The use of sensory and chemesthetic stimuli in the treatment of oropharyngeal dysphagia: scoping practice in the UK and Ireland

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Title:

The use of Sensory and Chemesthetic Stimuli in the Treatment of Oropharyngeal Dysphagia: Scoping Practice in the UK and Ireland

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Abstract

Background

The research identified by the author investigated speech and language therapists' (SLT) decision making; there were a limited number of treatments provided to clients with dysphagia (McCurtin 2012). The use of sensory/chemesthetic stimuli helps to facilitate a swallow (Krival and Bates 2012) and may influence a clients' behaviour to positive and aversive effects associated with eating and drinking (Krival 2013); thus these stimuli may have a place in the management of clients with oropharyngeal dysphagia.

Objectives

- Scope the use of sensory/chemesthetic stimuli in dysphagia practice,
- Compare demographic information and the utilization of sensory/chemesthetic stimuli,
- Verify the stimuli utilised,
- Determine if speech and language therapists' personal preference to tastes influences the stimuli utilised.

Methods

An electronic survey was used to gather information about speech and language therapists' demographics, practice behaviour and personal preferences to taste. An electronic survey tool was used to circulate the survey. Descriptive and inferential statistics were calculated.

Results

The survey was completed by 84 SLTs' working with clients with dysphagia. Seventy-three percent of SLTs' use sensory/chemesthetic stimuli in treatment. There were a number of factors that contributed to the use of the stimuli: dysphagia experience, percentage of clinical practice working with dysphagia and client group. The most popular stimuli utilised were sour, carbonation, sweet, bitter, spicy, specific strong tasting, salty and spicy. There was a high percentage of SLTs' that loved these tastes. Other stimuli had high preference ratings but low use in practice.

Conclusion

The results indicate there is unity among SLTs regarding the use of sensory/chemesthetic stimuli. This study highlighted the extent sensory/chemesthetic stimuli are utilised and the factors that contributed to their use. More research is required to validate the efficacy of sensory/chemesthetic stimuli in the dysphagia population.

Key Words: dysphagia, sensory/chemesthetic stimuli, clinical practice.

1.0 Introduction

Dysphagia is a term used to describe difficulty with a swallow (RCSLT 2009). Four phases occur during a swallow: oral preparatory, oral, pharyngeal and oesophageal. Accurate function of our motor and sensory nervous systems are required for a 'normal' swallow (RCSLT 2009). A normal swallow is difficult to define and is subject to individual variation. It is important to research clients with dysphagia as 50% of a speech and language therapists' (SLTs) caseload involves working with this condition (Pettigrew and O'Toole 2007). This client group is provided with a limited range of intervention strategies (McCurtin 2012) influenced by a lack of evidence base surrounding these strategies (Speyer et al 2010). It is hypothesised that sensory/chemesthetic stimuli may influence a clients' behaviour to positive and aversive effects associated with eating and drinking (Krival 2013), thus these stimuli may have a place in the management of clients with oropharyngeal dysphagia.

Our bodies react in different ways to stimuli. Sensory stimuli include chemical and non-chemical stimuli such as vision, touch, smell and sound (Krival 2013). Chemesthetic stimuli are the detection of chemicals in the mouth that are responsible for the sensitivity of temperature and pain receptors (Krival and Bates 2012; Pelletier and Dhanaraj 2006). The use of these stimuli may improve a clients' ability to swallow; they may not be sufficiently practiced in the field of dysphagia.

1.1 Aims of My Research

In regards to the findings mentioned the aims of my research are the following:

- To scope the clinical practice of SLTs' with regard to the use/non-use of sensory/chemesthetic stimuli in the treatment of clients with oropharyngeal dysphagia,
- To explicate the reasoning underpinning the use/non-use of sensory/chemesthetic stimuli in the management of oropharyngeal dysphagia*.

The following format will be used to discuss the literature surrounding the aims of my research: interventions, tongue sensory pathways and taste, sensory/chemesthetic stimuli, previous surveys that investigated clinical practice and summary of the literature.

* This project was a group effort. Analyses was divided into descriptive statistics and thematic analysis. I researched descriptive statistics. The points marked '*' were analysed by thematic analysis; for this information please refer to the corresponding paper.

1.2 Interventions

SLTs often recommend a change in diet to stimulate a clients' swallow (Kind et al 2011). Bolus modification techniques appear to be the favoured methods chosen by SLTs. Bolus modification is the changing of a bolus in some form. The two most popular techniques utilised in practice are thickening a bolus and thickening of liquids. Low level research designs surrounding these two methods will be discussed.

1.2a. Thickening a Bolus

Thickening a bolus was found to reduce the speed of a swallow in participants with dysphagia and healthy participants, thus it makes a swallow easier to accomplish (Bhattacharyya et al 2003; Bisch et al 1994; Clavé et al 2006; Dantas et al 1990). Thickening a bolus in dysphagia practice is recommended as it has been found to improve the safety and function of a swallow (Bhattacharyya et al 2003; Clavé et al 2006).

1.2b. Thickening Liquids

It is hypothesised that thickened liquids reduce the likelihood of liquid entering the airways (Bülow et al 2003). Research surrounding thickened liquids is inconclusive (Robbins et al 2008).

Research found clients who received thickened fluid diets failed to meet their daily fluid intake (Finestone et al 2001). It is anecdotally recognised that clients find it difficult to accept thickened liquid due to its unattractive taste and appearance (Bülow et al 2003). These considerations propose that our senses must play a crucial role in food acceptance and aversion.

1.3 Tongue Sensory Pathways and Taste

Our peripheral and central nervous systems collect and process information about the characteristics of food such as temperature, taste and texture. Sensory processing during the first stage of a swallow may stimulate a brain stems motor planning and response (Humbert and German 2013); which are influenced by a number of sensory pathways (Steele and Miller 2010). Sensory information is passed through ascending and descending pathways to and from the brain. Sensory input includes external and internal information.

The focus of this explanation will be our chemical senses of gustation, olfaction and oral chemesthetics.

Gustation is the ability to taste; in the mouth this information is passed via the glossopharyngeal and facial nerve (Krival 2013) to the brain stem where it is evaluated. Olfaction is the sense of smell through the nasal cavities; it interacts with gustation and is responsible for our sense of flavours (Krival 2013). This sense is transmitted through the olfactory nerve (Krival and Bates 2012). Oral chemesthetics was previously defined (see page 8); the detection of these stimuli is passed through the trigeminal and glossopharyngeal nerves (Grabenhorst and Rolls 2008). Chemesthetics stimuli are activated by transient receptor potential channels, these are located around our taste buds; information is passed in the brainstem and then to the thalamus (Krival 2013).

A sensory response is unique to each individual and influenced by factors such as age and gender (Bartoshuk et al 1986; Bartoshuk et al 1994). If sensory awareness is impaired more saliva will remain in the mouth than normal (Bisch et al 1994). Taste has been shown to be a major motivator for food selection in non-dysphagia populations (Feeney et al 2010). Food acceptance with the dysphagia population may be increased if more attention is concentrated on sensation (Bartoshuk 2000).

1.4 Sensory/Chemesthetic Stimuli

It is hypothesised the use of sensory/chemesthetic stimuli helps to facilitate a swallow (Krival and Bates 2012). Low level research designs has been applied to some of these stimuli such as carbonation, sweet, sour, bitter, salty, chalky, bland tastes and spicy.

1.4a. Carbonation

Research supports the use of the stimulus carbonation to improve swallow function (Bülow et al 2003; Michou et al 2012; Moritaka et al 2013; Sdravou et al 2012). The use of carbonated liquid reduced aspiration (Bülow et al 2003; Sdravou et al 2012) and penetration (Sdravou et al 2012); pharyngeal retention and pharyngeal transit time became shorter (Bülow et al 2003). The combination of carbonation and cold temperature was another method that was effective in the initiation of a swallow (Michou et al 2012). Significant results to trigger a swallow were also found when there was an increase in carbon dioxide added to a carbonated drink (Moritaka et al 2013).

Carbonated liquid was recommended by Bülow et al (2003) as an alternative therapy to thickened liquids. It is believed the effectiveness of carbonation to trigger a swallow is influenced by taste receptors in the mouth that activate the sensory pathways (Michou et al 2012), to send information to the thalamus that triggers neuromotor responses (Moritaka et al 2013).

1.4b. Sour/Sweet/Bitter/Salty/Bland Tastes

Sour stimulus is another sensory/chemesthetic stimuli that helps to initiate a swallow in dysphagia (Logemann et al 1995) and the animal population (Kajja et al 2002). A swallow may have been initiated as a result of a sour stimulus as there was an increase in saliva that activated a sensory response (Logemann et al 1995). Significant effects to initiate a swallow were observed when there was an increase in concentration of sourness. This effect may have activated the sensory pathway, as a result a swallow was observed (Kajiia et al 2002).

Sour tastes and temperature were compared to see which stimuli would be more effective at evoking a swallow. When sour taste and cold temperature were applied at the same time they showed a significant effect, a reduction in pharyngeal transit time (Cola et al 2010). A higher level study design found significant effects when sour-cold stimuli were given randomly (Cola et al 2012). Both studies recommend the use of sour tastes and cold temperature to be used as a method for therapy.

Pelletier and Dhanaraj (2006) looked at a variety of stimuli. The stimuli investigated were sweet, sour, salty, bitter and barium (barium is described as having a chalky taste). They found moderate sugar, high salt, and high citric acid (sour taste) yielded higher lingual swallowing pressures compared with water. This study suggests sweet, salty and sour stimuli may play a crucial part in the physiology of swallowing.

Each of the studies discussed support the use of some sensory/chemesthetic stimuli. Steele et al (2012) contradict their findings. The stimuli used in their research were water (bland taste), sweet, sour, sweet-sour, and citric acid; they found that chemesthetic stimuli do not have effects on tongue movement. This study was limited as there was variability in the location of the transducer coils; which measured tongue movement.

