An Initial Framework for use of Ultrasound by Speech and Language Therapists in the UK: Scope of Practice, Education and Governance

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An Initial Framework for use of Ultrasound by Speech and Language Therapists in the UK: Scope of Practice, Education and Governance

Abstract

There is growing evidence to support use of ultrasound (US) as a tool for the assessment and treatment of speech, voice and swallowing disorders across the Speech and Language Therapy (SLT) profession. Research has shown that development of training competencies, engagement with employers and the professional body are vital to progressing US into practice.

We present a framework to support translation of US into SLT. The framework comprises three elements: (i) scope of practice, (ii) education and competency and (iii) governance. These elements align to provide a foundation for sustainable and high-quality US application across the profession.

Scope of practice includes the tissues to be imaged, the clinical and sonographic differentials and subsequent clinical decision making. Defining this provides transformational clarity to SLTs, other imaging professionals and those designing care pathways. Education and competency are explicitly aligned with the scope of practice; and include requisite training content and mechanisms for supervision/support from an appropriately trained individual in this area. Governance elements include legal, professional and insurance considerations. Quality assurance recommendations include data protection, storage of images, testing of ultrasound devices as well as continuous professional development, and access to a second opinion.

The framework provides an adaptable model for supporting expansion of US across a range of SLT specialities. By taking an integrated approach, this multi-faceted solution provides the foundation for those with speech, voice, and swallowing disorders to benefit from advances in imaging-informed healthcare.
Introduction

The use of ultrasound (US) imaging outside of traditional radiology settings is an area of rapid growth. In the Speech and Language Therapy (SLT) profession there is growing evidence to support its application as a tool for the assessment and treatment of speech and swallowing disorders 1–4.

There are fundamental constraints to integration of US into SLT clinical practice such as cost, availability of equipment and lack of focused training 2,5. There is, however, a drive amongst the profession to start adopting US into practice whilst research to establish reliability of data acquisition and interpretation continues. To do this, mechanisms to address concerns around competency and scope of practice are required.

US imaging is a modality that requires experience to use and interpret. The skill and experience required by Speech and Language Therapists (SLTs) will vary according to the purpose for which US is being used. The paper uses a framework to describe the scope of practice, education and governance requirements associated with application of US in the profession. This has been used in other allied health professional (AHP) groups in the emerging areas of lung 6 and pelvic health 7 to address concerns including quality assurance and professional indemnity. This paper therefore shares some generic content with these publications 6,7, which in turn overlap with relevant professional guidance 8,9.

Speech & Language Therapists

In the United Kingdom, SLTs are autonomous clinicians who hold a formal qualification as a speech and language therapist. Typically, this will be a minimum of a BSc (Hons) Clinical Communication Studies/Speech Pathology and Therapy or post-graduate equivalent (e.g., MMedSci Clinical Communication Studies). Combined with their professional registration with the Health and Care Professions Council (HCPC) they can use the protected title of ‘Speech and Language Therapist’ and are eligible to join the professional body The Royal College of Speech and Language Therapists (RCSLT).

SLTs work across a range of patient and client 1 groups across the lifespan. Their key responsibilities include the assessment, management and monitoring of swallowing and communication, including speech disorders. Assessment includes clinical history-taking alongside a combination of assessment procedures. For swallowing, assessments may include a clinical bedside assessment or instrumental assessment via videofluoroscopic swallowing study (VFSS) or flexible endoscopic evaluation of swallowing (FEES), whereas assessment of both speech and voice quality may include perceptual, acoustic, and instrumental analysis, for example electropalatography 10 and vocal acoustic analysis 11. Applying a combination of clinical reasoning and patient-centred care, SLTs independently formulate and apply treatment approaches such as exercises to target the underlying speech, voice, or swallowing disorder and/or strategies to reduce the functional impact of the impairment.

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1 The term patient will henceforth refer to both patients and clients.
SLTs work closely with other professionals such as radiologists, audiologists, ear, nose and throat specialists, intensivists, neurologists, respiratory physicians, and physiotherapists to enable interdisciplinary assessment and management of speech, voice, and swallowing disorders. In this regard, there may be a degree of overlap with, and aspects of this framework may apply to, other professional groups.

**Applications of US across SLT**

There are several possible applications of US across the SLT profession. Some applications, such as use of US for biofeedback in speech disorder intervention, are already established part of clinical practice in some areas of the UK. Other applications, such as its use as a tool to assess dysphagia, remain solely in the research setting. Current and potential application of US across the profession, plus research evidence, have previously been described and are summarised according to SLT role across the full range of patient clinical presentations in Table 1.

