Non-speech oro-motor exercise use in acquired dysarthria management: regimes and rationales.

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Abstract

Background: Non-speech oro-motor exercises (NSOMExs) are described in speech and language therapy (SLT) manuals, and are thought to be much used in acquired dysarthria intervention, though there is no robust evidence of an influence on speech outcome. Opinions differ as to whether, and for which dysarthria presentations, NSOMExs are appropriate.

Aims: The investigation sought to collect development phase data, in accordance with the Medical Research Council evaluation of complex interventions. The aims were to establish the extent of NSOMExs use in acquired disorders, the exercise regimes in use for dysarthria, with which dysarthric populations, and the anticipated clinical outcomes. A further aim was to determine the influencing rationales where NSOMExs were or were not used in dysarthria intervention.

Methods & Procedures: SLTs throughout Scotland, Wales and Northern Ireland, working with adult acquired dysarthria, were identified by their service heads. They received postal questionnaires comprising 21 closed and two open questions, covering respondent biographics, use of NSOMExs, anticipated clinical outcomes, and practice influencing rationales.

Outcome & Results: One hundred and ninety one (56% response) completed questionnaires were returned. Eighty-one per cent of respondents used NSOMExs in dysarthria. There was no association with years of SLT experience. Those who used and those who did not use NSOMExs provided similar influencing rationales, including evidence from their own practice, and Higher Education Institute (HEI) teaching. More experienced SLTs were more likely than those more recently qualified to be guided by results from their own practice. Input from the attended HEI

was more influential for those less experienced than for those more experienced. Clinical outcome aims were not confined to speech, but included also improvements in movement, sensory awareness, appearance, emotional status, dysphagia and drooling. NSOMExs were used with many neurological disorders, especially stroke, all dysarthria classes, especially flaccid, and all severity levels. Tongue and lip exercises were more frequent than face, jaw and soft palate. The most common regimes were 4-6 repetitions of each exercise, during three practice periods daily, each of 6-10 minutes.

Conclusions & Implications: NSOMExs are a frequent component of dysarthria management in the UK devolved government countries. This confirmation, along with the details of SLT practice, provides a foundation for clinical research which will compare outcomes for people with dysarthria, whose management includes and does not include NSOMExs. SLT practice may be guided by evidence that speech outcome is or is not affected by NSOMExs

Introduction

Many dysarthria treatment manuals include movement exercises for the oral speech muscles, principally the tongue and lips (Robertson and Thomson 1987, Swigert 1997, Kaye 2000, Sugden –Best 2002). These non-speech oro-motor exercises (NSOMExs), also known as speech mechanism exercises (Hustad and Weismer 2007), or subsumed within the broader category of neuromuscular treatments (Clark 2003), appear to have a long tradition in speech and language therapy (SLT) practice. Publications in English, recommending and explaining NSOMExs for people with acquired dysarthria, date from around 1940 (Robbins 1940, Froeschels 1943). As is the case for many SLT treatments, no robust evidence base supports the use of NSOMExs in acquired dysarthria (Clark 2003). Moreover, there is ongoing debate as to whether the movement basis for such exercises is relevant to speech (Weismer 2006).

The rationale for NSOMExs is that these will increase levels of tension, endurance and power of weak muscles, for example of the tongue (Clark 2003). Establishing that weakness is actually present is seriously hindered by its clinical evaluation being almost always subjective, lacking normative reference data and demonstrated reliability, and involving activities which are not used in speech, such as pushing the tongue into the cheek,. An additional reservation is that physiological capacity in healthy individuals far exceeds speech requirements, so strength may not be a useful measure for predicting speech capacity (Kent 2009). Research using laboratory procedures for example the Iowa Oral Performance Instrument (Blaise Medical Inc), indicates that significant deficit in muscle strength may accompany normal speech (Rosenbek and Jones 2009). Wieismer's review (2006) of the literature shows little or

no relationship between NSOM performance and speech severity, thus demonstrating that extent of speech involvement cannot be predicted from weakness assessment. Therefore even if weakness can be reliably demonstrated in speech musculature, the assumption that this causes dysarthria is not valid.

Those who advocate widespread use of NSOMExs think that they form an important foundation for speech, and lead to enhancement of speech (Dworkin 1991, Kearns and Simmons 1998). Speech is regarded as a motor skill which can be reduced to components, as distinct from the view that speech is a highly specific activity, in respect of its motor control. Froeschels (1943), one of the early proponents of this approach, cautioned against initiating speech exercises in dysarthria 'before the best possible training of the muscles involved has been achieved', because to contravene this 'rule' 'might increase the unbalanced condition' (Froeschels 1943, P313). Some authors adopt a more cautious approach, believing NSOMExs to be relevant only to the most severely impaired patients (Darley, Aronson and Brown 1975), and used 'as a last resort' (Rosenbek and Jones 2009, P281). Rosenbek and Jones (2009) conclude that oral non- speech drills cannot be justified: 'Practice wagging your tongue and this skill will improve…..but speech will be uninfluenced.' (P271).

Some writers judge NSOMExs to be appropriate only for particular classes of dysarthria, but there is no consensus as to the relevant diagnostic groups. For Duffy (2005), these are flaccid, spastic, unilateral upper motor neurone and hypokinetic dysarthrias, and within these, only for occasional cases. Zraick and LaPointe (2009) include hyperkinetic conditions. Murdoch, Ward and Thodoros (2009) exclude

spastic dysarthria, because of the increased muscle tone which may be exacerbated by quick movements, and Rosenbek and Jones (2009) exclude hyperkinetic, hypokinetc and ataxic groups, because of disco-ordination and impaired timing. Cannito and Marquardt (2009) however include ataxic dysarthria, where significant hypotonia and weakness are present.

Intervention studies where NSOMExs have been used are few, and provide no conclusive support for their place in dysarthria management**.** Two studies report on small groups of participants who had dysarthria resulting from stroke. Ray (2002) demonstrated significant increases in single word intelligibility, but not in sentence or conversational intelligibility, following a programme of NSOMExs. Robertson (2001) reported score gains on a dysarthria assessment, in the majority of participants, following a therapy programme which included both oro-motor exercises and speech practice. The contribution of non-speech exercises to this outcome cannot be determined.