1.4c. Spice

A randomised trial by Ebihara et al (2006) found the inhalation of the black pepper resulted in an initiation of a swallow. Krival and Bates (2012) also support a spicy taste to influence a swallow. They looked at the effect of club soda and ginger brew. The heating effect of these stimuli was significant as they influenced greater neuromotor activity compared to water in the first stage of a swallow. Authors suggest more research is required for the comparison of chemesthetics with other techniques such as thickened liquids.

1.5 Previous Surveys that investigated Clinical Practice

Surveys have been distributed to SLTs to scope clinical practice. Internationally there are inconsistencies about what techniques SLTs include in their dysphagia management (Archer et al 2013; Bateman et al 2007; Krisciunnas et al 2012; Martino and Diamant 2004; Mathers-Schmidt and Kurlinski 2003; McCullough et al 1999; Pettigrew and O'Toole 2007). The process of assessment (Ax) and intervention choices requires the SLT to combine information from a variety of sources to make an informed clinical decision (IASLT 2012; RCSLT 2009). These studies focused on a wide variety of Ax and treatment (Tx) strategies. The focus of this research is the utilisation of sensory/chemesthetic stimuli. There were many factors that played a part in SLTs utilisation of therapies such as experience, education, client diagnosis and clinical setting. These factors are also included in this study to identify the demographic information that relates to the use/non-use of sensory/chemesthetic stimuli. Interestingly the research indicates the use of sensory/chemesthetic stimuli is not practiced by all SLTs (Archer et al 2013; Bateman et al 2007; Krisciunnas et al 2012; Mathers-Schmidt and Kurlinski 2003; McCullough et al 1999; Pettigrew and O'Toole 2007).

Since the studies that investigated clinical practice have been published there has been more research surrounding the efficacy of sensory/chemesthetic stimuli. The research discussed found sensory/chemesthetic stimuli helps to facilitate a swallow. It appears the use of sensory/chemesthetic stimuli might be more useful in the management of dysphagia clients than previously thought. It is necessary to scope clinical practice surrounding SLTs use/non-use of sensory/chemesthetic stimuli; although at present the evidence surrounding this Tx strategy is limited. The studies discussed did not ask SLTs' their reasoning to support their strategies in dysphagia management. Head et al (2007) recommended the inclusion of 'why' in future studies. The inclusion of 'why' in this study will identify the reasoning for the use/non-use of sensory/chemesthetic stimuli. The questions posed are as follows:

- If you use sensory or chemesthetic stimuli in your management of dysphagia, please tell us why you use such techniques.*
- If you do not use sensory or chemesthetic stimuli in your management of dysphagia, please tell us why you do not use such techniques.*

1.6 Summary of the Literature

This literature review has outlined a number of studies. These studies have contributed to the understanding of the importance of using sensory/chemesthetic stimuli in the treatment of clients with oropharyngeal dysphagia. The following are a number of factors that reflect why most of the studies in this literature review are of a low level design:

- No study includes a control group where participants receive no therapy; ethically this would not be possible,
- Samples are generally small,
- Data lacking regarding the use of sensory/chemesthetic in the dysphagia population,
- Accurate comparison of studies are difficult due to variables in methodology,
- Some studies included subjective measurements, and
- No longitudinal studies were included.

This project was a group effort; analyses of this study was divided into quantitative and qualitative analysis. The focus of this paper is quantitative analysis. The aim of this paper is:

- To scope the clinical practice of SLTs' with regard to the use/non-use of sensory/chemesthetic stimuli in the Tx of clients with oropharyngeal dysphagia.

To fully achieve this aim the research questions are as follows:

- Scope the use of sensory/chemesthetic stimuli in practice,

* This project was a group effort; for qualitative analysis please refer to the corresponding paper.

- Compare demographic information and the utilization of sensory/chemesthetic stimuli,
- Verify the stimuli utilised,
- Determine if SLTs' personal preference to tastes influences the stimuli utilised in practice.

2.0 Methods

The following layout will be used to discuss the method of this study: survey design, ethical approval and consent, participants and analysis.

2.1 Survey Design

Items for the survey were derived by the researchers (three Speech and Language Therapy MSc students) by referring to published dysphagia research. The survey was prepared on Survey Monkeys' online interface (www.surveymonkey.com). An electronic survey tool (www.surveymonkey.com) was used to circulate the survey. The survey consisted of fifteen questions (10 closed questions, 1 binary choice, 1 rating scale and 3 open questions) requiring approximately ten minutes to complete.

The first seven questions gathered information about respondents demographics, they were: SLTs' experience, dysphagia experience, percentage of clinical practice working with clients with dysphagia, country of practice, age group of clients and dysphagia client group. Questions 8 and 9 asked respondents to rate the frequency they use bolus modification in Ax and Tx, a definition of bolus modification was included in the question. The respondent identified if they frequently, occasionally or never use the technique; this was an introduction question to ease the respondent into the focus of the study. Question 10 and 11 focused on the goal of the study; they asked respondents to rate the frequency they use sensory/chemesthetic stimuli in practice. A definition of sensory/chemesthetic was included in the question. Again, the respondent identified if they frequently, occasionally or never use the technique. Question 12 listed a variety of the sensory/chemesthetic stimuli. The respondent ticked yes/no to indicate if they use/do not use one of the stimuli listed. Question 13 and 14 asked respondents their reasoning underpinning their use/non-use of sensory/chemesthetic stimuli, for ease of analysis an explanation was limited to 400 characters*. The final question (question 15) asked respondents to indicate their personal preferences to a list of tastes (e.g. maple syrup, seaweed, dark chocolate, walnuts, liver etc) by indicating if they: love it, neither love it nor hate it, hate it or never tried it/don't know. The survey questions can be found in Appendix A.

* This project was a group effort; for this information please refer to the corresponding paper.

2.2 Ethical Approval and Consent

The Faculty of Education and Health Sciences Research Ethics Committee granted ethical approval for the study. Return of a completed survey was taken as consent to participate in the study.

2.3 Participants

In order to participate in the study a number of criteria was outlined to identify suitable participants to achieve the research aims:

- *Inclusion criteria:* qualified SLTs', working with clients with dysphagia and a member of a Dysphagia Special Interest Group (SIG) in Ireland or the UK.
- *Exclusion criteria*: not an SLT, not working with dysphagia clients and not a member of a Dysphagia SIG in Ireland or the UK.

Potential gatekeepers were identified via email to SLT chairs of Dysphagia SIGs in the UK and Ireland; patient age, aetiology or practice settings were not constrained. The email (Appendix B) consisted of the following:

- clear description of the study,
- requested their participation,
- promised anonymous data analysis,
- requested them to forward the link of our survey to all SLTs' in their database,
- principle investigators contact details.

After consent, a link to the survey and the closure date for the link was sent to the gatekeepers to forward on to all SLTs in their databases. A reminder email was sent to the gatekeepers two weeks after the first email was sent; this email reminded them there was one week left to participate in the survey.

The number of responses for the survey was low (total number of respondents was forty-three). To maximise survey response we re-emailed the gatekeepers and extended closure of the survey for 1 week. The total number of respondents was eighty-four.

The gatekeepers were asked to identify the number of SLTs' that received the survey in their database. Three gatekeepers responded:

- PAEDs EDS SIG (Republic of Ireland): 40,
- Adult Dysphagia SIG (Republic of Ireland): 63,
- Dysphagia SIG Wales: 69.

The other SIGs did not respond to the email. The other SIGs were: Scotland EDS SIG, PAEDs EDS SIG (England), Adult Dysphagia SIG (England), and Dysphagia SIG Northern Ireland). It can be assumed that the English Adult Dysphagia gatekeeper did not distribute the link to the survey; there was one respondent from England (upon reviewing each survey individually, the English respondent treated the adult population). The total response rate cannot be calculated but the response rate for the following countries can. This response rate was low:

- Republic of Ireland: 42.5%
- Wales: 18.8%

2.4 Analysis

The analysis of this paper is quantitative analysis; descriptive and inferential statistics were calculated.

Descriptive statistics (frequencies and percentages) were calculated, using the software IBM-SPSS Statistics 20, to summarise demographic information, frequency sensory/chemesthetic stimuli were used/not used, the stimuli that were used and SLTs' personal preferences to tastes. By using this software cross tabulations were generated to show the relationships between the variables demographic data and use/non-use of sensory/chemesthetic stimuli. There was no missing data in the results. There were a number of limitations identified in the data that would not accurately reflect SLTs' practice behaviours. The following are the limitations and how they were resolved:

- Country of practice was collapsed in the demographic data. England and Northern Ireland were not included in the analysis. There was a low response rate from these regions: England had one respondent and Northern Ireland had five respondents. This level of respondents would not accurately reflect the practice behaviours in these regions.

- Client group was collapsed in the demographic data. There was a total of eight client groups in the survey (acquired neurological disorders, autism spectrum disorders, dysphagia post cancer, intellectual disabilities, physical disabilities, profound and multiple disabilities, progressive neurological disorders and people with dementia). To accurately reflect this information we reduced the group into four client groups (neurological disorders, dysphagia post cancer, disabilities and dementia). These smaller categories increased the validity of the use/non use of sensory/chemesthetic stimuli with these types of diagnoses.

- Four SLTs stated that they never use the stimuli, yet they answered question twelve in the survey. The question was phrased 'which sensory or chemesthetic stimuli do you use in assessing and/or treating clients with dysphagia?'. Obviously they answered no to each of the stimuli. Their responses were omitted.