In order to define SLT scope of practice, education, and governance, the applications described in Table 1 have been categorised into three domains. These are:

1) Static imaging of speech, voice, and swallowing structures
2) Qualitative evaluation of speech, voice, and swallowing movement
3) Quantitative analysis of speech, voice, and swallowing movement

The three domains are described in Table 2.

*Table 1: Aims and role of speech and language therapy for speech, voice, and swallowing presentations; including ultrasound role*

<table>
<thead>
<tr>
<th>Clinical presentation</th>
<th>Aims and role of speech and language therapy, grouped according to (i) assessment and diagnosis, (ii) treatment and outcome measurement (iii) integration with wider MDT (current/potential role for ultrasound imaging in <strong>bold</strong>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oro-pharyngeal dysphagia</td>
<td>(i) <strong>Screening</strong> for presence versus absence of oro-pharyngeal dysphagia.</td>
</tr>
<tr>
<td></td>
<td>Differentiate actual or likely aetiology of oro-pharyngeal dysphagia (more specifically, skill versus strength-based impairment via assessment of swallowing muscle size, structure, and kinematics) as a foundation for subsequent management.</td>
</tr>
<tr>
<td></td>
<td>Assessment of swallowing symptoms (aspiration and residue).</td>
</tr>
<tr>
<td></td>
<td>(ii) Informed by the above, treatment approaches include education, <strong>skill-training (using biofeedback)</strong> and strength training.</td>
</tr>
</tbody>
</table>
### Ultrasound Framework for Speech & Language Therapists

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Step (i)</th>
<th>Step (ii)</th>
<th>Step (iii)</th>
</tr>
</thead>
</table>
| **Measuring outcomes** of skill or strength-based treatment which includes measurement of swallowing symptoms (aspiration and residue), changes in **swallowing kinematics** and changes in **muscle size and structure**. | (iii) **Communication of findings** and management approach to patient and other care pathway members. Where appropriate, liaison with other healthcare team members for further investigation and intervention. | **Dysphonia (and other diagnosis* caused by an impairment of vocal fold movement)** | **Differentiate actual or likely aetiology** of dysphonia (more specifically, structural, or **kinematic impairment** of vocal fold mobility) as a foundation for subsequent management.  
Informed by the above, treatment approaches include **education**, environmental and behavioural adaptation (such as postural adjustment), surgical intervention (such as vocal fold augmentation) and **exercise-based therapy (including biofeedback)**.  
**Measuring outcomes** of treatment interventions which includes measurement of vocal fold movement.  
(iii) **Communication of findings** and management approach to patient and other care pathway members. Where appropriate, liaison with other healthcare team members for further investigation and intervention. |
| **Developmental speech sound disorders**                                  | (i) Differentiate actual or likely aetiology of speech sound disorder (more specifically, phonological, or articulatory/motor **impairment of tongue shape, placement, and kinematics**) as a foundation for subsequent management.  
(ii) Informed by the above, treatment approaches include **biofeedback**.  
**Measuring outcomes** of treatment interventions which includes measurement of **tongue shape and kinematics**.  
(iii) **Communication of findings** and management approach to patient and other care pathway members. Where appropriate, liaison with other healthcare team members for further investigation and intervention. | **Cleft lip and palate** | (i) Differentiate actual or likely aetiology of compensatory articulations (more specifically, **impairment of tongue shape, placement, and kinematics**) as a foundation for subsequent management. |
Informed by the above, treatment approaches include biofeedback. Measuring outcomes of treatment interventions which includes measurement of tongue shape, placement, and kinematics.

Communication of findings and management approach to patient and other care pathway members. Where appropriate, liaison with other healthcare team members for further investigation and intervention.

Differentiate actual or likely aetiology of speech disorder (more specifically, dysarthria or apraxia or impairment of tongue shape, placement, and kinematics) as a foundation for subsequent management.

Informed by the above, treatment approaches include biofeedback. Measuring outcomes of treatment interventions which includes measurement of tongue shape and kinematics.

Communication of findings and management approach to patient and other care pathway members. Where appropriate, liaison with other healthcare team members for further investigation and intervention.