A questionnaire study carried out in the USA by Gerratt, Till, Rosenbek, Wertz and Boysen (1991) showed that non speech manoeuvres are a frequent and valued component of dysarthria assessment. NSOMExs are reported to be currently in wide clinical use with the dysarthria population (Duffy 2007, Palmer and Enderby 2007), but there are no published data on for what reasons NSOMExs are used, how extensive this use is, and in what circumstances. Between 71.5% and 85% of clinicians use NSOMExs in therapy aimed at improvement of children's speech, and here too there is no demonstrated therapeutic effectiveness (Lof 2008). Despite the reservations of some leading authorities, and the lack of evidence, clinicians appear to

believe NSOMExs are beneficial, perhaps giving undue credence to literature which confirms their own hypotheses (McCauley 2001). In all clinical fields, published protocols for intervention, which busy therapists can use without the need for time demanding preparation, tend to be well received, and many exercise lists are readily available. Clinicians will be guided also by results of their own practice, and are likely to use techniques they consider to have been beneficial to individual patients.

Because of their apparent pervasive use in acquired dysarthria, Duffy (2007) rates the resolution of the debate about the efficacy of oro-motor exercises as an intervention research priority. In the long-term, the central research question is whether outcome differs for those dysarthric patients who receive NSOMExs as part of their intervention, and those who do not. Consistent with the development phase in the Medical Research Council recommended phases of evaluation of complex interventions (Craig, Dieppe, Macintyre, Mitchie, Nazareth and Petticrew 2008), we sought to establish the extent of, and rationale for, use of NSOMExs, the exercise regimes in use, the dysarthric populations with whom the exercises are used, and the anticipated clinical outcomes. The investigation was concerned with SLTs' use of active exercises for the oral speech organs, and did not include the use of passive exercises, for example stretching carried out by the clinician, massage, tapping or vibration, or the application of physical agents, such as cold or heat (Clark 2003). Syllable repetition quasi-speech tasks (alternatively known as diadochokinesis, or alternating motion rate) were also excluded from study, as were exercises for the phonatory and respiratory mechanisms.

Method

Through personal contact with all relevant SLT service heads, throughout Scotland, Wales and Northern (N) Ireland (the three countries of the United Kingdom with devolved governments), the numbers of SLTs whose remit included adults with acquired dysarthria was established. Individual questionnaires for these SLTs, information about the Project and postage paid envelopes, for return to the research team were supplied to the service heads, for distribution. The information explicitly stated that speech difficulty resulting from surgery or other treatments for cancer was not relevant. Inducements were not offered. No identifying information was requested and geographical anonymity was ensured by the removal of questionnaires from return envelopes, prior to being passed for processing. An additional letter and response form invited respondents to signal their interest in future plans for a clinical investigation, using a separate response addressed envelope. A questionnaire return date of around three weeks was requested. Just prior to this date, and also two weeks later, e mail reminders were sent to the distributors.

Questions on the following were included in the questionnaire:

Biographical: years since SLT qualification; years of practice; higher education institution (HEI) at which SLT qualification was obtained; current main work settings.

Use of exercises: whether NSOMExs are or would be used in management of dysarthria, apraxia of speech and dysphagia (the present/conditional tense verb aimed to exclude responses where NSOMExs may have been used previously but are no longer used).

Dysarthria management rationale: influencing factors for use of NSOMExs, and clinical outcomes anticipated; influencing factors for not using NSOMExs.

For those responding they do or would use NSOMExs in dysarthria:

Dysarthria management categories: with which neurological diagnostic groups, dysarthria types, severities and stages (definitions were supplied for severities and stages: see appendix 1a and 1b).

Dysarthria management regime: involving which anatomical structures, typical recommendations re number of exercise repetitions, frequency and length of practice; sources of exercises; use of written information and sources for this.

There were 21 closed questions (reduced to eight for respondents who did not use NSOMExs), specifying yes/no responses, or selection from lists, some of which required one option, and others selection of all options applicable. Additionally there were two open questions (HEI attended, and clinical outcome(s) anticipated). Piloting of a draft questionnaire indicated a completion time of between five and 15 minutes.

Responses to closed questions, and the open question on HEI attended, were entered on an SPSS (version 16) database. Descriptive statistics were calculated for all questions, and chi-square analyses were carried out to examine associations between some variables. The respondent population was fairly equally divided between 10 or fewer years of experience and 11 or more years, and in examining association between experience length and practice influencing variables, two groups were accordingly formed. Exact rather than asymptotic significance was calculated for examination of the group who did not use NSOMExs, as this numbered less than 50. Responses to the open question on the clinical outcomes aimed for were listed and examined for recurring themes.

Results

A total of 341 questionnaires were sent to service heads (Scotland: 208, Wales: 99, N Ireland: 34), in response to the staffing estimates received. One hundred and ninety-one (56%) completed questionnaires were returned.

Biographical details: Years since qualification and years of experience were very similar, so only experience years are reported. Thirty per cent of respondents had 11-20 years of experience. This was the highest response category, followed by 21 or more years (23%). The remaining categories of 1-2, 3-5 and 6-10 years were respectively 14%, 18% and 16%, so almost half of the responding dysarthria workforce had 10 or fewer years of experience. Seventy-two per cent of respondents had obtained their qualification from one of the four HEIs offering courses preparatory to entry to the SLT profession in the distribution area. Most other UK institutions which provide courses were represented, as were a few non-UK institutions. Main work settings were acute care (60%), out patient facility (51%), in patient rehabilitation (50%), domiciliary (46%), care home (34%), hospital day care (25%) and hospital long term care (19%). Many respondents selected more than one category.

Use of exercises:

Eighty-one per cent of respondents used NSOMExs in dysarthria, and 19% did not. There was no association with years of SLT experience ($\chi 2$ (4) = 2.60, n.s). Use of NSOMExs in dysarthria was examined in relation to the four main HEIs attended. There was no association between use and HEI ($\chi 2$ (3) = 0.34, n.s). Use of NSOMExs in dysarthria was further examined in relation to main work settings. A significant association was present for *in-patient rehabilitation* ($\chi 2$ (1) = 3.91, $p < 0.05$), and a

strong trend was present in respect of *domiciliary* ($\chi 2$ (1) = 3.18, p = 0.07). Those SLTs with in-patient rehabilitation as main work setting were more prone to use NSOMExs than those for whom this was not a main work setting, and there was an indication that there may be a similar relationship in respect of domiciliary work. Acute-care and out-patient facilities as main work settings were not associated with use or otherwise of NSOMExs (acute care: $\chi 2$ (1) = 0.16, n.s; out-patient: $\chi 2$ (1) = 1.04, n.s.).