- The personal preferences section included all SLTs (N=84). SLTs were asked how they felt about certain tastes e.g. coffee granules, mints etc. By responding to this question the respondent stated if they 'love it', 'hate it', 'neither love it nor hate it', 'hate it' or 'never tried it/don't know'. In order to compare these tastes to stimuli utilised in practice we categorised these tastes into sour/sweet/bitter (Table. 1., page 17). Respondents varied in their responses in these categories; this was not anticipated. In order to overcome these limitations respondents overall preference was defined by the preference they choose in the majority e.g. if there were 3 'love it' and 1 'hate it', we choose 'love it' as being their overall preference for the taste as this was the majority answer. For the occasion where 'love it' and 'hate it' occurred evenly the choice of 'neither love it nor hate it' was chosen as the respondent did not have an overall preference to the taste. If there was an occasion where 'love it' and 'neither love it nor hate it' occurred equally 'love it' was chosen as 'love it' was in the majority. The same analysis was used for 'hate it' and 'neither love it nor hate it'. If the respondent choose 'never tried/don't know' the preference was omitted unless this was chosen for all tastes in the category. This section was also collapsed into 'love it' or 'hate it'; this made the data comparable with use of stimuli. It is important to note that this section of analysis is subjective; this reflects the variability of SLTs' preferences to tastes and our idea of the tastes within the categories. Table 1. is an example of one respondents data to help explain this analysis:

Table. 1. One Respondents' Data and Analysis of Personal Preferences to Tastes

Stimulus Category and Tastes	Respondents Answers	*Respondents Preference Rating*	Stimulus Category and Tastes	Respondents Answers	*Respondents Preference Rating*
Sour Pure lemon juice Vinegar	 N H	*Hates sour tastes*	**Perfume** Rosewater Lavender oil	 N Never	*Neither loves nor hates perfume tastes*
Sweet Fudge Maple Syrup Vanilla Sugar Hard meringue	 L L L N Never	*Loves sweet tastes*	**Spicy** Cumin Raw jalapeno pepper Chilli powder	 L H L	*Loves spicy tastes*
Bitter Dark chocolate Coffee	 L L	*Loves bitter tastes*	**Menthol** Mints Chewing gum	 L L	*Loves menthol tastes*
Salty Seaweed Table salt Seawater	 Never N N	*Neither loves nor hates salty tastes*	**Fatty** Cooking oil Cream Unsalted margarine	 N N N	*Neither loves nor hates fatty tastes*
Umami Soy Sauce	 L	*Loves umami tastes*	**Chalky** Non-flavoured antacids	 Never	*Never tried chalky tastes*
Carbonation Tonic water Sparkling water Soda water Beer	 L N N N	*Neither loves nor hates carbonated tastes*	**Herbs** Thyme Fennel Rosemary Mint Parsley	 L H L N N	*Loves herb tastes*
Metallic Red meat cooked rare Liver	 L N	*Loves metallic tastes*	**Smoky** Smoky bacon Smoked salmon Smoked teas	 L L N	*Loves smoky tastes*
Strong Garlic Onion Black pepper Parmesan Cheese Gouda Cheese Mackerel Ginger Kidney beans Gouda cheese	 H H L L N L H L H	*Neither loves nor hates strong tastes*	**Bland** Water Plain porridge Yoghurt Walnuts Plain pasta	 L N N L N	*Neither loves nor hates bland tastes*
Alcoholic Vodka Whiskey	 H H	*Hates alcoholic tastes*			

Note:
Meaning of Abbreviations: L: love it; H: hate it; N: neither loves it nor hates it; Never: never tried it/don't know

Inferential statistics were calculated (using the software IBM-SPSS Statistics 20) to test if the results had statistical significance that could be compared to the SLT population. A statistic of significance means it is less likely that the relationship between the variables happened by chance. It does not mean it is useful to justify clinical decisions. Associations between demographics and use/non-use of sensory/chemesthetic stimuli were measured using Fishers' Exact Test; because of multiple significance testing, a Bonferroni-adjustment significance level of 0.025 was implemented to account for the increased possibility of type-1 error (a Fisher' Exact score of $p \leq 0.025$ was counted as significant).

3.0 Results

Eighty-four SLTs' participated in the survey. Results from the survey will be discussed under the following headings:

- demographic information,
- bolus modification,
- sensory/chemesthetic stimuli,
- demographic information and the use of sensory/chemesthetic stimuli,
- sensory/chemesthetic stimuli that are used in management,
- relationship between stimuli used in practice and SLTs' personal preferences to tastes.

3.1 Demographic Data

The sample represented a range of dysphagia experience, from SLTs' with less than 5 years (*N*=26, 31%), 5-10 years (*N*=25; 29.8%) and more than 10 years (*N*=33, 39.3%). The majority of SLTs' caseload consisted of over fifty per cent of their time working with clients with dysphagia (65.5%). Over half of the respondents were from Republic of Ireland (53.6%). The vast majority of SLTs worked with the adult population (84.5%). Respondents represented a variety of client groups (neurological disorders, disabilities, dementia and dysphagia post cancer). Neurological disorders (50%) and disabilities (32.1%) were the main client groups. The use of sensory/chemesthetic stimuli were utilised with neurological disorders and disabilities, therefore these groups were of greatest interest. A summary of the demographic data is presented in Table. 2 page 20.

3.2. Bolus Modification

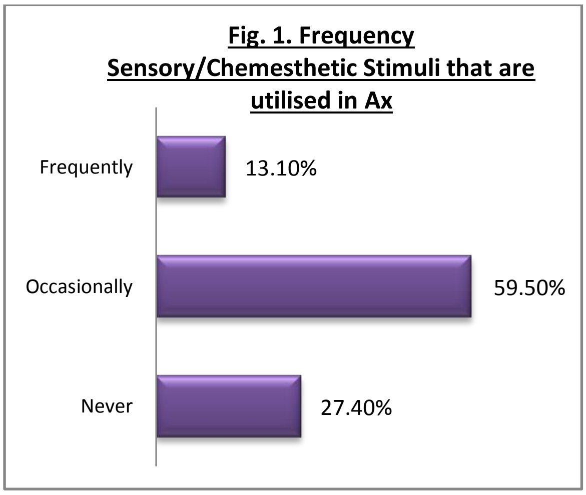
The use of bolus modification is popular in practice (Ax: 97.6%; Tx: 97.6%). SLTs were asked if they frequently/occasionally/never use the technique; the majority of SLTs used this technique frequently in Ax (77.3%) and Tx (79.76%).

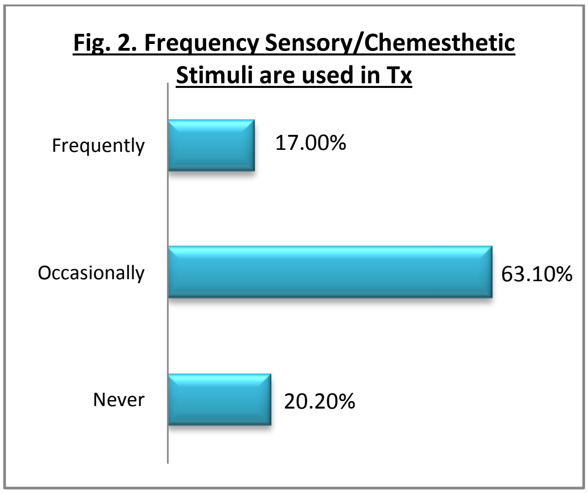
Table. 2. Participant Demographics

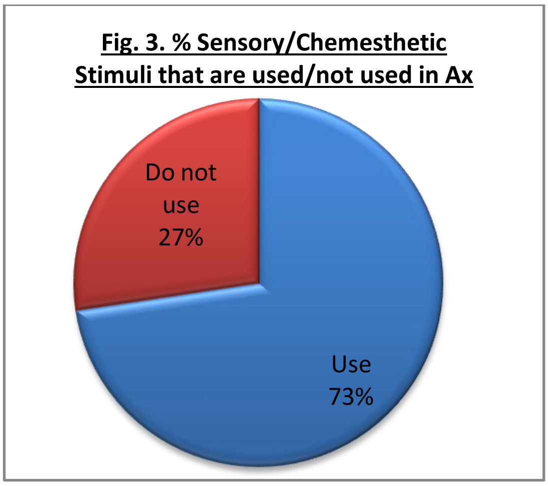
Variable	*N*	*%*	*Variable*	*N*	*%*
Dysphagia experience	*84*		*Main dysphagia client group*	*84*	
<5 years	26	31	Acquired neurological disorders	40	47.6
5-10 years	25	29.8	Autism spectrum disorders	2	2.4
>10 years	33	39.3	Dysphagia post cancer	2	2.4
% clinical practice working with clients			Intellectual disabilities	8	9.5
with dysphagia	*84*		Physical disabilities	6	7.1
<25%	13	15.5	Profound and multiple disabilities	10	11.9
26-49%	16	19.1	Progressive neurological disorders	3	3.6
>50%	55	65.5	People with dementia	13	15.5
Country of practice	*84*		*Dysphagia Client Group (collapsed*		
England	1	1.2	*group)*	*84*	
Northern Ireland	5	6	Neurological disorders	42	50
Republic of Ireland	45	53.6	Dysphagia post cancer	2	2.4
Scotland	20	23.8	Disabilities	27	32.1
Wales	13	15.5	Dementia	13	15.5
Country of practice (collapsed)	*78*		*Frequency stimuli is used/not used*		
Republic of Ireland	45	57.7	*in Ax*	*84*	
Scotland	20	25.6	Frequently	11	13.1
Wales	13	16.7	Occasionally	50	59.5
			Never	23	27.4
Age group of clients with dysphagia	*84*		*Frequency stimuli is used/not used*		
Adults	71	84.5	*in Tx*	*84*	
Children	13	15.5	Frequently	14	16.7
			Occasionally	53	63.1
			Never	17	20.2

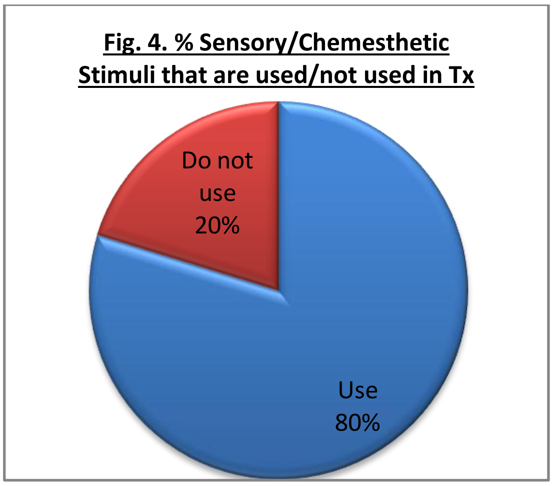
3.3 Sensory/Chemesthetic stimuli

All of the participants (N=84) indicated if they "frequently", "occasionally" or "never" use sensory/chemesthetic stimuli in Ax or Tx of dysphagia clients. The frequencies and percentages of responses indicating their frequency of use of the stimuli are presented in Fig. 1. and Fig. 2. Percentages for "frequently" and "occasionally" were combined into "use" and are presented in Fig. 3. and Fig. 4.









