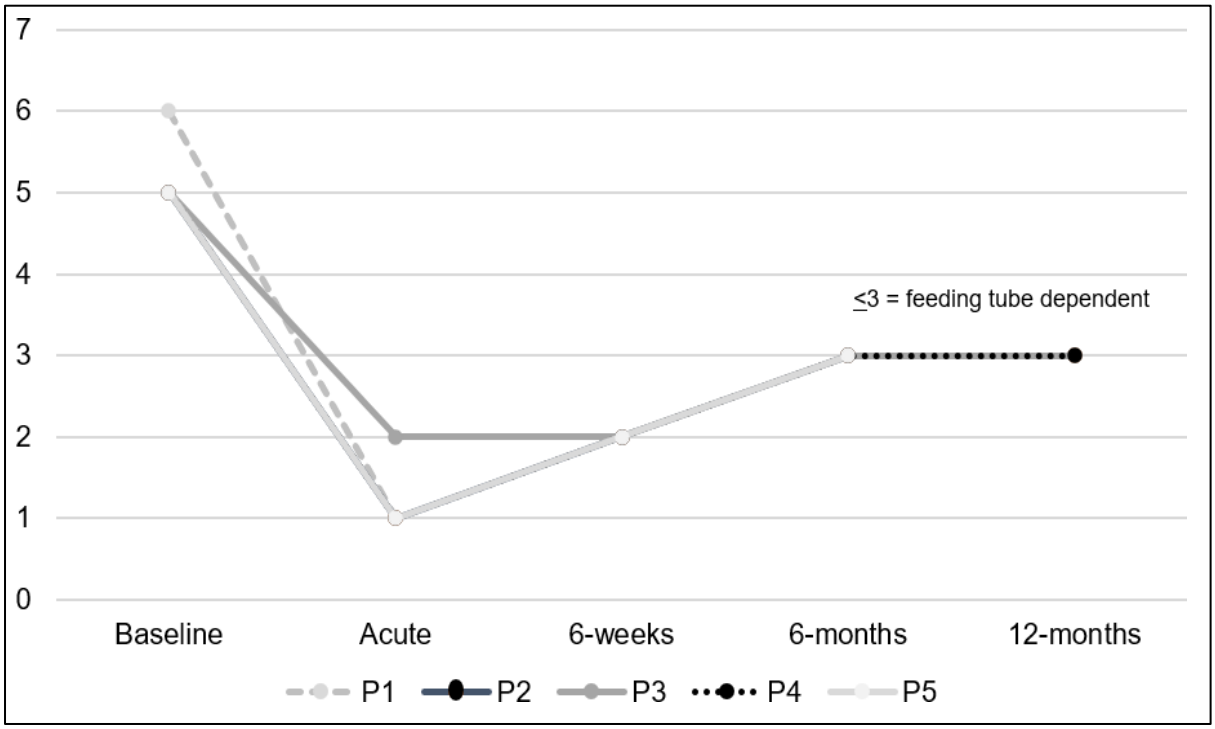
Baseline FOIS scores indicated that all participants could meet their nutritional and hydration needs through oral intake alone (Figure 1). All participants were safely tolerating thin fluids, with some requiring solid food modification and self-taught strategies to aid efficiency (i.e., fluid wash with soft and bite sized solids). However, following surgery there was a profound functional decline in swallowing, necessitating consistent SLP input. Enteral feeding support was implemented for all participants with two cases receiving prophylactic PEGs at the time of surgery, and the remaining three receiving reactive PEGs before they could be discharged from hospital. Throughout the early post-treatment stage, compensatory management strategies, including texture modification, were crucial to maximise swallow safety. Table 2 presents the IDDSI fluid and food scores over time.

Over the following six to 12-months post-surgery, participants were observed to consume more consistent oral intake of modified consistencies, however none achieved a total oral diet, and at 12-months the remaining three participants continued to require supplementation of nutrition and hydration via enteral feeding (Figure 1).

Table 2: IDDSI fluid and food scores over time.

`	Baseline		Acute		6-weeks		6-months		12-months	
	Fluid	Food	Fluid	Food	Fluid	Food	Fluid	Food	Fluid	Food
P1	0	6	NBM	NBM	x	x	x	x	x	x
P2	0	5	NBM	NBM	2#	-	2	4	2	4
P3	0	5	2#	-	2#	4#	2	4	2	4
P4	0	4	NBM	NBM	2#	-	2	4	2	4
P5	0	4	NBM	NBM	2#	-	2	-	x	x

P=Participant; NBM = nil by mouth; – denotes no food consumed; x denotes participant deceased; # denotes small oral trials of this consistency only. Fluids are graded 0 (thin) to 4 (extremely thick); foods are graded 3 (liquidised) to 7 (easy to chew/regular).