**Injection of botulinum toxin (botox) into the salivary glands**

(i) Anatomical location of the (parotid, submandibular & sublingual) salivary glands

(ii) Confirmation of injection location for botulinum toxin into the salivary glands

Table 2: Applications of ultrasound across speech and language therapy divided into three domains: i) static imaging of speech, voice, and swallowing structures, ii) qualitative evaluation of speech, voice, and swallowing movement iii) quantitative analysis of speech, voice, and swallowing movement

<table>
<thead>
<tr>
<th>Domain</th>
<th>Purpose</th>
<th>Example</th>
<th>Useful references</th>
<th>Patient group</th>
<th>Alternative Approach(es)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static imaging</td>
<td>Professional training</td>
<td>Pre-registration SLTs to support</td>
<td>(1,2)</td>
<td>Not applicable</td>
<td>X-ray, Computed</td>
</tr>
<tr>
<td>Knowledge acquisition of speech, voice, and swallowing anatomy.</td>
<td>Tomography (CT), Magnetic Resonance Imaging (MRI) Medical illustrations Cadaver</td>
<td>Post-registration SLTs to support knowledge acquisition of head and neck imaging modalities and/or as a precursor for use as a speech and swallowing assessment tool.</td>
<td>As above</td>
<td>Not applicable</td>
<td>X-ray, Computerized Tomography (CT), Magnetic Resonance Imaging (MRI) Medical illustrations Cadaver</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Patient education</td>
<td>To educate patients in the anatomy associated with normal speech, voice, and swallowing</td>
<td>Medical illustrations 3D models Video clips/education Apps</td>
<td>Medical illustrations 3D models Video clips/education Apps</td>
<td>Any patients able to participate in US assessment &amp; be supported to understand the findings</td>
<td>As above</td>
</tr>
<tr>
<td>To educate patients in the altered anatomy affecting speech, voice and swallowing associated with their condition.</td>
<td>As above</td>
<td>May include (but not limited to) patients with head and neck cancer pre-and post-surgical resection or patients with cleft lip and palate.</td>
<td>Medical illustrations 3D models Video clips/education Apps</td>
<td>As above</td>
<td></td>
</tr>
<tr>
<td>Clinical assessment ** (+/- outcome measurement)</td>
<td>Detection of bolus material in the pharynx or larynx to identify the symptoms (aspiration or aspiration or dysphagia).</td>
<td>(3–5)</td>
<td>Flexible endoscopic evaluation of swallowing (FEES)</td>
<td>Patients with dysphagia thought to cause residue or aspiration.</td>
<td>(3–5)</td>
</tr>
</tbody>
</table>

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2 Bolus refers to food and drink material that has been swallowed.
<table>
<thead>
<tr>
<th>Assessment of the upper and large airway for a range of possible functions e.g., identifying subglottic stenosis, tracheomalacia or predicting endotracheal or tracheostomy size.</th>
<th>Patients requiring elective or urgent airway assessment.</th>
<th>Endoscopic evaluation of the larynx (EEL) Bronchoscopy MRI CT Microlaryngoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of the size and echogenicity of the muscles involved in swallowing to determine atrophy and fat infiltration.</td>
<td>Patients with a disease known (or suspected) to cause muscle wasting/atrophy (e.g., motor neuron disease). Patients who have undergone treatments known to cause structural changes in muscle fibres (e.g., radiotherapy). Patients who have not used their speech/swallowing muscles for a period time and have</td>
<td>Magnetic Resonance Imaging (MR)</td>
</tr>
<tr>
<td>Clinical treatment</td>
<td>Detection of salivary glands for the purpose of botulin toxin injection.</td>
<td>(11) Patients with sialorrhea</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Qualitative evaluation of movement involved in speech, voice and swallowing</strong></td>
<td>Treatment of speech sound disorders including cleft lip and palate</td>
<td>(12–15) Patients with hearing impairment, Down syndrome, cleft lip and palate, Childhood Apraxia of Speech, Childhood dysarthria, and persistent or residual speech sound disorder of unknown origin</td>
</tr>
<tr>
<td>Treatment of swallowing disorders</td>
<td></td>
<td>(16) Patients undergoing dysphagia therapy which target movements visible on US.</td>
</tr>
<tr>
<td>Clinical Assessment (+/- outcome measurement)</td>
<td>Assessment of vocal fold adduction and abduction to assess, for example, presence/absence of vocal fold palsy, paradoxical vocal</td>
<td>(17–19) Patients with suspected impairment of vocal fold mobility</td>
</tr>
<tr>
<td>Ultrasound Framework for Speech &amp; Language Therapists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Fold movements/inducible laryngeal obstruction, airway protection for swallowing.</strong></td>
<td><strong>Assessment of tongue kinematics</strong></td>
<td><strong>Patients with diagnosis known to cause disorders of tongue movement related to speech or swallowing e.g., those with hearing impairment, craniofacial abnormalities, tumour, apraxia.</strong></td>
</tr>
<tr>
<td><strong>Electropalatography</strong> Electromagnetic Articulography</td>
<td><strong>Clinical Assessment (+/- outcome measurement)</strong></td>
<td><strong>Various including timed water swallow test and patient reported tools</strong></td>
</tr>
<tr>
<td><strong>Quantitative analysis of movement involved in speech, voice and swallowing</strong></td>
<td><strong>A screening tool to determine the presence or absence of swallowing disorder.</strong></td>
<td><strong>Patients with a diagnosis known to cause disorders of speech, voice or swallowing.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>An assessment tool to determine the severity of specific parameters of movement associated with speech, voice, or swallowing disorder.</strong></td>
<td><strong>VFSS FEES FNE Electropalatography Acoustic or aerodynamic analysis</strong></td>
</tr>
</tbody>
</table>