3.4 Demographic Information and the use/non-use of Sensory/Chemesthetic Stimuli

The relationship between demographic information and the frequencies and percentages of the use/non-use of sensory/chemesthetic stimuli will be reported.

3.4a. Dysphagia Experience

The responses between dysphagia experience, use of the stimuli (frequency and percentages) in Ax/Tx and results from Fishers Exact Test are presented in Table. 3. and Table. 4.

Table. 3. Dysphagia Experience: frequency of use of Stimuli in Ax

Dysphagia Experience	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
<5 years	26	3.8	46.2	50	50
5-10 years	25	16	68	84	16
>10 years	33	18.2	63.6	81.8	18.2
p Value (dysphagia experience and use/non-use of the stimuli): 0.036					

Table. 4. Dysphagia Experience: frequency of use of Stimuli in Tx

Dysphagia Experience	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
<5 years	26	11.5	50	61.5	38.5
5-10 years	25	20	68	88	12
>10 years	33	18.2	69.7	87.9	12.1
p Value (dysphagia experience and use/non-use of the stimuli): 0.128					

3.4b. Percentage of Clinical Practice working with Clients with Dysphagia

Table. 5. and Table. 6. indicate the frequency, percentages and test of statistical significance between percentage of clinical practice working with clients with dysphagia and use/non-use of sensory/chemesthetic stimuli in Ax and Tx.

Table. 5. Percentage of Clinical Practice working with clients with Dysphagia: frequency of use of Stimuli in Ax

% clinical practice working with clients with dysphagia	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
<25%	13	0	61.5	61.5	38.5
26-49%	16	18.8	43.8	62.6	37.5
>50%	55	20	69.1	89.1	10.9
p Value (percentage of clinical practice working with clients with dysphagia and use/non-use of the stimuli): 0.154					

Table. 6. Percentage of Clinical Practice working with clients with Dysphagia: frequency of use of Stimuli in Tx

% clinical practice working with clients with dysphagia	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
<25%	13	0	61.5	61.5	38.5
26-49%	16	6.2	50	56.2	43.8
>50%	55	18.2	61.8	80	20
p Value (between percentage of clinical practice working with clients with dysphagia and use/non-use of the stimuli): 0.02					

3.4c. Country of Practice (reduced data group)

The responses among country of practice (reduced data group) and use of the stimuli in Ax/Tx, statistical significance between these variables are presented in Table. 7. and Table. 8.

Table. 7. Country of Practice: frequency of use of Stimuli in Ax

Country of Practice	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
Republic of Ireland	45	11.1	53.3	64.4	35.6
Scotland	20	15	65	80	20
Wales	13	15.4	76.9	92.3	7.7

p Value (between country of practice (reduced data group) and use/non-use of the stimuli): 0.311

Table. 8. Country of Practice: frequency of use of Stimuli in Ax

Country of Practice	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
Republic of Ireland	45	15.6	60	75.6	24.4
Scotland	20	15	70	85	15
Wales	13	15.4	76.9	92.3	7.7

p Value (Fishers Exact Text between country of practice (reduced data group) and use/non-use of the stimuli): 0.755

3.4d. Age Group

Table. 9. and Table. 10. indicate the frequency, percentages and test of statistical significance of use/non-use of sensory/chemesthetic stimuli.

Table. 9. Age Group of Clients with Dysphagia: frequency of use of Stimuli in Ax

Age group of clients with dysphagia	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
Adults	71	15.5	56.3	71.8	28.2
Children	13	0	76.9	76.9	23.1

p Value (between age group use/non-use of the stimuli): 0.315

Table. 10. Age Group of Clients with Dysphagia and the use/non-use of Stimuli in Tx

Age group of clients with dysphagia	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
Adults	71	19.7	60.6	80.3	19.7
Children	13	0	76.9	76.9	23.1

p Value (between age group use/non-use of the stimuli): 0.021

3.4e. Client Group (reduced data group)

The responses between client group (reduced data group) and use of the stimuli in Ax and Tx, statistical significance between these variables are presented in Table. 11. and Table. 12.

Table. 11. Client Group: frequency of use of Stimuli in Ax

Client Group	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
Neurological Disorders	42	19	66.7	85.7	14.3
Disabilities	27	11.1	59.3	70.4	29.6

p Value (Fishers Exact Text between client group (reduced data group) use/non-use of the stimuli): 0.29

Note: Client group was reduced for ease of data analysis into neurological disorders, disabilities, dysphagia post cancer and dementia. 0% of SLTs' (that use the stimuli) had dysphagia post cancer or dementia as their main client group.

Table. 12. Client Group and the use/non-use of Stimuli in Tx

Client Group	*N*	*% Frequently*	*% Occasionally*	*% Total Use*	*% Non-use*
Neurological Disorders	42	23.8	64.3	88.1	11.9
Disabilities	27	14.8	55.6	70.4	29.6

p Value (Fishers Exact Text between client group (reduced data group) use/non-use of the stimuli): 0.164

Note: Client group was reduced for ease of data analysis into neurological disorders, disabilities, dysphagia post cancer and dementia. 0% of SLTs' (that use the stimuli) had dysphagia post cancer or dementia as their main client group.

3.5 Sensory/Chemesthetic Stimuli that are used in Management

The data indicates that SLTs who use the stimuli in Ax, use the same stimuli in Tx. The stimuli utilised are presented in Fig. 5. Fishers Exact Test results between use/non-use of sensory/chemesthetic stimuli in Ax/Tx with each stimulus are presented in Table. 13.