Eighty seven per cent of respondents used NSOMExs with dysphagia, 10% did not and 3% did not respond. For apraxia of speech (AOS), 38% used NSOMExs, and 62% did not. Of those who used NSOMExs in dysarthria, 94% did so also in dysphagia, and 42% in AOS. Seventy two per cent of those who did not use NSOMExs in dysarthria did use them in dysphagia and 17% in AOS. Cross tabulations of NSOMExs use in dysarthria with dysphagia and AOS are given in table 1.

table 1 about here

Dysarthria management rationale

Agreement with 12 options offered as rationales for using NSOMExs ranged from 8 - 63% (see figure 2). Many respondents selected several options. The main influences on decision to use NSOMExs in dysarthria were *evidence from own practice*, and *discussion with colleagues*, both cited by over 60%. Other common influences, all with over 40% response, were *patient expectations*, *HEI SLT education*, *SLT tradition*, *observation of other SLTs*, and *lack of evidence regarding alternative approaches.*

Agreement with ten options offered as rationales for not using NSOMExs ranged from 8-78%.(see figure 1). Many respondents selected several options. The main influences on decision not to use exercises in dysarthria were *lack of published evidence*, and *evidence from own practice*, both cited by over 70%. Other common influences, all with over 40% response, were *discussion with colleagues, HEI SLT education*, *postgraduate education*, and *relevant reading*.

figure 1 about here

Some commonality between the most frequent rationales for using and not using NSOMExs was evident. Associations between years of experience and *evidence from my own practice,* as a reason for both using ($\chi 2$ (1) = 6.25, p = 0.01), and not using ($\chi 2$ (1) = 6.89, p = 0.01) NSOMExs were significant with more experienced SLTs more likely than more recently qualified respondents to be influenced by results from their own practice. Association between *HEI SLT education* and years of experience was significant for those not using NSOMExs ($\chi 2$ (1) = 7.84, p < 0.01), and for those using NSOMExs there was a strong trend towards association ($\chi 2$ (1) = 3.09, p = 0.08), suggesting greater influence from the attended HEI for less than for more experienced respondents.

C*linical outcomes*

An open question invited participants to indicate the clinical outcomes they aimed to achieve by using NSOMExs with dysarthric adults. Responses were received from 95% (146) of NSOMExs users, providing a total of 247 statements. Responses were first examined by MM. In discussion with CM**,** six main recurring themes were

discriminated as improvement targets. These were assigned broad labels of *speech* (including also reference to intelligibility and articulation); *movement* (reference to strength, tone, rate, range, direction and control); *sensory awareness* (including also reference to proprioception and feedback); *appearance* (including also reference to facial symmetry and expression); *emotional status* (reference to motivation, morale, mood, quality of life and confidence); *dysphagia and drooling* (reference to eating, drinking and saliva control). Additional miscellaneous comments included objectives of reduction in oedema, and promotion of oral hygiene. MM and CM independently categorised responses according to these themes. Level of agreement was 98%. The few cases of disagreement were resolved by discussion. Improvement in speech was the most common theme, but for 41% of those who responded to this question, no reference was made to speech, intelligibility, or articulation. Clinical outcome aim data are given in table 2, with illustrative examples.

table 2 about here

Dysarthria management categories

NSOMExs were used with all ten neurological conditions included in the questionnaire, all eight dysarthria types, all five levels of severity, both acute and chronic stages, and also improving, stable and progressive presentations.

By far the most common neurological condition with which NSOMExs were used was stroke (95%), followed by traumatic brain injury (58%), and Parkinson's disease/Parkinsonism (47%). All other options were selected by fewer than 30% (see figure **2**). Of dysarthria types, flaccid (87%) was distinctly the most common category. Hypokinetic, mixed and spastic were all above 40% (see figure 3). Ninety-

seven per cent of respondents who used NSOMExs did so with people at acute (defined as less than three months duration) and 70% at chronic (duration of three months or longer) stage. NSOMExs were used with those whose dysarthria was considered improving (94%), stable (60%) and progressive (35%) (see appendix 1a for definitions). As regards severity levels (see appendix 1b for definitions), NSOMExs were used with moderate (87%), severe (86%), mild (63%), profound (51%) and anarthria (38%).

figures 2 and 3 about here

Dysarthria management regimes

NSOMExs for tongue, lips, face, jaw and soft palate were used. The frequency of exercise use (*always, very often, often, occasionally, never*) for each structure is shown in figure 4. All respondents used exercises for lips and tongue, and *always* or *very often* was the response category in at least 80% of instances. For face, jaw and soft palate these frequencies of involvement were all less than 30%. The most common response category was *occasionally* for jaw and soft palate, and for face, *often* .For these three structures, small numbers of respondents (<15%) never gave exercises.

figure 4 about here

There was much variation in advice typically given to patients about numbers of repetitions of each exercise and number and length of practice periods each day-(see figure 5a-c). The most frequent regimes were 4-6 repetitions of each exercise, during

three practice periods daily, each of 6-10 minutes duration. Respondents drew these exercises from many sources, particularly therapy resource manuals (88%), materials produced by their departments (77%), discussion with other SLTs (55%) and text books (54%). For all but one respondent, written information and instructions about the exercises were given to patients, most often obtained from therapy resource manuals (84%) and materials produced by their departments (77%).

figure 5 a-c about here

Interest in future research

One hundred and twenty three respondents (64%) expressed interest in being informed of future developments in our NSOMExs research.

Discussion

The 56% response rate for this study is well in advance of the 35% return considered acceptable for postal questionnaires (Jackson and Furnham 2000). In the study of communication disorders, a rate below 50% is noted to be typical (Pring 2005).

This survey was undertaken as a basis for future research evaluating clinical outcomes in relation to use of NSOMExs. It was established that such exercises are a frequent component of management of dysathria in the devolved government countries of the UK, and are equally used by both recently qualified therapists and by those with much experience, regardless of the HEI attended. If the investigation had shown that these exercises were little used, the foundation for clinical trial research might be questioned.

Factors influencing practice

In the absence of evidence from controlled experimental work, expert opinion may be cited as evidence to support practice, albeit at the lowest level (Scottish Intercollegiate Guidelines Network 2008a).The literature referred to in the Introduction to this paper includes such expert opinion, encouraging, but also opposing, the use of NSOMExs. Rosenbek and Jones (2009) believe that even uncontrolled descriptive studies of an individual clinician's treatment contribute to evidence. The main reason respondents gave for using NSOMExs, cited by 64%, was evidence from their own practice, indicating that there is a widely held belief that NSOMExs have been of value to patients. However this same explanation was forwarded as a rationale by a sizeable majority (70%) of those who elected not to use exercises. In both cases experienced SLTS were more likely to note this influence than those working for ten or fewer years. Thus there is no experienced practitioner consensus which might be forwarded as guidance for practice.