* Under IR(MR)R 2019, only non-medical referrers that are suitably state registered are permitted to request imaging tests that involve radiation.*
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** whilst image analysis for clinical assessment is likely to be static for bolus residue and the upper airway, image acquisition may be dynamic (e.g., bolus residue may be assessed over a specified time). For this reason, clinical assessment within this domain may be considered under the categories of either qualitative or quantitative analysis of movement, depending on the exact purpose of the examination.

A framework approach to supporting use of US in SLT

The movement towards use of US as an SLT assessment or diagnostic tool, necessitates the need for quality assurance and clarity of the SLT role. Recognising this, we propose the use of a framework to support application of US in SLT (Figure 1), comprising the elements of (i) scope of practice, (ii) education and competency and (iii) governance for each of the uses of US in the SLT profession. The framework uses each element to ensure robust delivery of US across the profession. The same approach has been utilised by other professional groups and therefore ensures application of US in SLT with is consistent with other AHPs. In the same way, new areas of US activity can be established by developing or revising one or more of the elements, thereby ensuring alignment across the framework.

Figure 1: A framework approach to supporting use of US in SLT comprising the elements of (i) scope of practice, (ii) education and competency and (iii) governance.

Scope of practice: clinical and sonographic

Scope of practice refers to numerous elements including the tissues to be imaged, the clinical and sonographic differentials, subsequent clinical decision making and reporting.
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As the uses of US in SLT are at different stages of development, scope of practice will depend on the specific area in which the SLT wishes to practice and the multidisciplinary support available to them. The combined (i) clinical usability and (ii) clinical utility of US imaging according to the literature are key determinants of the scope of practice in this area.

Table 3 provides an indicative list of imaging that may be performed according to the domains described in Table 2. How the device is used depends on the purpose for which US has been selected by SLT clinicians. Emphasis is currently upon static imaging of structures involved in speech, voice & swallowing as part of staff and patient education, as well as qualitative evaluation of structures involved in speech, voice and swallowing for the purpose of biofeedback therapy.

US can support the likely differentials generated from the SLT clinical assessment, providing a foundation to move towards use of US as a ‘rule in’ screening or assessment tool. For example, poor oral containment of a liquid bolus may be hypothesised from the SLT clinical swallowing assessment and further supported (or confirmed) with US when the soft tissue structures of the tongue-base and soft palate are not observed to contact during the oral phase of swallowing. This contrasts with a ‘rule out’ approach (more typically employed by imaging services provided by imaging professionals such as radiologists and sonographers) where a range of potential sonographic findings (and subsequent clinical differentials) may be ruled out via the imaging. In the example above, US would/could not be used to ‘rule out’ other swallowing deficits, such as delayed initiation.

In describing US scope of practice for SLT clinicians, this also determines which tissues are not to be imaged, clinical and sonographic differentials and subsequent clinical decision making is not to be performed. Examples of imaging not listed in Table 3 and therefore considered outside the SLT scope of practice might include:

- Space occupying lesions in the head and neck
- Vascular imaging of the head and neck
- Musculoskeletal or maxillofacial issues related to the head and neck, such as temporomandibular junction (TMJ) disorders.
- Head and neck movements outside that of speech, voice, and swallowing, such as blepharospasm and fasciculations.