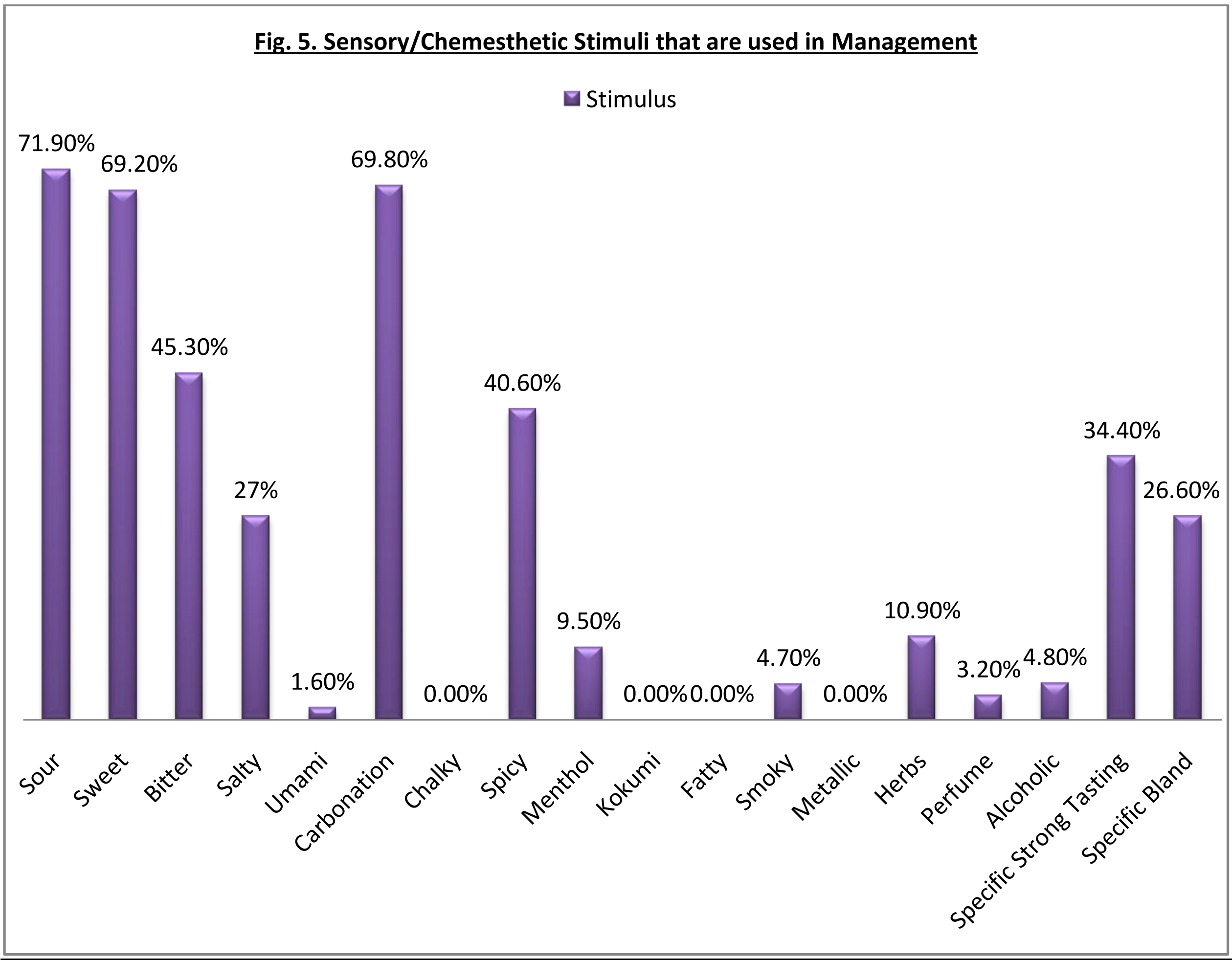
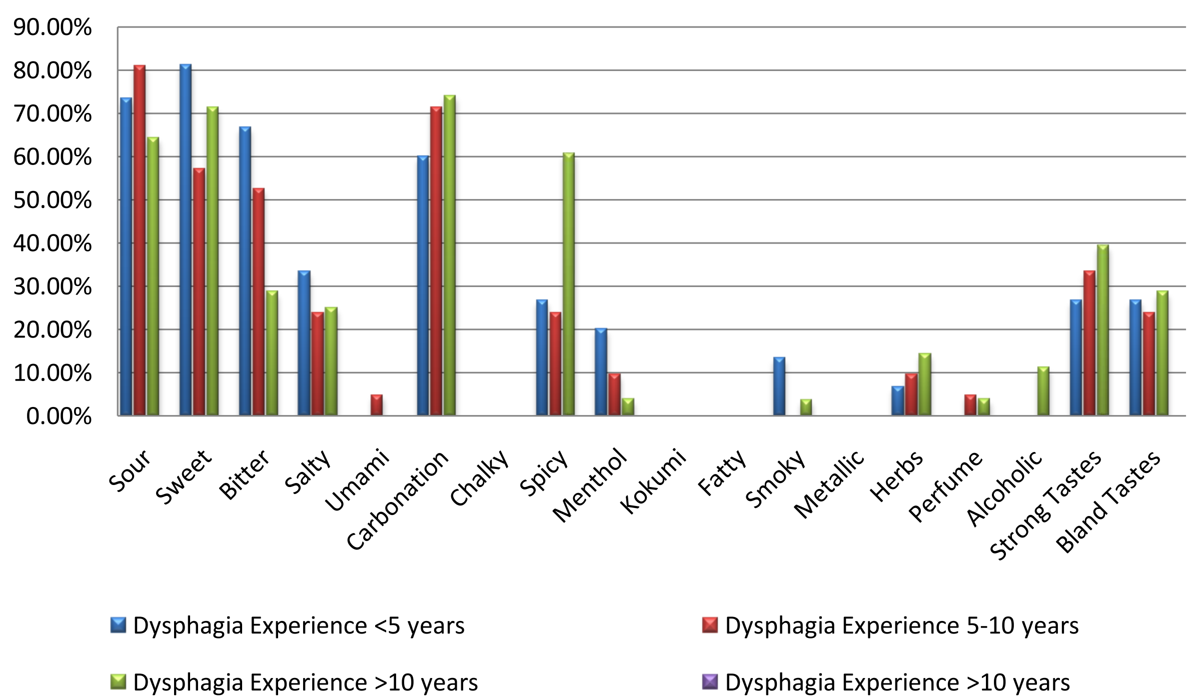


Table. 13. Fishers Exact Test Results: Stimulus and use/non-use of Stimuli in Practice		
Stimulus	***p Value in Ax***	***p Value in Tx***
Sour	0.017	0.153
Sweet	0.186	0.882
Bitter	0.223	0.456
Salty	0.317	1
Umami	1	1
Carbonation	0.095	0.093
Chalky	Could not be computed	Could not be computed
Spicy	0.075	0.859
Menthol	0.507	0.647
Kokumi	Could not be computed	Could not be computed
Fatty	Could not be computed	Could not be computed
Smoky	0.636	0.558
Metallic	Could not be computed	Could not be computed
Herbs	0.664	0.685
Perfume	0.493	0.422
Alcoholic	0.643	0.564
Specific strong tasting	0.914	0.838
Specific bland	0.260	0.809
Note: some p values could not be computed as no SLT used the stimuli in practice		

The relationship between demographic information and stimuli utilised will be presented:

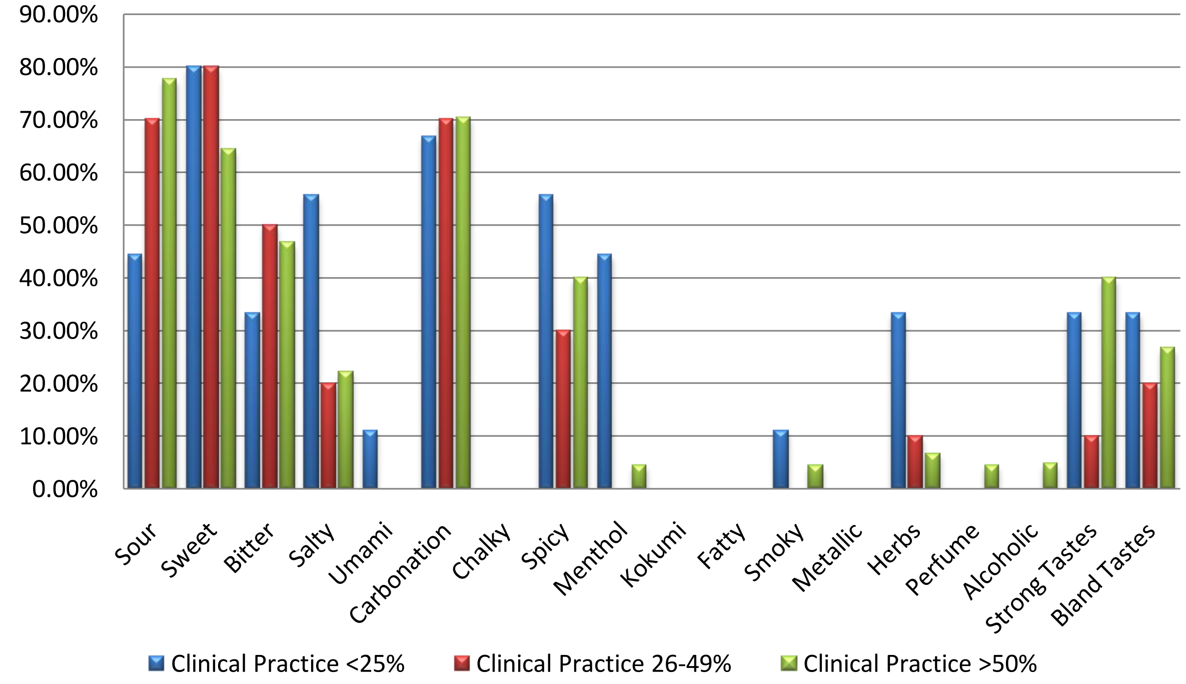
- *Dysphagia Experience:* the percentage of responses within each category and the stimuli utilised are presented in Fig. 6.

Fig. 6. Dysphagia Experience and Stimuli

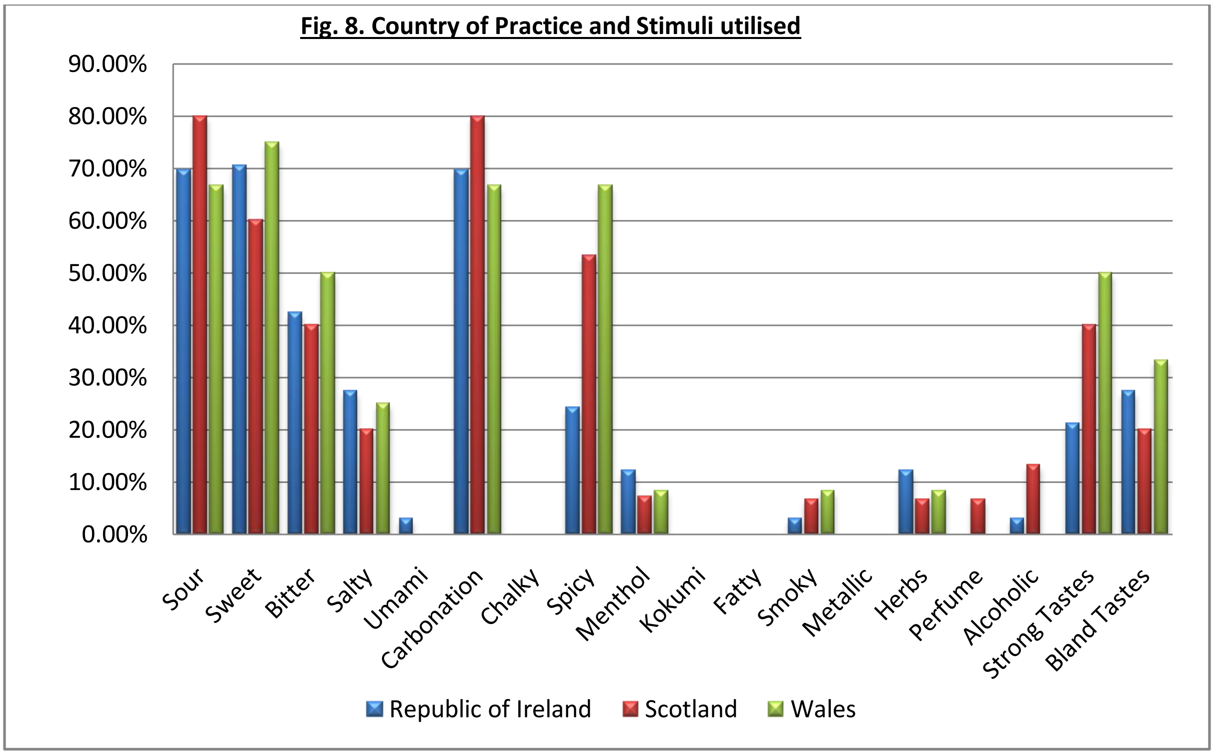


- *Percentage of clinical caseload working with clients with dysphagia:* Fig. 7. indicates SLTs' percentage of clinical practice working with clients with dysphagia and their use of sensory/chemesthetic stimuli.