What is taught in HEIs to students in training should be a powerful influence on professional practice. Over 40% of those both using and not using NSOMExs were influenced by their SLT education. It is only within the last decade that the necessity of a strong evidence base for practice has been emphasised in the allied health professions, so SLTs who graduated within the last 10 years might reasonably be expected to have a more cautious approach to NSOMExs, as reference would be made to the lack of evidence in their HEI dysarthria teaching. The data do not support this. However for both those using and for those not using NSOMExs, there were indications that HEI education was more influential for those working for ten or

fewer years, than for more experienced clinicians. HEIs might differ in the teaching emphasis, or the recommendations made, regarding NSOMExs in dysarthria, but the decision to use NSOMExs did not appear to be affected by the HEI attended.

Apraxia of speech and dysphagia

Muscular weakness, whereby ability to exert force is reduced, is a common feature of dysarthria, associated with flaccid and spastic classes (Palmer and Enderby 2007), the latter including unilateral UMN lesions, according to some classifications. A key distinction between dysarthria and apraxia of speech (AOS) is that in AOS the speech disorder exists in the absence of detectable weakness or hypertonicity (Weismer 2007). A common diagnostic criterion for AOS is that strength of articulators is deemed to be within normal limits (McNeil, Robin and Schmidt 2009). Because AOS is understood to be a speech programming disorder, Rosenbek and Jones (2009) describe the use of NSOMExs in AOS treatment as 'nonsensical' (Rosenbek and Jones 2009, P271), though Duffy (2005) notes that sometimes they are used with the aim of improving ability to plan or programme movements.. NSOMExs use with the AOS population was not anticipated in this survey. Nevertheless 38% of respondents, including some who did not use NSOMExs in dysarthria, carried out NSOMExs with AOS patients. Dworkin, Abkarian and Johns (1988) included intensively practised oro-neuromotor control activities, such as raising and lowering the tongue, plus speech activities, in a treatment progaramme for a patient with AOS.Improvements in both movement and speech were evident, but as in Robertson's (2001) dysarthria study, it is not possible to conclude whether the NSOMExs did or did not contribute to the change.

As with dysarthria, empirical support for use of NSOMExs in dysphagia is very limited (Clark 2003). It was anticipated that those using NSOMExs in dysarthria would do so in dysphagia also, given their common co-occurrence in disorders such as stroke and Parkinson's disease. The frequency of use of NSOMExs in dysphagia was 87%, thus a little higher than in dysarthria. Seventy two per cent of those who did not use NSOMExs in dysarthria regarded them as appropriate to dysphagia. Dysarthria was the focus of the survey, so guiding rationale for NSOMExs in dysphagia was not questioned, and given the general nature of the question it is possible that respondents did not confine their responses to neuro-muscular dysphagic disorders.

Clinical outcomes

Most respondents who used NSOMExs provided at least one statement indicating what they aimed to achieve by this practice. Reference to improved speech status was the most commonly occurring theme, but many respondents made no mention of speech, confining themselves to aspects of muscles and movements, sensation, and appearance. There was also a belief in some respondents that psychological benefits might arise from NSOMExs, for example relating to motivation and morale. Furthermore although the question specified dysarthria context, responses included eating and drinking goals. It is thus clear that therapists have many and varied goals when using exercises in dysarthria. It may be that some of these additional objectives underlie the incorporation of NSOMEXs in AOS management.

Dysarthia categories

Given the conflicting advice about the types of dysarthria for which NSOMExs might be suitable, it is not surprising that all dysarthria categories were represented in the responses. Authors who think NSOMExs may have a place in dysarthria management are in agreement only over the flaccid class. The response frequency (87%) for that diagnostic group was around double that of the next most accepted classes (hypokinetic, mixed and spastic). This may reflect awareness of endorsement in relevant literature, or previous experience with patients. Where flaccid dysarthria results from myasthenia gravis there is consensus in the literature that NSOMExs are explicitly contradicted, because of the fatigue which is characteristic of the disease. However a small number (7%) of the respondents who used NSOMExs did so with myasthenia gravis patients.

The number of respondents selecting hyperkinetic dysarthria was low (15%). There is little published speech research involving hyperkinetic patients, despite this type of dysarthria being reported as the most frequently occurring presentation of all the single, uncomplicated classes (Duffy 2005). Therefore it is likely that respondents would have experience with hyperkinetic patients. SLTs may be influenced by the many authors who consider NSOMExs to be inappropriate for this group**,** or again their own results may guide their decision.

NSOMExs are regarded by respondents as suitable in a wide range of neurological disorders and diseases, but stroke is remarkable in that only 5% of those using NSOMExs did not include stroke cases. Stroke is the most common cause of severe disability in adults (Scottish Intercollegiate Guidelines Network 2008b) and dysarthria

is present in 8-30% of stroke patients, sometimes as the only clinical manifestation (Urban et al 2006). Therefore for SLTs who work with dysarthria, stroke is likely to be one of the most frequently encountered neurological disorders. Stroke has been associated with all forms of dysarthria, accounting for 22% of dysarthria cases according to Duffy's (2005) audit data. The questionnaire data do not permit extrapolation as to whether and how use of NSOMExs varied with the stroke dysarthric diagnostic class. However it is interesting that despite Duffy's (2005) data showing 90% of cases of uniUMN dysarthia to have vascular aetiology, only 30% of respondents who use NSOMExs did so with that group. Although its occurrence is reported to be equivalent to flaccid, spastic and hypokinetic classes, all at around 9% of total dysarthria assessments (Duffy 2005), uniUMN dysarthria is usually considered to be mild and of short duration (Duffy 2005). However, given that 63% of respondents using NSOMExs do so with mild degrees of dysarthria, and 95% with patients thought to have improving presentation, a higher response might have been expected for this dysarthria class.

Some authors see a place for NSOMExs with only the most severe patients. In this investigation, the most severe levels (profound and anarthria) attracted the lowest positive responses. How severity is defined is relevant here, and for the purposes of the questionnaire for both of these categories, speech would require to be augmented or replaced by other forms of communication. The lower response relative to less severe categories, may indicate a shift of emphasis away from speech management, in favour of alternative or augmentative approaches. Nevertheless even where patients have no useful speech (anarthria), 38% of relevant respondents use NSOMExs,

suggesting a belief that the practice of NSOMExs will facilitate the return of functional speech.