Whilst the above lie outside of SLT scope of practice, they may be identified as either incidental or concurrent imaging findings. Just as an SLT has a duty of care to escalate patient elements that may be strictly out of remit such as evidence of abuse or risk of self-harm, it is also necessary that they can act upon any unexpected imaging concerns. In this regard a clear protocol must be in place for the clinician to be able to discuss concerns and for the clinical assessment and/or imaging of the patient to be escalated. A precedent for this has been established in other emerging SLT service models and could include lines of established communication with those who have more specialist US imaging expertise, access to other imaging modalities and/or surgical or medical opinion. The benefits of SLTs undertaking their US imaging as part of a wider clinical and/or imaging team becomes apparent in such situations.
The US report should be written and issued by the SLT undertaking the US activity and viewed as an integral part of the process or examination\textsuperscript{15}. Findings should be clearly and accurately communicated to the patient and other care pathway members either orally and/or via a written report. The format and nature of the reporting will vary accordingly to the purpose for which US has been used, however a formal written report is required where US has been applied for assessment or diagnostic purposes\textsuperscript{18,19}.

**Table 3** Indicative imaging performed and how this information is used by US SLT clinicians.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Indicative imaging performed</th>
<th>Role of the imaging of these structures</th>
<th>Role of SLT clinicians in context of patient management</th>
</tr>
</thead>
</table>
| Static imaging of structures involved in speech, voice & swallowing | Identification of normal anatomy associated with speech and swallowing. Bones/cartilages*:*:  
- Hyoid  
- Thyroid  
- Cricoid  
- Epiglottis  
- Arytenoid (left & right)  
- Hard palate  
- Tracheal rings  
Soft tissue structures/muscle:  
- Tongue (genioglossus)  
- Soft palate  
- Geniohyoid  
- Anterior belly digastic  
- Mylohyoid  
- False vocal folds (left & right)  
- True vocal folds (left & right)  
- Salivary glands  
- Masseter  
- Upper oesophageal sphincter | • Awareness of spectrum of ‘normal’ presentations.  
• Landmark identification serves as mechanism to enhance accuracy of imaging; integral aspect of protocol-based imaging. | Recognition of ‘normal’ as part of sonographic and clinical differential diagnosis process.  
Standardised approach to imaging as quality assurance mechanism. |
Further imaging (as appropriate to role and emerging research evidence):

Bolus residue/presence within head/neck structures to include:
- Pyriform fossae (left & right)
- Valleculeae (left & right)
- Laryngeal vestibule
- Tracheal rings (subglottis)

Measurements of muscle size & echogenicity to include:
- Genioglossus
- Masseter
- Anterior belly digastric
- Geniohyoid

Qualitative evaluation of movement involved in speech, voice and swallowing

Identification of ultrasound appearances of normal position and gross (normal) dynamics.
- Binary vocal fold movement (unilateral & bilateral)
- Tongue movement in swallowing
- Tongue movement for speech sounds
- Presence/absence of hyoid movement

- Awareness of ‘normal’ movement for speech, voice, and swallow.
- Gross differential between normal and disordered movements which include (e.g., glossopalatal seal during bolus hold, bilateral vs unilateral vocal fold movement, fronting/backing/distortion of speech sounds, sustained versus non-sustained hyoid movement)
- Biofeedback/therapy function to support

Recognition of ‘normal’ versus abnormal speech and swallowing movement as part of sonographic and clinical differential diagnosis process.

To serve as a therapy/biofeedback tool for gross disorders of swallowing or speech.
**Further imaging (as appropriate to role and emerging research evidence):**
- Disorders of timing

<table>
<thead>
<tr>
<th>Quantitative analysis of movement involved in speech, voice and swallowing</th>
<th>Identification of ultrasound appearances of normal position and refined dynamics.</th>
</tr>
</thead>
</table>
| | - Grades of vocal fold movement
| | - Grades of tongue movement
| | - Grades of hyoid movement

Further imaging may evolve as research evidence emerges.

| | Allows for refined sonographic identification of non-normal/pathological presentations |
| | Initially as an educational mechanism for both SLT staff, MDT & patient (as appropriate).
| | Provides foundation for exploration of US as a potential assessment adjunct (alongside existing assessment approaches).
| | This aligns with exploring potential prognostic capabilities and as an outcome measure for monitoring effectiveness of treatment. |

* Acknowledgement that bones/cartilages cannot directly be ‘viewed’ on US, only inferred

**Education and competency**

As per Figure 1, the education and competency elements must align with, and should be reflective of, the scope of practice. In this regard, a description of SLT specific components is outside of the remit of this paper; but would include both formal and informal training, supervision/support from an appropriately trained individual in this area, mentoring and feedback regarding pathology, clinical reasoning, and clinical management.