P = participant. FOIS range 1 (nothing by mouth) to 7 (total oral diet with no restrictions).

Figure 1: FOIS scores over time.

VFSS outcomes

Overall, severity of dysphagia rated on DIGEST was consistent with the FOIS data, supporting that all participants presented with moderate to severe dysphagia severity throughout the 12-months following treatment. There was no indication of spontaneous recovery, and both swallow safety, and efficiency, remained impaired (Table 3).

Table 3: DIGEST scores over time.

	Baseline			Acute			6-weeks			6-months			12-months		
	S	E	OS	S	E	OS	S	E	OS	S	E	OS	S	E	OS
P1	0	2	1	4	4	4	x	x	x	x	x	x	x	x	x
P2	0	1	1	3	4	4	3	3	3	3	2	3	3	2	3
P3	-	-	-	3	4	4	2	3	2	3	2	3	1	2	2
P4	-	-	-	3	4	4	3	2	3	1	2	2	2	2	2
P5	0	2	1	3	4	4	2	2	2	0	2	2	x	x	x

P = participant; S = safety; E = efficiency; OS = overall severity rating; x denotes participant deceased; - denotes missing data as participant unable to attend for VFSS; _ denotes ceiling score. Safety score (maximum Penetration Aspiration Scale [PAS] score) ranges 0 (no PAS) to 4 (chronic and gross aspiration, silent or not cleared). Efficiency score (maximum % pharyngeal residue) range 0 (minimal/no residue) to 4 (>90% residue). Overall severity score range 0 (no impairment) to 4 (life threatening).

From the subcomponents of the DIGEST scale, the safety of swallowing (determined by frequency and volume of airway invasion defined by the Penetration Aspiration Scale [PAS]), revealed a marked deficit that was maintained throughout the 12-month period. Silent airway entry was a concerning feature at all timepoints, with chronic aspiration being the primary issue rather than gross aspiration. Swallowing efficiency was similarly impaired across the 12-month period post-treatment, particularly with solids, although fluids were also problematic for some participants (Table 3). As expected, residue increased with more viscous or solid textures. Biomechanical impairments gathered from MBSImp data revealed all participants exhibited deficits in both the oral and pharyngeal stages of swallowing with slow recovery over time (Table 4). The main oral phase deficits were in bolus preparation and bolus transport, which both remained impaired across the 12-months, resulting in consistent oral residue. These impairments limited the consistencies of oral diet which could be tolerated and necessitated texture modification to compensate for dysphagia symptoms. Some participants also used behavioural strategies to facilitate bolus movement such as fluid wash and/or head tilt. No participants experienced issues with premature spillage over the tongue base.

Table 4: MBSImp Items over time.

MBSImp Item & Scoring Range	Acute					6 weeks					6 months					12 months				
	P1	P2	P3	P4	P5	P1	P2	P3	P4	P5	P1	P2	P3	P4	P5	P1	P2	P3	P4	P5
Lip closure (0-4)	-	-	-	4	-	x	-	-	-	-	x	-	-	-	-	x	-	-	-	x
Tongue control (premature spillage) (0-3)	1	2	2	2	1	x	2	1	1	1	x	2	1	0	0	x	0	0	1	x
Bolus preparation / mastication (0-3)	3	3	3	3	3	x	2	2	3	3	x	#	2	2	2	x	#	1	2	x
Bolus transport / lingual motion (0-4)	1	3	4	1	3	x	3	2	3	3	x	3	3	3	-	x	3	3	0	x
Oral residue (0-4)	3	3	3	3	2	x	3	3	3	3	x	3	3	3	3	x	2	2	2	x
Initiation of pharyngeal	3	3	3	3	1	x	3	3	3	1	x	3	3	3	3	x	3	3	0	x

swallow (0-4)																				
Laryngeal elevation (0-3)	2	2	3	2	3	x	2	2	2	0	x	2	1	1	0	x	1	1	1	x
Soft palate elevation (0-4)	1	0	0	0	0	x	0	0	0	0	x	0	0	0	0	x	0	0	0	x
Anterior hyoid excursion (0-2)	2	2	1	1	2	x	2	1	2	1	x	1	1	1	1	x	1	1	1	x
Epiglottic movement (0-2)	2	1	2	2	1	x	0	1	1	0	x	1	0	0	1	x	1	0	0	x
Laryngeal vestibular closure – height of the swallow (0-2)	1	1	1	2	1	x	1	1	1	1	x	1	1	0	1	x	1	1	1	x
Pharyngeal stripping wave (0-2)	2	1	2	1	1	x	1	1	1	1	x	1	1	0	1	x	1	1	1	x
Pharyngeal contraction (0-2)	-	-	-	-	-	x	-	-	-	-	x	-	-	-	-	x	-	-	-	x
Pharyngoesophageal segment opening (0-3)	3	2	2	2	2	x	1	1	2	1	x	1	1	1	1	x	1	1	2	x
Tongue base retraction (0-4)	3	2	2	2	2	x	2	2	2	2	x	3	2	2	2	x	2	2	2	x
Pharyngeal residue (0-4)	4	3	4	4	4	x	3	3	4	3	x	3	3	2	2	x	2	2	2	x