Exercise regimes

Where there is a lack of published evidence to guide practice, therapists are likely to adopt differing regimes. This was evident in the numbers of repetitions, and frequencies and durations of practice periods. . Although the most common schedules typically used were 4- 6 repetitions per exercise, three practise periods each day, and each period of 6-10 minutes, there were many examples of more limited and more extensive practice. A few respondents indicated that they encouraged patients to practice for as long and as often as they wished to. Hageman (2009) contends that NSOMExs tend not to capture the elements of strengthening activity which are necessary to generate neural adaptation for speech movements. Intensive training, with progressively increasing demands, is thought necessary for motor learning (Rosenbek and Jones 2009). According to Clark (2003) increases in strength, endurance and power require overload, that is the taxing of the muscles beyond their typical workload, and improvement in strength and endurance cannot be expected when exercise is discontinued before reaching the point of fatigue. Several authors specify more practice than that typically used by the respondents. Duffy (2005) advises that if there is a commitment to NSOMExs, there should be concerted effort: 5 to 10 exercise periods each day, with exercises done in 5 sets of 10 repetitions each, 3 to 5 times per session. From limited data, Robertson (2001) reported that patients whose dysarthria scores improved less carried out less home practice. There are however practical issues, not least patient compliance. Robertson's (2001) research protocol had included three practice sessions each day, but the maximum achieved by

individuals was a mean of 2.7, and the participant consensus was that two practice sessions per day would be more realistically achievable.

In the current research, there were no indications of a relationship between the regimes adopted and therapists' belief that they had evidence of efficacy. The questionnaire asked about typical practice and did not seek information as to whether type or regime of exercise varied across dysarthria classes, severities, or causative neurological disorders. This would have considerably complicated the questionnaire, which may have negatively affected response rate. This information might be further explored through individual interviews or focus groups. The variation in practice amongst respondents underscores the need for investigative work where there is a control of potentially influencing variables, such as numbers of exercises and repetitions, frequency of practice and length of practice periods.

Conclusion

That NSOMExs are appropriate in dysarthria is part of the folklore of SLT, and folklore may be a potent influence, even impeding the adoption of approaches which have scientific validity, in favour of what is handed down by word of mouth, or demonstration (Geary 2005). Rosenbek and Jones (2009) refer to there being for SLTs a 'historic predilection' (P282) to use NSOMExs. *Tradition* was a reason for exercise use for 45% of the relevant respondents, and for 44%, *observing* the practice of other therapists was influential. Furthermore it appears that behaviour is influenced by a public presumption that exercises will be given, in that 51% of the respondents using NSOMExs gave *patient expectations* and 25% gave *carer expectations*, as a rationale for use.

For many reasons, including, but not confined to, education, the experience of practice, observation, discussion with colleagues, and patient and carer pressure, the consensus of opinion would appear to be that non-speech oro-motor exercises have a place in dysarthria management, especially in stroke, and flaccid conditions. Whether this is justified requires to be assessed, and the high number of respondents who indicated interest in being informed about future research plans is encouraging. It is only through the results of well controlled research, which compares outcomes for people with dysarthria who receive NSOMExs as part of their SLT management, and those who do not, that clinicians may be able to set aside folklore in favour of more convincing rationales for using NSOMExs. Alternatively they might be persuaded that such exercises are inappropriate in the management of acquired dysarthria.

What this paper adds

Non-speech oro-motor exercises are reported to be widely used in dysarthria intervention. This paper highlights the divergence of opinions about the relevance for speech of these exercises, and the absence of robust evidence which would guide clinical practice.

A survey of practice and opinions of 191 speech and language therapists revealed that non-speech oro-motor exercises are used in acquired dysarthria by 81% of respondents, with a wide variety of neurological disorders, diagnostic classes and severities. Those who use, and those who do not use, exercises are guided by similar rationales, including the opinion that they have evidence from their own practice to support their approach The study provides a justification and foundation for clinical research comparing outcomes for people whose dysarthria management includes and does not include non-speech oro-motor exercises.

Appendix 1a)
Stages of dysarthria

Improving
Severity of dysarthria has reduced from an earlier presentation but symptoms are not resolved.

Stable
Severity of dysarthria is now relatively unchanging.

Progressive
Symptoms of dysarthria may continue to progress and/or new symptoms may appear.

Appendix 1b)
Severities of dysarthria

Mild
Dysarthria is noticeable but intelligibility is unaffected. Speech rate is essentially normal.

Moderate
Speech is intelligible but rate and naturalness are reduced.

Severe
Natural speech is the primary means of communication, although it is not completely understood in all situations. Speech rate and naturalness are markedly affected.

Profound
Natural speech may serve some communicative functions, such as greetings or response to questions, but intelligibility is markedly reduced. Function is maintained by supplementing natural speech with other modes of communication.

Anarthria
No useful speech.

Table 1. Non-speech oro-motor exercise use in dysarthria, dysphagia and apraxia of speech (N = 191)

	Respondents	**Dysphagia: yes**	**AOS: yes**	**Dysphagia: no**	**AOS: no**
Dysarthria yes	154	140	62	9	84
Dysarthria no	37	25	6	10	29
Totals	191	165	68	19	113

Table 2. Clinical outcome aims in non-speech oro-motor exercise use (Respondents = 146)

Themes	Total comments	Comment examples (Respondent number)
Speech	90	Either maintenance or improvement in intelligibility in functional setting. (R106) Improve oral skills and therefore transfer into speech skills. (R045)
Movement	56	Increase strength, range and speed of movements of oro-motor structures. (R105) Maintenance and/or improvement in tone, strength and accuracy of oral movements. (R066)
Sensory awareness	25	Maintain/ improve sensation (R155) Increase proprioceptive awareness. (R177)
Appearance	20	Improved appearance – improved tone in facial muscles. (R100) Improved facial animation. (R186)
Emotional status	22	Involving client in managing their own condition can further increase motivation. (R94) Reduction in the impact of dysarthria on the person's life. (R087)
Dysphagia and drooling	31	Improved bolus control and co-ordination in feeding. (R165) Improved chewing, management of food in the mouth, improved swallow. (R117)
Miscellaneous	03	Promoting reduction of oedema. (R031) Maintain oral hygiene (R187) Better co-ordination of laryngeal muscles/respiration. (R121)
Total comments	247	