A core consideration for any area of US is that whilst the scope of the scan may be limited, the standards must be the same as for imaging professionals such as radiographers and sonographers. Certified training courses specifically for SLTs do not currently exist however best practice guidance for the acquisition and maintenance of SLT competence can
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be developed via expert consensus, utilising occupational training standards\(^{19-22}\) and those developed for other professions as appropriate\(^8\).

A ‘foundation’ US curriculum is initially proposed in Table 4. Levels 1 (foundation), 2 (intermediate) and 3 (advanced) have been used to guide the level of skill required for each application (or scope of US practice) described in Table 2.

Parts of the curriculum (e.g., foundation level) have potential to be integrated at undergraduate/pre-registration level whereas the intermediate and advanced curriculum might align with the aspirational scope of practice as a diagnostic tool, prognostic indicator, or outcome measure for monitoring effectiveness of treatment. Training at this level is likely to be undertaken by more experienced clinicians.

The level of education and training an SLT requires will be dictated predominantly by the requirements of their job role, rather than their banding or years of expertise. For example, injection of botulinum toxin into the salivary glands is likely to require advanced training as well as governance and recognition as an extended scope of practice, compared to the skills and competency required for providing biofeedback for speech sound disorders. The SLT must have the pre-requisite competencies required for their job role prior to integration of US as an education, treatment and/or assessment tool. Training programmes should include the principles and practicalities of ergonomic US practice as well as the safe use, and potential hazards of diagnostic ultrasound equipment\(^{23}\).

**Advanced clinical practice agenda**

As a progressive area of highly skilled practice, use of US for assessment and diagnostic purposes would seem to naturally align with the advanced clinical practice agenda \(^{24}\). We advocate though that US has the potential to become a routine part of SLT practice and that as such these clinicians do not need to be operating at ‘advanced level’ or above prior. Nonetheless, the four pillars of advanced practice (clinical practice, leadership and management, education and research) overlap substantially with the expanding role that is the use of US by SLTs \(^{25}\). As such we encourage US adopters to explore how use of the imaging modality can further advanced clinical practice and consultant roles.

**Table 4** Proposed curriculum for Speech and Language Therapists who wish to integrate ultrasound into their clinical practice. Educational elements have been divided into three components: i) theoretical understanding ii) technical skill iii) analysis and interpretation

<table>
<thead>
<tr>
<th>Education Elements</th>
<th>Level of ultrasound application</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Theoretical understanding</td>
<td>Foundation (level 1)</td>
</tr>
<tr>
<td>1. Understanding of how an ultrasound image is generated.</td>
<td>Basic level of knowledge required; to</td>
</tr>
</tbody>
</table>
# Ultrasound Framework for Speech & Language Therapists

## Includes:
- Fundamental physics as applied to ultrasound
- Artefacts and how to manage / interpret them

## Understanding Ultrasound Echoes
- Include physics of ultrasound, echogenicity of tissues limited to those they are imaging.
- Understand what grey-scale images of all speech/swallowing structure represent.

## 2. Safety and professional considerations.
Includes:
- Thermal and non-thermal effects; ALARA principles
- Awareness of limitations of ultrasound imaging and awareness of role of other imaging modalities
- Infection control
- Use of protocols; taking and labelling of standardised views
- Reporting terminology; secure storage of images

<table>
<thead>
<tr>
<th>Level</th>
<th>Knowledge Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>Due to limited scanning duration, and non-diagnostic, non-invasive role.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Due to increased scanning duration and biofeedback role.</td>
</tr>
<tr>
<td>High</td>
<td>Due to potential scanning duration; and diagnostic (potentially invasive) role.</td>
</tr>
</tbody>
</table>

## ii) Technical skill

### 3. Image acquisition & optimisation
Includes:
- The function of ultrasound machine settings (relating back to fundamental physics principles)
- Knowledge of different types and purposes of ultrasound transducers
- ‘Knobology’ and application of image optimisations strategies in practical scenarios
- Adaptation of imaging based upon factors