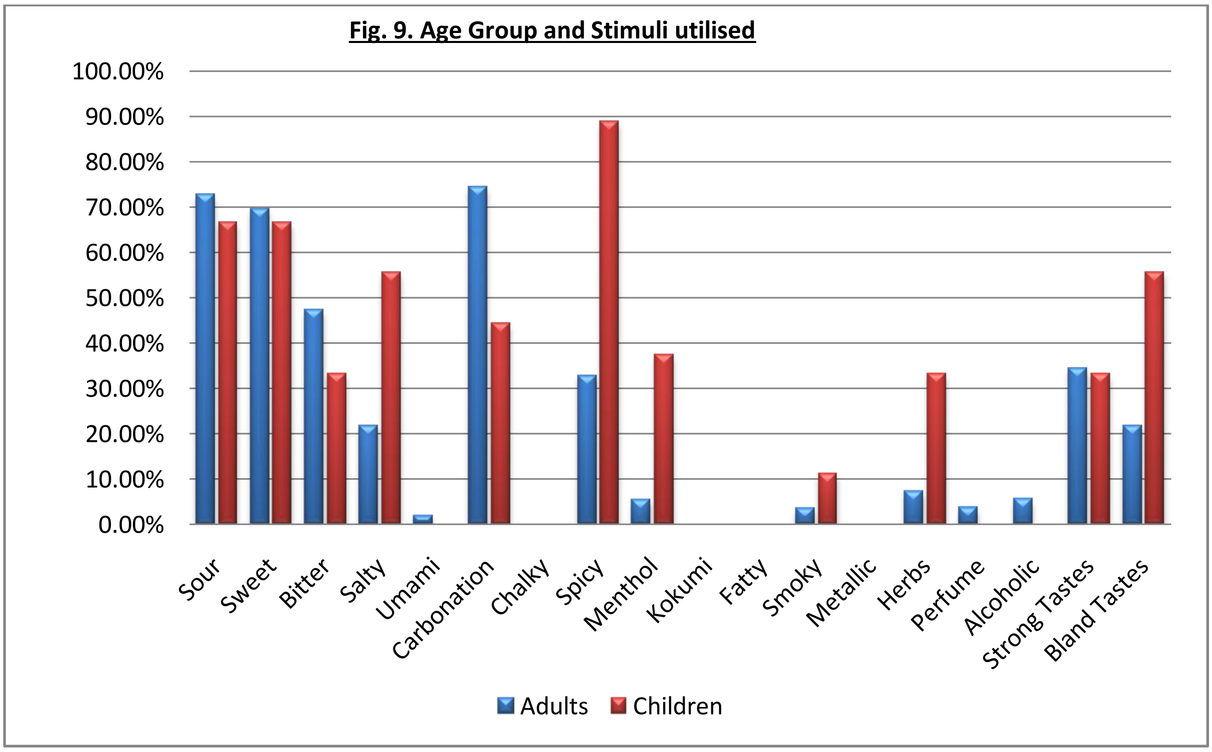
Fig. 7. Percentage of Clinical Practice working with clients with Dysphagia and Stimuli used



- *Country of Practice:* the responses to country of practice and use of the stimuli are presented in Fig. 8.

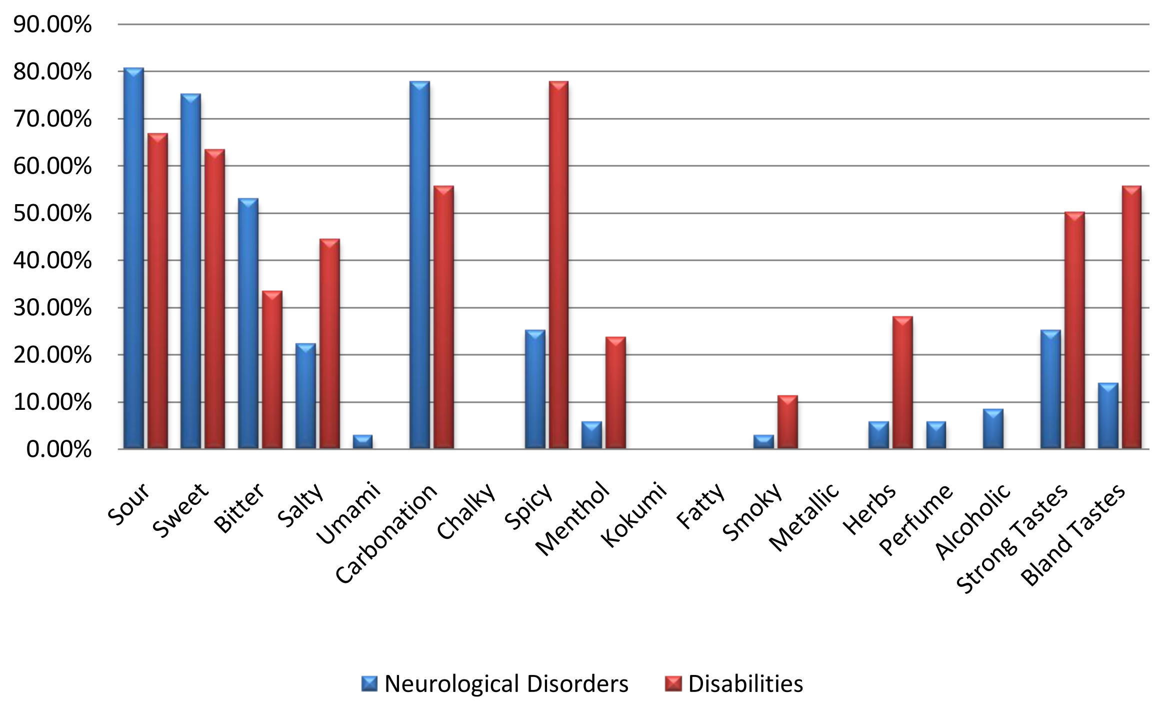


- *Age group:* Fig. 9. presents SLTs' age group and stimuli utilised.



- *Client group:* The responses of SLTs' client group and stimuli used in practice are presented in Fig. 6.

Fig. 6. Client Group and Stimuli utilised



Test of statistical significance (Fishers Exact Test) between demographic information and each stimulus are presented in Table. 14.

Table. 14. Fishers Exact Test: between demographic information and each stimulus

Stimuli	Dysphagia Experience	Clinical Practice	Country of Practice	Age Group	Client Group
Sour	0.463	0.138	0.795	0.703	0.319
Sweet	0.298	0.543	0.75	1	0.37
Bitter	0.039	0.795	0.881	0.494	0.249
Salty	0.818	0.133	0.922	0.048	0.119
Umami	0.571	0.143	1	1	1
Carbonation	0.649	1	0.795	0.114	0.119
Spicy	.019	0.571	0.018	0.002	0.0
Menthol	0.255	0.004	1	0.023	0.076
Smoky	0.166	0.422	0.583	0.37	0.255
Herbs	0.779	0.047	1	0.052	0.034
Perfume	1	1	0.45	1	0.547
Alcoholic	0.246	1	0.25	1	0.543
Strong Tastes	0.707	0.212	0.143	1	0.124
Bland Tastes	0.936	0.824	0.737	0.048	0.003

3.6 Relationship between Stimuli utilised in Practice and SLTs' Personal Preferences to Tastes

Demographic information, use of stimuli in practice and SLTs' personal preferences to tastes are represented in the Tables 15-19:

Table. 15. Dysphagia Experience

Stimuli	*<5 years:% use stimuli*	*<5 years: % love taste*	*5-10 years: % use stimuli*	*5-10 years: % love taste*	*>10 years: % use stimuli*	*>10 years: % love taste*
Sour	73.3	73.3	81	85.7	64.3	65.3
Sweet	81.2	100	57.1	93.8	71.4	100
Bitter	66.7	70	52.4	94.7	28.6	69.2
Salty	33.3	6.7	23.8	20	25	53.8
Umami	0	94.4	4.8	84.6	0	88.2
Carbonation	60	70.6	71.4	75	74.1	76.5
Chalky	0	0	0	62.5	0	20
Spicy	26.7	76.9	23.8	75	60.7	66.7
Menthol	20	94.1	9.5	86.4	3.7	91.7
Fatty	0	44.4	0	50	0	30
Smoky	13.3	84.2	0	88.2	3.6	70
Metallic	0	37.5	0	35.7	0	25
Herbs	6.7	76.9	9.5	100	14.3	82.4
Perfume	0	44.4	4.8	66.7	3.7	57.1
Alcoholic	0	18.8	0	35.3	11.1	13
Strong Tastes	26.7	87.5	33.3	87.5	39.3	83.3
Bland Tastes	26.7	82.4	23.8	94.7	28.6	100