Figure 1

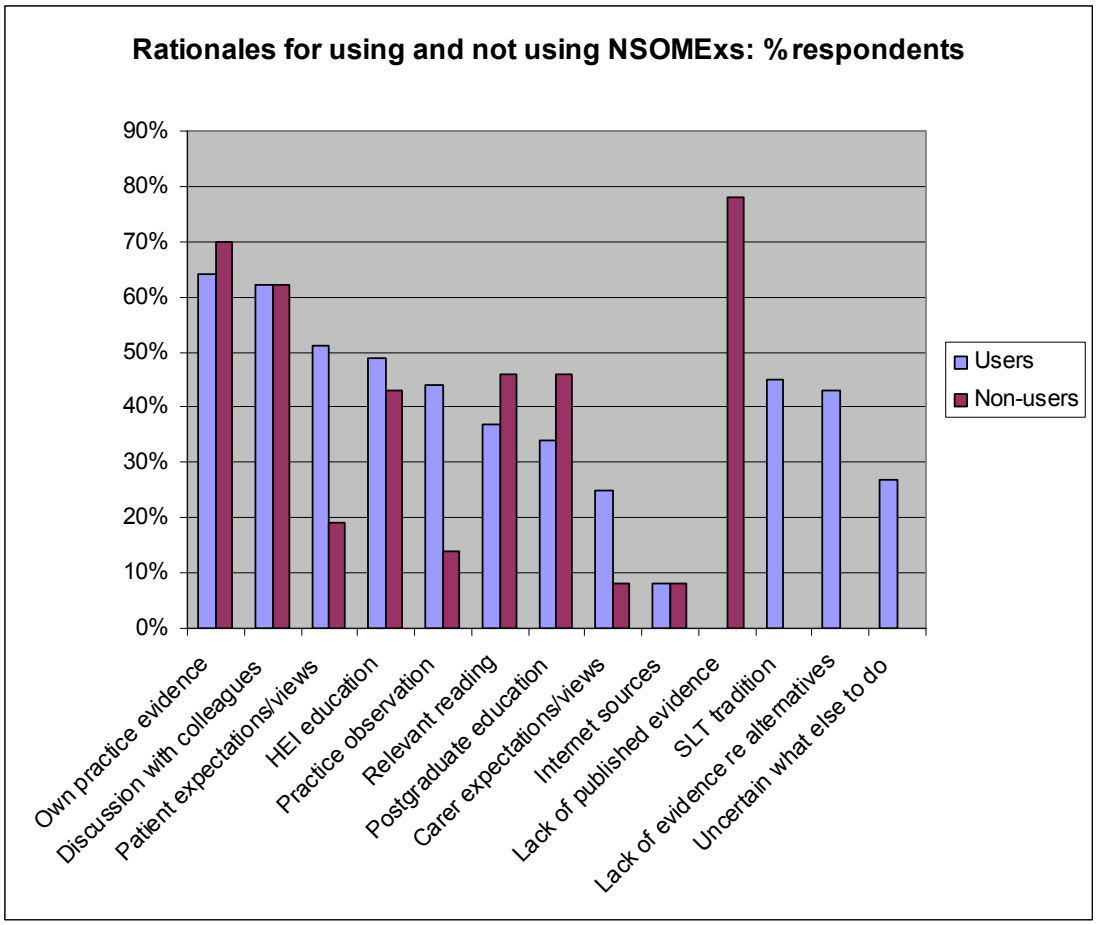

Rationales for using and not using NSOMExs: %respondents
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Users
Non-users
Own practice evidence
Discussion with colleagues
Patient expectations/views
HEI education
Practice observation
Relevant reading
Postgraduate education
Carer expectations/views
Internet sources
Lack of published evidence
SLT tradition
Lack of evidence re alternatives
Uncertain what else to do

Figure 2

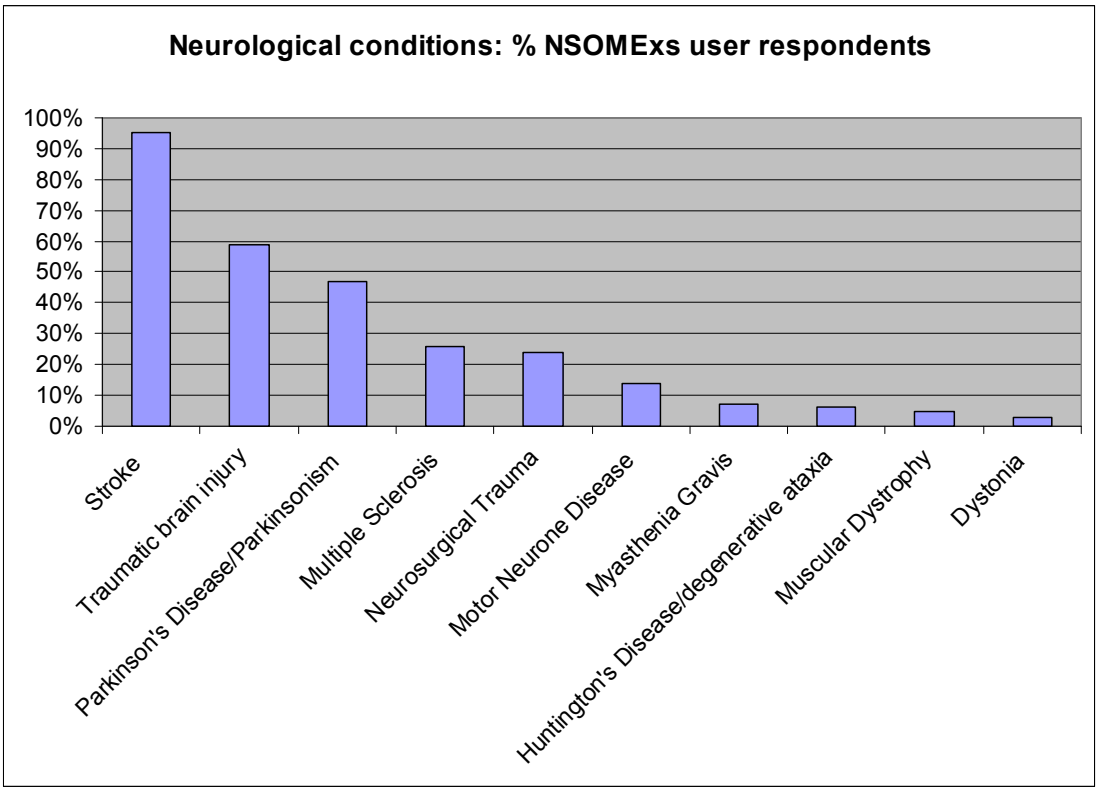

Neurological conditions: % NSOMExs user respondents
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Stroke
Traumatic brain injury
Parkinson's Disease/Parkinsonism
Multiple Sclerosis
Neurosurgical Trauma
Motor Neurone Disease
Myasthenia Gravis
Huntington's Disease/degenerative ataxia
Muscular Dystrophy
Dystonia