<table>
<thead>
<tr>
<th>Level</th>
<th>Skill Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>To enable ‘plug and go’ application and simple adjustments to account for range of normal differences in size of head/neck anatomy. US is inaccessible if ‘fine tuning’ is required.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Allows operator to ‘drive’ the machine to accurately identify and optimise the image for the target tissue(s).</td>
</tr>
<tr>
<td>High</td>
<td>Allows operator to ‘drive’ the machine to accurately identify a range of normal and pathological presentations in a range of tissue types. May include settings related to avoidance of neurovascular structures and accurate needle placement such as Spectral Doppler, Power Doppler, needle guidance/enhancement.</td>
</tr>
</tbody>
</table>
such as high BMI, poor patient positioning or anatomical variants.

### iii) Analysis & Interpretation

#### 4. Static imaging of speech, voice, and swallowing structures

Includes:
- Ability to use standardised protocols, recognise normal structures and variation in anatomy.

| Basic level of skill required, limited to just one structure of interest. | Moderate level knowledge, skill and demonstrable competency required applied to a limited range of target tissue types. | High level knowledge, skill and demonstrable competency required due to wide range of target tissue. |

#### 5. Qualitative evaluation of speech, voice, and swallowing movement

Includes:
- Ability to use standardised protocols, recognise normal vs abnormal variation in speech/swallowing movement.

| Basic level of skill required, limited to just one set of movements and one function (speech vs swallowing) of a single structure (non-diagnostic). | Moderate level of skill required, limited to just one sets of movements and one function (speech vs swallowing) of more than one structure (non-diagnostic). | High level knowledge required extended to more than one sets of movements and/or function (speech vs swallowing) in more than one structure (may be diagnostic). |

#### 6. Quantitative analysis of speech, voice, and swallowing movement

Includes: Ability to use standardised protocols, measurement

| Not applicable. | Moderate level of skill required, limited to just one set of movements and one function (speech vs swallowing) of one | High level of skill required, extended to more than one set of movements and/or function (speech vs swallowing) in more than one structures or |
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<table>
<thead>
<tr>
<th>of speech/swallowing movements.</th>
<th>or more structures (likely to be diagnostic).</th>
<th>modality (which may include quantitative muscle ultrasound or Doppler) (likely to be diagnostic).</th>
</tr>
</thead>
</table>

*Ultrasound-specific term referring to the competency of the operator in determining and refining ultrasound settings for image acquisition

**Insurance and Governance**

US is a non-regulated imaging modality; thus, no legal restrictions inhibit practice in this area. Use of US is recognised by RCSLT as an ‘extended scope’ of practice. As such, insurance is provided to its members provided the appropriate training and competency elements are in place; however, insurance is not an ‘exact science’, and each claim is usually assessed on its own merits. Activities that fall outside the remit of an SLT (e.g., use of US for muscle biopsy) require alternative cover and accountability agreed with the employer/provider.

Defining the scope of practice confers numerous governance and care pathway benefits. This includes awareness by other care pathway members of what the scan is and is not undertaken for, and support from clinical managers in care pathway design and staffing.

The use of terminology to explicitly clarify the nature of the scan is encouraged. An example of the professional context to the imaging process that could be communicated to colleagues is: “Aligning with the scope of clinical and sonographic practice outlined for SLTs performing US (**this publication**), this scan is undertaken for the purposes of assessing/treating XXX as an adjunct to XXX as part of SLT management. The identification of other anatomical or pathological elements is explicitly beyond the scope of practice of the clinician. Therefore, the scan cannot be relied upon to either confirm or exclude any such anatomical or pathological elements.”

Quality assurance considerations include data protection, storage of images/videos, testing of ultrasound devices as well as continuous professional development, and access to a second opinion. As US is often undertaken in non-radiology settings, direct access to picture archiving and communication system (PACS) for secure storage and backing up of sonographic images may not be available. This may pose a risk to data security as well as continuity of care and the ability to review image quality. Mechanisms for the secure storage of sonographic images/videos will need to be addressed in-line with the information governance policy of the employer. Storage may include bespoke mechanisms to upload to PACS, or the use of other secure image storage capacity as advised by a data compliance officer. There are circumstances where recording of US data is often not required, for example when used for professional training purposes or biofeedback therapy.