Table. 16. Percentage of Clinical Practice working with clients with Dysphagia

Stimuli	*<25%: use % stimuli*	*<25%: % love taste*	*26-49%: % use stimuli*	*26-49%: % love taste*	*>50%: % use stimuli*	*>50%: % love taste*
Sour	44.4	50	70	50	77.8	81.6
Sweet	80	100	80	100	64.4	97.2
Bitter	33.3	81.8	50	75	46.7	76.2
Salty	55.6	0	20	20	22.2	32.1
Umami	11.1	100	0	80	0	89.7
Carbonation	66.7	66.7	70	85.7	70.5	73.5
Chalky	0	25	0	0	0	35.3
Spicy	55.6	80	30	56.6	40	75.9
Menthol	44.4	77.8	0	100	4.5	90.5
Fatty	0	33.3	0	25	0	45
Smoky	11.1	70	0	83.3	4.4	82.4
Metallic	0	37.5	0	40	0	27.8
Herbs	33.3	100	10	81.8	6.7	85.2
Perfume	0	50	0	25	4.5	61.8
Alcoholic	0	25	0	18.2	4.8	21.6
Strong Tastes	33.3	88.9	10	90.9	40	83.3
Bland Tastes	33.3	100	20	87.5	26.7	92.1

Table. 17. Country of Practice						
Stimuli	*Ireland: % use stimuli*	*Ireland: % love taste*	*Scotland: % use stimuli*	*Scotland: % love taste*	*Wales: % use stimuli*	*Wales: % love taste*
Sour	69.7	75	80	78.6	66.7	70
Sweet	70.6	96.4	60	100	75	100
Bitter	42.4	85.7	40	66.7	50	57.1
Salty	27.3	20.8	20	50	25	33.3
Umami	3	90	0	80	0	100
Carbonation	69.7	82.8	80	62.5	66.7	77.8
Chalky	0	45.5	0	0	0	20
Spicy	24.2	70	53.3	90	66.7	55.6
Menthol	12.1	87.5	7.1	93.8	8.3	100
Fatty	0	44.4	0	25	0	50
Smoky	3	75.9	6.7	86.7	8.3	87.5
Metallic	0	35.7	0	38.5	0	20
Herbs	12.1	95	6.7	85.7	8.3	75
Perfume	0	54.5	6.7	58.3	0	60
Alcoholic	3	33.3	13.3	14.3	0	10
Strong Tastes	21.2	88	40	75	50	100
Bland Tastes	27.3	96.4	20	100	33.3	88.9

Table. 18. Age Group				
Stimuli	*Adults: % use stimuli*	*Adults: % love taste*	*Children: % use stimuli*	*Children: % love taste*
Sour	72.7	72.9	66.7	75
Sweet	69.6	97.9	66.7	100
Bitter	47.3	79.2	33.3	66.7
Salty	21.8	25	55.6	33.3
Umami	1.9	92.7	0	71.4
Carbonation	74.4	73.3	44.4	80
Chalky	0	28.6	0	25
Spicy	32.7	74.4	88.9	50
Menthol	5.5	92.4	37.5	81.8
Fatty	0	43.5	0	25
Smoky	3.6	81.2	11.1	75
Metallic	0	29.8	0	42.9
Herbs	7.3	85	33.3	100
Perfume	3.7	59.5	0	40
Alcoholic	5.60	22.9	0	12.5
Strong Tastes	34.5	86.4	33.3	83.3
Bland Tastes	21.8	91.5	55.6	100

Table. 19. Client group				
Stimuli	*Neurological Disorders: % use stimuli*	*Neurological Disorders: % love taste*	*Disabilities: % use stimuli*	*Disabilities: % love taste*
Sour	80.6	65.5	66.7	84.6
Sweet	75	100	63.2	100
Bitter	52.8	80.6	33.3	73.9
Salty	22.2	23.8	44.4	30
Umami	2.8	87	0	87.5
Carbonation	77.8	69.2	55.6	80
Chalky	0	25	0	12.5
Spicy	25	71.4	77.8	76.9
Menthol	5.6	93.9	23.5	85.7
Fatty	0	56.2	0	14.3
Smoky	2.8	86.2	11.1	77.8
Metallic	0	40.7	0	17.6
Herbs	5.6	84	27.8	90.9
Perfume	5.6	58.3	0	44.4
Alcoholic	8.3	18.8	0	26.7
Strong Tastes	25	84	50	87.5
Bland Tastes	13.9	93.8	55.6	100

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4.0 Discussion

This study investigated the use of sensory/chemesthetic stimuli among SLTs in the UK and Ireland. The findings of this survey found there are a number of factors that contribute to the use of these stimuli. This discussion will focus on the following: techniques used in practice, demographic information, stimuli utilised, relationship between SLTs' personal preferences to tastes and the tastes used in practice, analysis of study design and conclusion.

4.1 Techniques used in Practice

In the survey there was an introduction question regarding the use of bolus modification; this was not the research goal. The question was posed as previous research indicates it is widely used in practice (McCurtin 2012). From the data in this study bolus modification remains to be widely utilised; this indicates there remains to be a strong cultural trend in the use of bolus modification in clients with oropharyngeal dysphagia. The focus of this research paper is the practice behaviours of SLTs' with their utilisation of sensory/chemesthetic stimuli.

In general there is relatively a high percentage of SLTs that use sensory/chemesthetic stimuli in practice. The findings from this study indicate that there is unity among SLTs regarding the use of sensory/chemesthetic stimuli. This consistency among SLTs' decision making contradicts previous research (Archer et al 2013; Bateman et al 2007; Krisciunnas et al 2012; Martino and Diamant 2004; Mathers-Schmidt and Kurlinski 2003; McCullough et al 1999; Pettigrew and O'Toole 2007). The data signifies that SLTs must find sensory/chemesthetic stimuli effective in the management of clients with dysphagia. These stimuli have been found to facilitate a swallow (Krival and Bates 2012). The theory surrounding these stimuli is that they activate the sensory pathways that triggers the neuromotor response of a swallow (Kajiia et al 2012; Krival and Bates 2012; Logemann et al 1995; Michou et al 2012, Moritaka et al 2012).

4.2 Demographic Information

SLTs' demographics influenced the use/popularity of sensory/chemesthetic stimuli:

- SLTs' with >5 years experience and 50% of their caseload working with clients with dysphagia are more likely to use the stimuli. These results indicate these SLTs' may be more confident with their skills and abilities, therefore they implement sensory/chemesthetic stimuli in management.

- Between the countries (Republic of Ireland, Scotland and Wales) there were relatively high rates of sensory/chemesthetic stimuli use. The utilisation of the stimuli was most popular in Wales. SLTs' from Wales that responded may have a high interest in this topic. It also may be influenced by the level of SLTs training or the protocols in their clinical setting.

- The use of sensory/chemesthetic stimuli are similar between adults and children in the data. Interestingly no SLT frequently uses sensory/chemesthetic stimuli in management of children. From the literature review children were not included in research.

- Sensory/chemesthetic was highly utilised with clients with neurological disorders and disabilities. SLTs that indicated they treated clients with dysphagia post cancer and dementia as their main client group did not utilise this therapy technique. the majority of SLTs treated more than one client group. SLTs' main client group was taken into account in the study.

4.3 Stimuli Utilised

The same stimuli were utilised in Ax and Tx. Demographic data was compared to each stimulus to investigate if there were factors that influenced their use:

- *Dysphagia Experience*: Sweet and carbonation were popular to use in the three groups (<5 years, 5-10 years and >10 years dysphagia experience). Bitter was a stimuli that was popular to use in SLTs with <5 and 5-10 years experience. Spicy was popular to use in SLTs with >10 years experience.

- *Percentage of clinical caseload working with clients with dysphagia:* Sour, sweet, spicy and carbonation were popular stimuli high utilised between groups (<25%, 36-49%, >50%). SLTs with <25% of their caseload working with clients with dysphagia also use salty and menthol. Bitter is popular to use with SLTs that have 26-49% and >50% of their caseload working with clients with dysphagia.

- *Country of Practice:* Sweet and sour are popular stimuli to use in the Republic of Ireland, Scotland and Wales. Carbonation is used by SLTs in Ireland and Wales. Bitter is popular to use in Ireland and Scotland. Spicy and specific strong tasting are used in Scotland and Wales. Salty is popular to use in Ireland.

- *Age group:* Carbonation, sour and sweet are popular to use in adults and children. Bitter and specific strong tasting stimuli are popular to use with adults. Spicy and salty used with children.

- *Client group:* Sour, carbonation, sweet and spicy are popular to use in clients with neurological disorders and disabilities. Bitter is used in client with neurological disorders. Specific bland tastes are popular to use in clients with disabilities.

It is clear that SLTs that use sensory/chemesthetic stimuli, are aware of the literature surrounding these stimuli as the majority of the most popular tastes (bitter, carbonation, salty, sour, spicy and sweet) utilised have research support (Bülow et al 2003; Cola et al 2010; Cola et al 2012; Ebihara et al 2006; Kajiia et al 2002; Krival and Bates 2012; Logemann et al 1995; Michou et al 2012; Moritaka et al 2013; Pelletier and Dhanaraj 2006; Sdravou et al 2012;). The other most popular stimuli used were: specific strong tasting or specific bland; to my knowledge these type of stimuli do not have research support.

4.4 SLTs' Personal Preference to Tastes and Tastes used in Practice

Taste is a motivator of food acceptance and aversion in the non-dysphagia population (Feeney et al 2010). One might assume the use of tastes in practice reflects SLTs' personal preferences to tastes. Demographic information was compared to stimuli used in practice and their personal feelings towards a taste:

- *Dysphagia experience:* Stimuli highly used in practice had the majority of SLTs that loved the taste.

- *Clinical practice:* Findings indicate the most popular stimuli used between groups have high preference ratings among SLTs. However over half of SLTs' with <25% of clinical practice working with client with dysphagia use the stimulus salty. No SLTs in this group loved the taste salty.

- *Country of practice:* Stimuli highly used in practice in this category had high preference ratings.

- *Age group:* Stimuli that are most popular to use in practice between these groups have the majority of SLTs that love the taste. There is one exception-salty. Over half of SLTs use the stimuli salty in practice however only one third of SLTs love the taste.