Figure 3

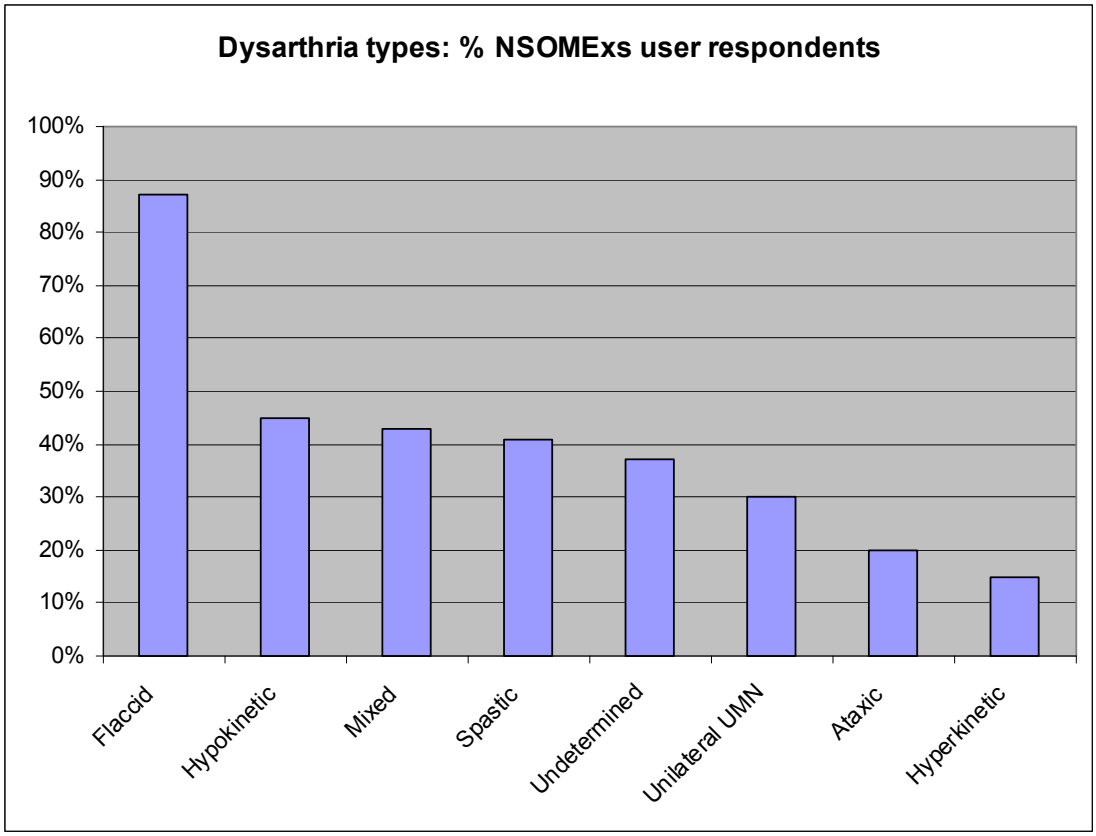

Dysarthria types: % NSOMExs user respondents
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Flaccid
Hypokinetic
Mixed
Spastic
Undetermined
Unilateral UMN
Ataxic
Hyperkinetic

Figure 4

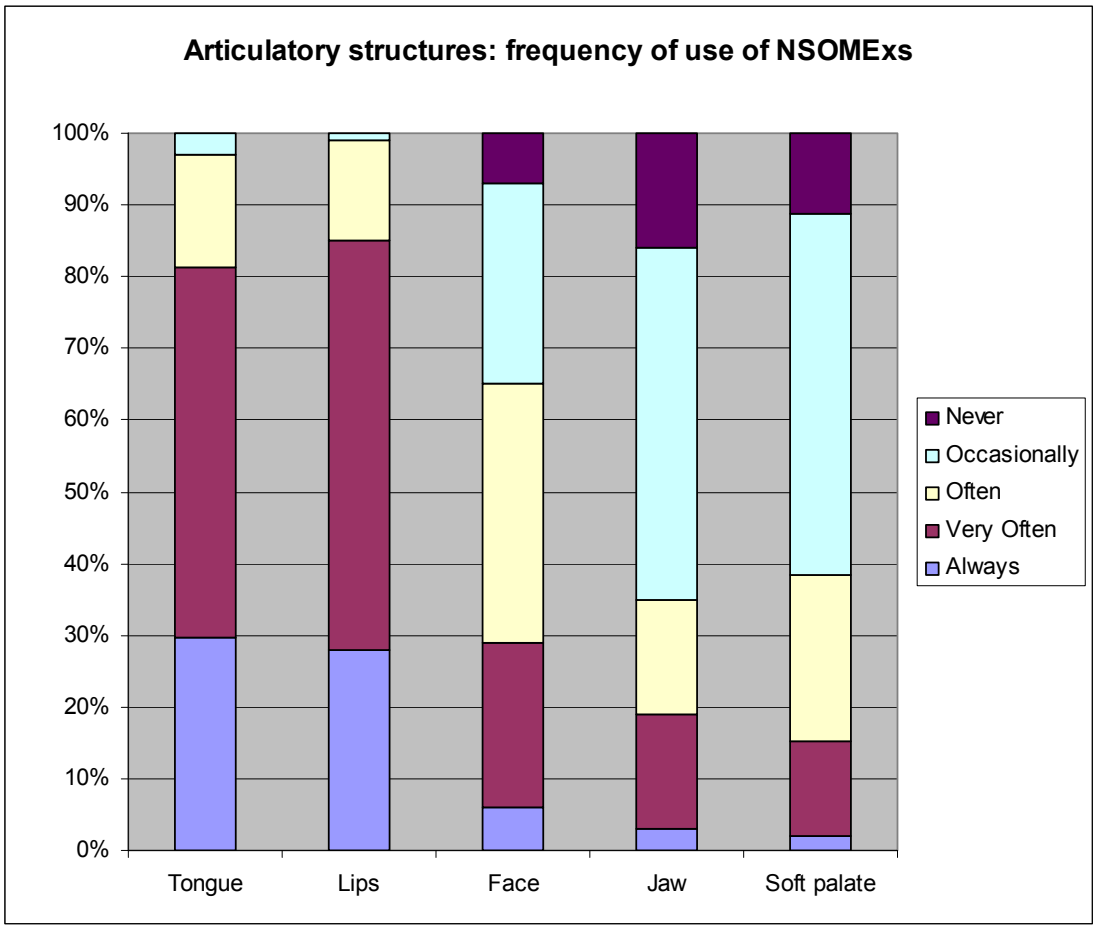

Articulatory structures: frequency of use of NSOMExs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Tongue
Lips
Face
Jaw
Soft palate
Never
Occasionally
Often
Very Often
Always

Figure 5a)

