

Clinical Forum

The Application of Evidence-Based Practice to Nonspeech Oral Motor Treatments

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Evidence-based practice (EBP) is a perspective on clinical decision making that is apparent in many fields today, including speech-language pathology. It integrates clinical expertise with the best available current evidence from systematic research in making clinical decisions about the management of clients. Nonspeech oral motor treatments (NSOMTs) focus on nonspeech movements of the speech mechanism such as exercise, blowing, positioning, icing, swallowing, and other

nonspeech activities. They have been used by speech-language pathologists (SLPs) to treat a heterogeneous group of speech problems. However, despite their use for many years, NSOMTs are controversial because there is weak or limited evidence to support their use for improving swallowing and speech. Recommendations for the use of NSOMTs usually are based on opinion and not higher levels of evidence. Application of the best available evidence in the research literature should serve as the

ABSTRACT: Purpose: The purpose of this article is to help speech-language pathologists (SLPs) apply the principles of evidence-based practice (EBP) to nonspeech oral motor treatments (NSOMTs) in order to make valid, evidence-based decisions about NSOMTs and thus determine if they are viable treatment approaches for the management of communication disorders.

Method: A detailed description of EBP is provided, including levels of evidence for rating the quality of evidence. NSOMTs are described and a survey of the literature on NSOMTs is provided along with a determination of the level of evidence of each study reported. A systematic literature search was conducted using the electronic databases of MEDLINE and CINAHL (Cumulative Index to Nursing and Allied Health Literature) within an unrestricted time period. In addition, reference lists from identified articles were also reviewed. Ethical and fiscal issues related to EBP and NSOMTs, as well as clinical implications of EBP for the use of NSOMTs, are discussed.

Results: A total of 45 articles/reports were published between 1981 and 2006 in peer-reviewed and non-peer-reviewed

journals. Most of the sources (25) relied on weak anecdotal evidence and opinions. Moreover, studies that employed stronger designs reported negative results for NSOMTs (i.e., evidence against the use of NSOMTs for modifying speech).

Conclusion: Despite their use for many years and their popularity among some SLPs for the treatment of a wide variety of speech problems in children and adults, NSOMTs are controversial because sufficient evidence does not exist to support their effectiveness in improving speech. Moreover, limited evidence exists for the use of NSOMTs to facilitate nonspeech activities. Therefore, the available evidence does not support the continued use of NSOMTs as a standard treatment and they should be excluded from use as a mainstream treatment until there are further data. SLPs should consider the principles of EBP in making decisions about NSOMTs.

KEY WORDS: evidence-based practice, levels of evidence, nonspeech oral motor treatments

foundation for decisions about NSOMTs. The purpose of this article is to help SLPs apply EBP principles to NSOMTs in order to make valid, evidence-based decisions about them. A discussion of EBP and levels of evidence will be followed by a review of available evidence to determine if NSOMTs are a viable clinical treatment approach for managing communication disorders.

EBP

EBP originated in clinical medicine and is apparent in many other fields today such as education, pharmacology, and mental health. It is “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients... [by] integrating individual clinical expertise with the best available external clinical evidence from systematic research” (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996, p. 71). *Best evidence* for EBP is evidence that is obtained from studies that were designed specifically to address questions about clinical practice.

A review of professional activity in speech-language pathology and audiology reveals how important and pervasive is the issue of EBP. The following examples serve as proof of EBP’s impact on the professions:

- The Academy of Neurologic Communication Disorders and Sciences (ANCDs), with the support of the American Speech-Language-Hearing Association’s (ASHA’s) Neurophysiologic and Neurogenic Speech and Language Disorders Special Interest Division, applied EBP principles to the establishment of practice guidelines (Golper et al., 2001).
- A symposium on EBP in communication sciences and disorders was cosponsored by ASHA (2003b) and the National Institute on Deafness and Other Communication Disorders (NIDCD).
- A special issue of the *Journal of Communication Disorders* was devoted to the research symposium on EBP in communication sciences and disorders (Plante, 2004).
- ASHA’s Research and Scientific Affairs Committee released a technical report on EBP (ASHA, 2004a).
- ASHA prepared a position statement on EBP (ASHA, 2004b).
- ASHA established an advisory committee on EBP. This standing committee was charged with (a) establishing a set of terminology and definitions related to EBP for consistent usage, (b) identifying and prioritizing clinical questions to be addressed, (c) convening panels of independent reviewers to provide evidence reviews on identified clinical questions, (d) establishing processes for the conduct and dissemination of evidence reviews, and (e) advising ASHA’s National Office staff on members’ needs in EBP (Mullen, 2005).
- The Canadian Association of Speech-Language Pathologists and Audiologists, which is affiliated with the Canadian Cochrane Network and Center, has promoted the application of EBP in clinics, classrooms, and research settings (Orange, 2004).
- ASHA established the National Center for Evidence-Based Practice in Communication Disorders, which contains a registry of clinical practice guidelines and systematic reviews (Mullen, 2006).
- The theme for the 2005 ASHA convention was “Using Evidence to Support Clinical Practice.”
- ASHA established the Communication Sciences and Disorders Clinical Trials Research Group, whose sole purpose is the development and administration of clinical trials that provide evidence concerning the differential effectiveness and appropriateness of particular evaluation and treatment programs (Baum, Logemann, & Lilenfeld, 1998; Logemann, 2004; Logemann & Gardner, 2005).
- The October 2006 issue of *Language, Speech, and Hearing Services in Schools* was devoted to a clinical forum on EBP (Fey, 2006; Gillam & Gillam, 2006; Justice, 2006; Kamhi, 2006a, 2006b, 2006c; Kent, 2006; Ratner, 2006; Tyler, 2006; Ukrainetz, 2006).

Thus, it is apparent that EBP is of paramount interest and importance to the professions of speech-language pathology and audiology. EBP is also essential for the future success of the professions.

In the introduction of the special issue of the *Journal of Communication Disorders* that was devoted to the 2003 research symposium on EBP in communication sciences and disorders, Plante (2004) stated that,

An increasing emphasis on evidence, rather than intuition, for guiding clinical practice signals disciplinary maturation. Professional reliance on evidence-based practices sets a verifiable standard for what constitutes an acceptable procedure in a field. It communicates to the members of the profession, as well as the consumers of their services, that best practices reflect a standard that is rooted in data, is replicable, and provides an expectation of accuracy (in the case of diagnostic procedures), positive results (in the case of therapeutic procedures), and benefit to either the consumer in particular or society in general. (p. 389)

Dollaghan (2004, p. 392) pointed out that EBP “could be extraordinarily useful for addressing questions about clinical practice in communication disorders. However, in several ways, the EBP paradigm requires a radical re-thinking of what we ‘know’ about clinical decision-making in communication disorders, and new criteria for deciding when we know it.” She presented three propositions from the EBP orientation that challenge traditional wisdom about the evidence base for clinical decisions in communication disorders. They are outlined in the following paragraphs.

Proposition 1. *The opinions of expert authorities, singly or in groups such as consensus panels, should be viewed with skepticism and discounted entirely when they contradict evidence from rigorous scientific studies.* Therefore, “The lesson of EBP is not that clinical experience and patient perspectives should be ignored; rather they are considered against a background of the highest quality scientific evidence that can be found. Thus, progress in clinical practice requires that we look beyond unsupported opinions and theories even if these come from respected authorities in the field” (Dollaghan, 2004, pp. 392–393). In this regard, ASHA’s Research and Scientific Affairs Committee (ASHA, 2004a) cited examples in their technical report in which the recommendations of respected authorities were wrong and/or harmful. These include:

- The recommendation of giving oxygen to premature infants to prevent retrolental fibroplasia (a type of blindness), a condition that eventually was scientifically proven to be *caused* (not *cured*) by oxygenation (Meehl, 1997).
- More recently, hormone replacement therapy, which was widely recommended for more than 40 years for postmenopausal

women, has been proven, via scientific investigation, to have serious health risks (Barrett-Connor, 2002).

Both recommendations were consistent with the current clinical thinking of their time. However, under rigorous scientific investigation, they were found to be harmful. Thus, although expert clinical opinion provides a starting point for empirical study, the EBP orientation requires evidence from carefully controlled empirical research studies to validate clinical opinions.