- *Client group:* Stimuli that are most popular to use between groups have the majority of SLTs that love the taste.

In all groups there are a number of stimuli that SLTs rated as loving the taste however they were not used in practice such as menthol, umami, herbs and smoky.

There is not a strong correlation between stimuli used in practice and SLTs that loved the taste. Interestingly the tastes with most research support had a high percentage of SLTs that loved the taste. The lack of relationship is evident as SLTs loved other tastes and these had low use in practice. This could reflect client centred practice. SLTs implement a Tx programme that is suitable and proven to be safe for the client and has evidence base to support its use in practice.

<u>4.5 Analysis of Study Design</u>

There were a number of limitations to the study:

- Low response rate and major imbalance between the residence of the survey takers. These limitations indicate that the results do not confirm the level sensory/chemesthetic stimuli are utilised in practice. It is clear from the data that one gatekeeper did not distribute the email. Another factor that may contribute to the low response rate is the title of the survey may have discouraged participants; they may not have found this topic interesting.

- Method of distributing the survey was not effective; non-response error is present in the data. It was assumed an electronic survey would easily enrol participants. Face-to-face or telephone interviews have been found to be the most effective method to avoid non-response errors (Visser et al 2000). The method chosen was the best available as it was low cost, easy to develop, more than one box could not be ticked (this problem occurred in a survey by Pettigrew and O'Toole (2007)), easy access (SLTs' all over Ireland and the UK were contacted) and data was returned as soon as the survey was complete.

- Bias exist as data errors are present (SLTs that did not respond to the survey may have a different answer to those who responded to the survey).

- The design of answers to question two may have caused confusion. If an SLT had five years experience they could have said they had 'less than 5 years' or 'between 5 to 10 years'. If an SLT had ten years experience they could have said they had 'between 5 to 10 years' and 'more than 10 years'. A number of colleagues should have been asked to review the survey to establish its clarity before it went live.

- The final section of the survey is subjective. This could not be resolved as the perception of taste is unique to each individual.

4.6 Conclusion

The findings from this study are focused on the use of sensory/chemesthetic stimuli in oropharyngeal dysphagia. The results indicate there is unity among SLTs regarding the use of these stimuli. This study highlighted the extent sensory/chemesthetic stimuli are utilised and the factors that contributed to their use.

Upon reviewing the literature and conducting this research there are a number of topics in need for future research:

- Strong evidence is lacking in the use of sensory/chemesthetic stimuli in the dysphagia population. The majority of research is focused on healthy individuals. Longitudinal studies focusing on the effect of sensory/chemesthetic stimuli at rehabilitating clients with oropharyngeal dysphagia is required.

- Randomised control trials investigating sensory/chemesthetic stimuli are required for further research. Dysphagia populations should be included in these studies to determine best practice for this population.

- If results from the control trials find sensory/chemesthetic stimuli are significant: optimal frequency and intensity of sensory/chemesthetic Tx is warranted in future studies.

- A robust survey scoping SLTs use of sensory/chemesthetic stimuli is warranted.

There is a place for the use of sensory/ chemesthetic stimuli in the management of clients with oropharyngeal dysphagia. Research surrounding the efficacy of sensory/chemesthetic stimuli is persuasive and continuing to develop. By offering clients with dysphagia more tastes, it may help them receive their daily nutritional intake and maintain their weight. These factors will contribute to a clients overall wellbeing.

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Appendix A: Survey

1. First, tell us how many years have you worked as a speech and language therapist?
    - ☐ Less than 5 years
    - ☐ Between 5 to 10 years
    - ☐ More than 10 years

2. How many years have you worked with clients with dysphagia?
    - ☐ Less than 5 years
    - ☐ Between 5 to 10 years
    - ☐ More than 10 years

3. What percentage of your clinical practice is spent working with clients with dysphagia?
    - ☐ Less than 25%
    - ☐ Between 26%-49%
    - ☐ More than 50%

4. In which country do you practice?
    - ☐ England
    - ☐ Northern Ireland
    - ☐ Republic of Ireland
    - ☐ Scotland
    - ☐ Wales

5. Which age group does your clinical dysphagia work mostly involve:
    - ☐ Adults
    - ☐ Children

6. Please identify the main dysphagia client group you work with:
    - ☐ Acquired neurological disorders
    - ☐ Autism spectrum disorders
    - ☐ Dysphagia post cancer
    - ☐ Intellectual disabilities
    - ☐ Physical disabilities
    - ☐ Profound and multiple disabilities
    - ☐ Progressive neurological disorders
    - ☐ People with dementia

7. If you work frequently and equally with more than one client group, identify those groups here:

8. Bolus modification is defined as "an approach that amounts to adjusting parameters such as viscosity, volume, temperature, and/or acidity of the bolus" (Speyer et al 2010). When assessing clients with dysphagia, do you use bolus modification techniques?
   - ▢ Frequently
   - ▢ Occasionally
   - ▢ Never

9. When treating clients with dysphagia, do you use bolus modification techniques?
   - ▢ Frequently
   - ▢ Occasionally
   - ▢ Never

10. Chemesthetic refers to the chemical properties of a stimulus. Examples include "the sensation of carbonation in a soft drink, the hotness of a chilli or the coolness of menthol" (Pelletier and Dhanaraj 2006). Sensory refers to the sensory properties of a stimulus. Examples include the bitterness of coffee and the sourness of lemon. When assessing clients with dysphagia, do you sensory and/or chemesthetic stimuli?
    - ▢ Frequently
    - ▢ Occasionally
    - ▢ Never

11. When treating clients with dysphagia, do you use sensory and/or chemesthetic stimuli?
    - ▢ Frequently
    - ▢ Occasionally
    - ▢ Never

12. Which sensory or chemesthetic stimuli do you use in assessing and/or treating clients with dysphagia? Tick the yes or no box.
    - ▢ Sour tastes
    - ▢ Sweet tastes
    - ▢ Bitter tastes
    - ▢ Salty tastes
    - ▢ Umami tastes
    - ▢ Carbonation

- ☐ Chalky flavours
- ☐ Spicy flavours
- ☐ Menthol flavours
- ☐ Kokumi flavours
- ☐ Fatty tastes
- ☐ Smoky tastes
- ☐ Metallic tastes
- ☐ Herbs
- ☐ Perfumes foods
- ☐ Alcoholic flavours
- ☐ Specific strong tasting or pungent food
- ☐ Specific bland or neutral flavoured foods

13. If you use sensory or chemesthetic stimuli in your management of dysphagia, please tell us why you use such techniques (max 400chars).

14. If you do not use sensory or chemesthetic stimuli in your management of dysphagia, please tell us why you do not use such techniques (max 400chars).

15. Tell us what you personally think of the foods and flavours below 2.
    - ☐ Fudge
    - ☐ Raw garlic
    - ☐ Black pepper
    - ☐ Cooking oil
    - ☐ Tonic water
    - ☐ Soy sauce
    - ☐ Raw thyme
    - ☐ Raw onion
    - ☐ Smoky bacon
    - ☐ Plain pasta
    - ☐ Raw ginger
    - ☐ Gouda cheese
    - ☐ Rosewater
    - ☐ Raw fennel

2 Participants clicked a box to indicate their preference for the taste. They choose between the following: love it, hate it, neither love it nor hate it and never tried it/don't know.

- [ ] Whiskey
- [ ] Mints
- [ ] Red meat cooked rare
- [ ] Cream
- [ ] Pure lemon juice
- [ ] Maple syrup
- [ ] Seaweed
- [ ] Dark chocolate
- [ ] Walnuts
- [ ] Liver
- [ ] Strong goats cheese
- [ ] Cumin
- [ ] Smoked teas e.g. lapsang suchong
- [ ] Water
- [ ] Vanilla
- [ ] Rosemary
- [ ] Non-flavoured antacids e.g. rennies
- [ ] Vodka
- [ ] Unsalted margarine
- [ ] Raw jalapeno pepper
- [ ] Natural yoghurt
- [ ] Sparkling water
- [ ] Beer
- [ ] Plain porridge
- [ ] Table salt
- [ ] Vinegar
- [ ] Parmesan cheese
- [ ] Coffee granules
- [ ] Lavender oil
- [ ] Raw parsley
- [ ] The herb mint
- [ ] Kidney beans
- [ ] Chilli powder
- [ ] Mackerel
- [ ] Smoked salmon
- [ ] Soda water
- [ ] Minty chewing gum e.g. airwaves
- [ ] Hard meringue
- [ ] Seawater
- [ ] Sugar

Appendix B Email to Gatekeeper

Dear *(name of gatekeeper),*

I am an MSc Speech and Language Therapy Student. My fellow students and I are carrying out a study. We were told that you are the gatekeeper for x (name of SIG).

We are MSc students from the University of Limerick who are conducting some research on sensory and chemesthetic stimuli in the treatment of oropharyngeal dysphagia under the supervision of Ms Arlene Mc Curtain. To participate you must be a speech and language therapists who works with clients with dysphagia/eating, drinking and swallowing problems. As part of this research we are interested in finding out what dysphagia clinicians are doing in this area.

The name of the study is: 'the use of sensory and chemesthetic stimuli in the treatment of oropharyngeal dysphagia: scoping practice in the UK and Ireland'. The study involves a short electronic survey that takes 10 minutes to complete. Contribution will remain anonymous at all stages of the process. The survey has 3 parts: some demographic questions, questions about your clinical practice in this area and a final question about personal preferences to tastes.

If you are interested in taking part in this study I will email you a link with the survey. We would be very grateful if you could pass the link onto your members.

If you have any questions regarding the study before you accept or reject participation please do not hesitate to contact me via email or my supervisor Dr Arlene McCurtin 00353*********(telephone number).*

We would be grateful for you and your members input,
Yours sincerely,
Mairéad Felle