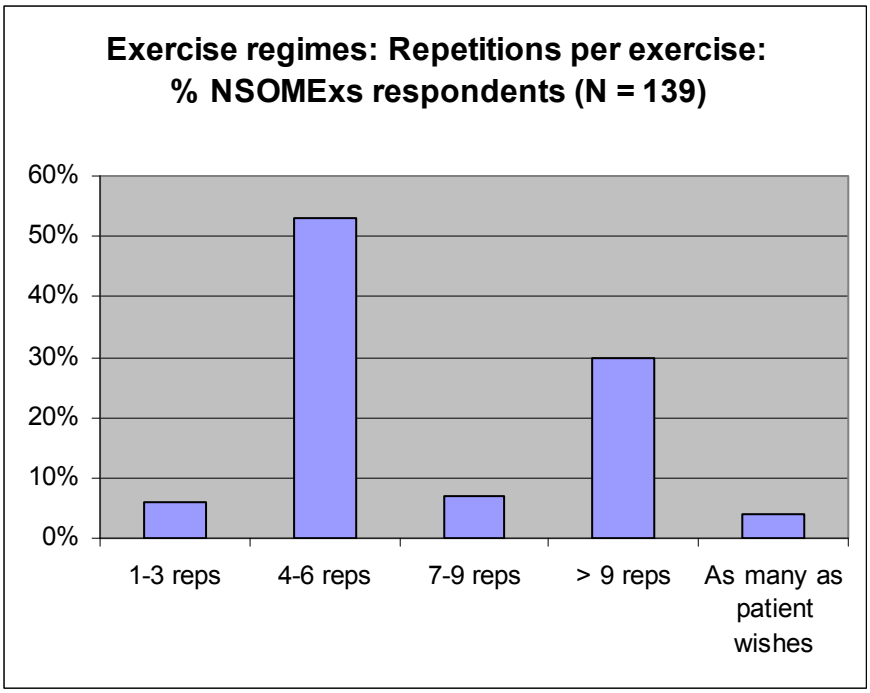


Figure 5b)

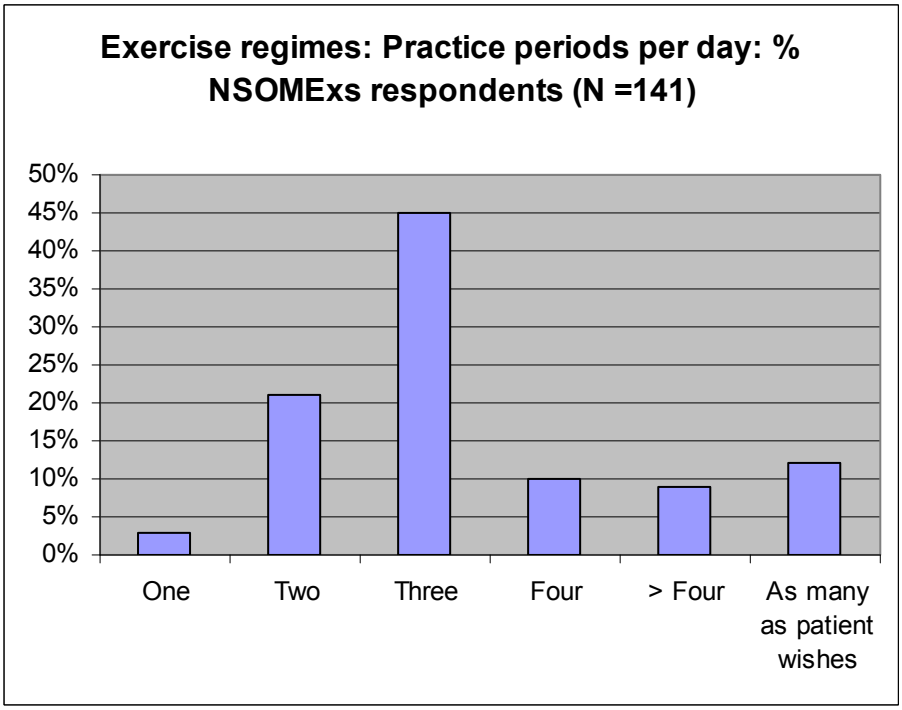
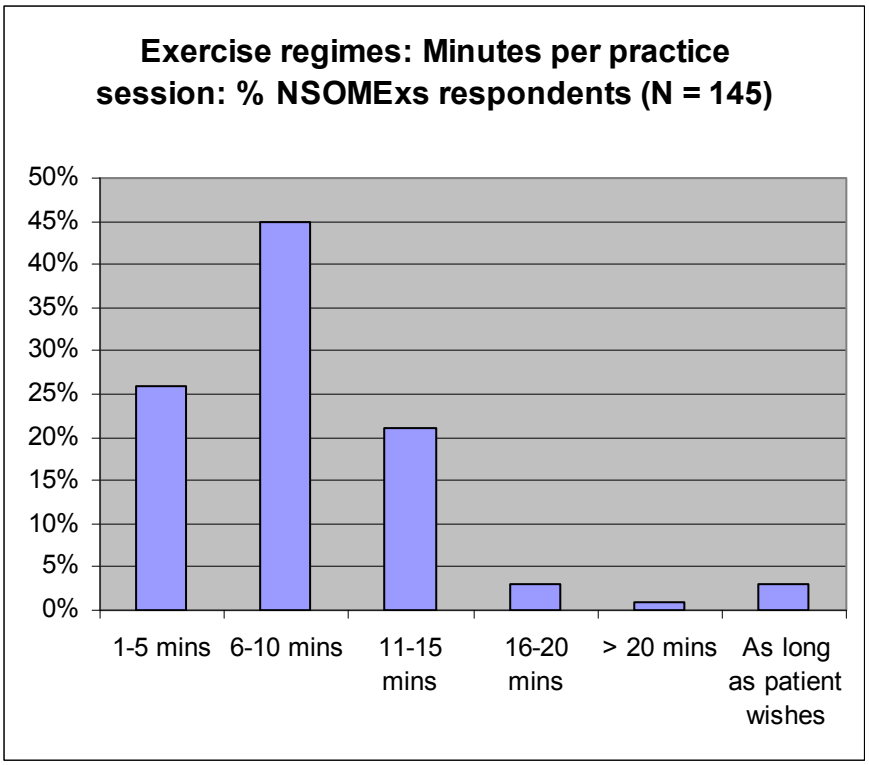


Figure 5c)


Exercise regimes: Minutes per practice session: % NSOMExs respondents (N = 145)
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1-5 mins
6-10 mins
11-15 mins
16-20 mins
> 20 mins
As long as patient wishes

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