Peer-review of the ultrasound images and reports should form part of the quality assurance process, particularly in the emerging areas of assessment and diagnostic practice. A peer-
review audit tool for such purposes is offered by The British Medical Ultrasound Society (BMUS)\textsuperscript{26}.

**Broader considerations**

**Expansion of scope of practice**

Description of SLT clinical and sonographic scope of practice is not intended to stifle innovation or development of clinical practice or roles. Examples of expanded scope of are provided in Table 2 and align with the advanced clinical practice agenda \textsuperscript{24}. Such activity may include the potential for SLTs to use US to make tracheal measurements for the purpose of tracheostomy insertion \textsuperscript{27–29} as well as confirmation of injection site of botulinum toxin in patients with sialorrhea \textsuperscript{30}. Applying the principles outlined in this paper means that where the activity demonstrably sits within the SLT management of a patient, then professional regulation and RCSLT insurance considerations would conceivably have already been addressed. Education and demonstrable competency considerations would need to be satisfied, as well as any documentation required by the employer clinical governance committees that demonstrates the change in clinical practice is safe and regularly evaluated.

Another permutation might be where an SLT commences a parallel or advanced clinical activity which involves US imaging in a role that sits outside of what would otherwise be considered part of the SLT management of patients with speech or swallowing disorder. An example might include US-guided muscle biopsy of the muscles involved in speech and/or swallowing to support neurological diagnosis. RCSLT insurance considerations may not apply in such cases, therefore a potential alternative route would be to arrange indemnity insurance via an employer. Again, education and demonstrable competency considerations would need to be satisfied along with agreement with clinical managers.

**Research**

Given the sparsity of research evidence to support the application of US in the SLT profession, it is imperative to develop the evidence base relating to if, where and how US can enhance clinical effectiveness and efficiency of SLT assessment and treatment pathways. This includes consideration of optimal education and service delivery models as well as whether the use of imaging may have a negative impact on clinical outcomes or efficiency of resource use. The research priorities in this area are described in a recently-published consensus paper \textsuperscript{5}.

In relation to SLTs performing diagnostic US, some evidence, including a diagnostic test accuracy analysis in relation to the use of US to detect vocal fold palsy, can be drawn from other professional groups such as intensivists, anaesthetists and ear, nose and throat (ENT) medical practitioners \textsuperscript{31,32}. Nonetheless, the evidence-base for use of diagnostic US by SLTs needs development. The overlap with ENT practitioners, intensivists and head and neck sonographers provides potential opportunity for pooled research and inter-professional collaboration.
In addition to research which seeks to demonstrate the effectiveness of US biofeedback and evaluate assessment protocols, ongoing work seeks to improve the US technology. For speech assessment, systems are now available which synchronise the audio and US signals for play back and analysis. To analyse tongue-shape and movement, the surface of the tongue must be tracked accurately. Ongoing work seeks to refine automatic tracking for both speech and swallowing assessment, allowing the analyst to extract numerical values to measure movement. Another approach involves machine learning to classify images. An example of this includes recent work to determine the correctness of articulatory gestures in children with speech disorders automatically; an approach which can also be used for outcome measurement. Further work using machine learning to classify various speech, swallow, and laryngeal functions is likely in the future.

**A direction of travel for other specialities and geographical regions**
This paper specifically reflects the situation for SLTs in the UK and in this regard, it is noted that the level of autonomy enjoyed is greater than that of some professionals in many other countries. It is hoped therefore that the generic mechanisms outlined in this paper will provide a potential direction of travel for such professions and regions to advance their use of US imaging in a robust and sustainable manner.

**Conclusion**
This paper presents a framework approach to support use of US in the SLT profession. As the uses of US in SLT are at different stages of development, scope of practice will depend on the specific area in which the SLT wishes to practice and the multidisciplinary support available to them. The combined (i) clinical usability and (ii) clinical utility of US imaging according to the literature are key determinants of the scope of practice in this area. This encompasses a broad range of imaging elements relating to the assessment and therapeutic management of patients with speech, voice and/or swallowing disorders.

Education and competency assessment considerations are explicitly aligned with the clinical and sonographic scope of practice and provide the foundation for robustly satisfying a range of governance requirements. These are further addressed with elements such as data security and continuing professional development.

The framework provides an adaptable model for supporting expansion of US across a range of SLT specialities, including those outside of the current scope of SLT practice.

**References**


15. Society and College of Radiographers and British Medical Ultrasound Society. Guidelines for Professional Ultrasound Practice,