P = participant; x denotes participant deceased; - denotes unable to assess due to image quality; underlined values denotes ceiling (worst) impairment score; # denotes solid bolus not assessed. Scores range 0 (no impairment) to >3 (greater impairment).

Multiple severe impairments in the pharyngeal phase of swallowing were observed. This included delayed initiation of the pharyngeal swallow, contributing to pre-swallow aspiration risk, which did not improve across the 12-months. Laryngeal elevation showed partial movement and remained consistently impaired at 12-months presenting a risk of intra-swallow aspiration. Anterior hyoid excursion was abnormal and remained impaired at one year, compromising the width and duration of upper oesophageal sphincter (UES) opening, and presenting a risk for post-swallow aspiration. Epiglottic deflection was impaired but showed some improvement at 12-months. Laryngeal vestibular closure at the height of the swallow was incomplete at all timepoints representing a risk of aspiration pre- or during the swallow. Clearance of the bolus was problematic at all timepoints across the series. Pharyngeal stripping wave was consistently diminished representing a risk for residue. There was also only partial width and duration of pharyngoesophageal segment opening representing a risk of bolus obstruction, hypopharyngeal residue and post- swallow airway entry. Tongue base retraction was likewise impaired with consistently incomplete base of tongue to posterior pharyngeal wall approximation across the 12-months. This represented a risk for diffuse pharyngeal residue in the setting of the above deficits.

Quality of life outcomes

Table 5 details MDADI scores over time. Across the cases, Global MDADI scores (scored 1-5) indicated a moderate impact at baseline, followed by a marked deterioration post-surgery which persisted to the first six-weeks. Only slight improvement was observed at six-months and no further improvement, by 12-months. Composite scores at baseline (scored 20-100) were below 50, indicating an existing impact to QoL. Post-surgery, the composite scores reduced further with four of the five cases showing clinically meaningful decline in functioning. There was limited change by either six-weeks or six-months. By 12-months, the remaining participants (n=3) were rated as having adequate (n=1) or poor (n=2) ongoing functioning. Overall, the MDADI data confirmed an overall deterioration in swallowing related QoL post-treatment which showed limited change over time.

Table 5: MDADI global and composite scores over time.

	Category	Baseline	Acute	6-weeks	6-months	12-months
P1	Global	2	1	x	x	x
	Composite	52	25*	x	x	x
P2	Global	2	1	1	2	2
	Composite	48	25*	30	22	32
P3	Global	3	2	2	3	3
	Composite	44	32	28	36	62*
P4	Global	3	1	1	2	2
	Composite	45	23*	25	36	44
P5	Global	3	1	1	1	x
	Composite	27	22	25	20	x

P = participant; X denotes participant deceased; * denotes a difference of >20 points signifying a meaningful change. Global scores range from 5 (high functioning) to 1 (extremely low functioning); Composite scores 100 (high functioning) to 20 (extremely low functioning).

DISCUSSION

Dysphagia is a well-recognised complication of multi-modal treatment for OC/OPSCC [32-34]. Impaired swallow efficiency is associated with malnutrition, while compromised swallow safety is linked to an increased risk of aspiration pneumonia [35], the leading cause of noncancer-related deaths in long-term HNC survivors [36]. Typically, swallowing rehabilitation is provided by SLPs to patients with symptoms, but the effectiveness of these interventions depends on understanding the underlying causes of the dysphagia. In cases where this knowledge is lacking, as seen with the MLRA [14], patient outcomes may be negatively affected by suboptimal care pathways and rehabilitation programs.

This study presents a prospective analysis of dysphagia profile, severity and recovery of five participants post-treatment for OP/OPSCC managed with the MLRA. All participants were planned for multi-modal treatment (n=4 completed) which is known to impact swallow function, however the severity and duration of dysphagia observed here is more pronounced than what is typically reported in the literature. It is hypothesised that the MLRA

contributed significantly to these outcomes, as the division of the suprahyoid musculature during the procedure may impair crucial functions, such as hyolaryngeal excursion, airway protection, and UES opening. These biomechanical deficits may help explain the severe and chronic dysphagia observed in this cohort.

Swallowing efficiency deficits are well-documented in OC/OPSCC patients due to the location of the tumour and impact on surrounding structures [37-39]. Oral stage deficits, particularly in bolus preparation and transport, are common post-treatment, and these were observed in this series, with little improvement over time [2,3]. The nature of deficits in oral swallow efficiency observed in this study relating to bolus preparation and transport were expected and consistent with existing literature [3]. Pharyngeal deficits, such as reduced tongue base propulsion, are also commonly reported, especially when free flap reconstruction is involved [39,40]. Our study similarly found bolus control and propulsion to be an issue, exhibiting little change over time.

Compromised swallow safety, however, is less commonly described in the literature for OC/OPSCC unless a substantial volume of tissue has been resected (i.e., total glossectomy) [40]. In this case series multiple biomechanical impairments were observed, including abnormal laryngeal vestibular closure, impaired laryngeal elevation, incomplete anterior hyoid movement, and partial epiglottic deflection, all of which remained impaired at 12 months post-surgery. These deficits contribute to significant aspiration risk, which was observed to be a persistent feature across all cases. The presence of silent aspiration in particular highlights the severe risks associated with these swallowing impairments. This data is the first to confirm that such biomechanical impairments exist for this population and may well be attributable to the surgical approach. The next steps in validating these valuable insights gained is to confirm their applicability to a larger cohort.

Despite dysphagia being expected in OC/OPSCC populations, recovery to a functional swallow is typically anticipated within the first-year post-treatment [35,36]. A systematic review from 2013 found that the majority of patients recovering from tongue cancer resection with free flap reconstruction achieved swallowing function close to pre-operative levels after 12 months [41]. In contrast, the five participants in this series exhibited minimal recovery, with dysphagia remaining severe at 12 months. Therefore, the current data suggests that the severity and chronicity of dysphagia in this cohort are more pronounced than what is commonly seen.

The impact of dysphagia on QoL is well-documented in the literature [42,43]. The MDADI scores in this case series were lower than expected, with participants reporting significant negative impacts on their QoL from baseline, worsening post-surgery, and showing only minimal improvement over time. Long-term reliance on enteral feeding was a notable feature, with detrimental effects on physical, psychological, and social outcomes. This underscores the importance of recognising the multifaceted consequences of severe dysphagia and the need for comprehensive care.

Key findings from this study highlight the need for proactive and ongoing speech-language pathology intervention, starting early and continuing for at least one-year post-treatment. Comprehensive pre-treatment education is essential to prepare patients for the severity of post-treatment dysphagia and the limited recovery that can be expected. PEG placement should also be considered, particularly given the chronicity of swallowing deficits in this cohort. The inclusion of instrumental swallow assessments, such as VFSS, at regular intervals is vital to assess aspiration risk and inform rehabilitation strategies.

Given the extent of biomechanical deficits identified, the data suggest that strength-based rehabilitation approaches should be employed to target both the oral and pharyngeal stages of swallowing. This approach has shown promise in other HNC populations and may be particularly effective in addressing the deficits observed in this case series. However, given the chronicity and severity of the dysphagia, long-term rehabilitation involving multiple targets will likely be necessary to optimise swallow function and improve patient outcomes over time.

Limitations

The current report represents a small clinical case series, and across the 12-months two participants had deceased. As such, the current data cannot be considered definitive, and rather represents patterns of behaviour that could be expected to occur in this population. Although there were only five cases, it is noted that the early post-discharge data from these five cases was highly comparable to that reported previously [14]. A further limitation was that the study was conducted during the COVID-19 pandemic and the completion of all planned VFSS assessments was impacted by COVID-19 lockdowns and periods of temporary cessation of VFSS procedures. Finally, as participants were managed within other centres after acute care discharge, there was no data available on the nature of any active rehabilitation provided. As a result, it is impossible to comment on the impacts of rehabilitation on long-term outcomes within this cohort.

CONCLUSION

This case series underscores the importance of early and sustained multidisciplinary care in the management of dysphagia following MLRA surgery for OC/OPSCC. The findings suggest that more severe, prolonged, and chronic dysphagia may be expected in this patient population than previously reported, and that comprehensive, individualised rehabilitation is essential for improving swallowing function and quality of life. Specifically, SLP intervention should include comprehensive pre-treatment education on the potential nature and extent of dysphagia, advocacy for prophylactic gastrostomy tube placement, and the use of instrumental swallow assessment at regular timepoints post-surgery to confirm the extent of aspiration risk and identify biomechanical deficits to inform dysphagia rehabilitation. The extent of biomechanical deficits identified in the current case series is new knowledge revealed by this case series. Further research is needed to confirm these findings and explore targeted rehabilitation strategies to mitigate the impact of these deficits.

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