Proposition 2. *Not all research is relevant to decisions about clinical practice.* Therefore,

Results from basic research do not in and of themselves provide adequate evidence concerning clinical decision-making. This is because the aims, designs, methods, and interpretations of studies of clinical questions differ, in some respects strikingly, from those of studies addressing basic disease mechanisms. Thus, rather than trying to stretch findings from basic research to cover questions about clinical practice, EBP demands rigorous, systematic studies specifically designed to answer questions about clinical decision-making at a given point in time, along with an explicit acknowledgment that these answers will need to be updated routinely and frequently as new evidence becomes available. (Dollaghan, 2004, p. 393)

Proposition 3. *Being judgmental about evidence quality is a goal, not a character flaw.* Thus,

Studies purporting to provide evidence on clinical questions should be evaluated according to explicit and stringent criteria, a process known as critical appraisal (Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000). The quality of evidence from a study depends on the extent to which these explicit criteria are met; critical appraisal enables us to identify the best available external clinical evidence for use in our clinical decision-making." (Dollaghan, 2004, p. 393)

Levels of Evidence

Not all evidence is equal in quality; some evidence is stronger than other evidence. This is an important issue in the framework of EBP, where specific criteria are used to assess the quality of evidence that is available to support clinical decisions. Some of these criteria are specific to clinical studies; others are common to all scientific research. There are numerous systems available for ranking the credibility of evidence, with some assigning "grades" to clinical recommendations based on the strength of their supporting evidence. The rules of evidence differ according to whether the clinical question deals with screening versus diagnosis versus treatment versus prevention versus prognosis versus health care economics.

One such system that differentiates levels of evidence for studies of treatment efficacy that is ranked according to quality and credibility from *strongest/most credible* (Ia) to *weakest/least credible* (IV) is that adapted from the Scottish Intercollegiate Guideline Network (2002) and employed by ASHA (2004a). This system is presented in Table 1.

Recently, ASHA developed a levels of evidence classification based on eight factors: study design, blinding, sampling, subjects, outcomes, significance, precision, and intention. Four steps are included in this classification system: (a) evaluation of the quality of individual studies on the review topic, (b) determination of the stage of the study(ies), (c) rating of the quality of a study relative to its stage of research, and (d) synthesis of the information into a table of evidence in regard to research quality and stage (Mullen, 2007).

There are five themes involved in ratings of the quality of evidence (ASHA, 2004a).

- **Independent confirmation and converging evidence.** Although an individual study usually does not provide the definitive answer to a clinical or scientific question, the synthesis of a body of evidence composed of high-quality investigations can lead to a conclusion, even when findings vary across studies. For treatment efficacy, the highest evidence ranking belongs to well-designed meta-analyses that summarize results from a number of well-controlled studies. Although such studies are rare, meta-analyses have appeared in the communication disorders literature (see, for example, Casby, 2001; Robey, 1998). The following organizations sponsor reviews of evidence according to explicit and stringent criteria: (a) Cochrane Collaboration (www.cochrane.org), (b) Scottish Intercollegiate Guideline Network (www.sign.ac.uk), and (c) Agency for Healthcare Research and Quality of the U.S. Department of Health and Human Services (www.ahrq.gov). Although a single meta-analysis or systematic review of evidence may cause disagreement and debate because of the relatively small number of available high-quality studies, the principle of seeking converging evidence from multiple strong studies is the goal of the EBP approach.
- **Experimental control.** The design characteristics of individual studies also influence ratings of the quality of evidence. In the EBP framework, the highest rating is reserved for studies that are well controlled (comparing an experimental and control group) and that use prospective designs in which participants are recruited and assigned to conditions on a random basis

Table 1. Levels of evidence for studies of treatment efficacy.

Level		Description
Ia	Strongest	Well-designed meta-analysis of >1 randomized controlled trial
Ib	Strong	Well-designed randomized controlled study
IIa	Moderate	Well-designed controlled study without randomization
IIb	Moderate	Well-designed quasi-experimental study
III	Limited	Nonexperimental studies (i.e., correlational and case studies)
IV	Weak	Opinion of authorities, based on clinical experience

Note. From *Evidence-Based Practice in Communication Disorders: An Introduction*, by American Speech-Language-Hearing Association, 2004. Available at www.asha.org/policy. Copyright 2004 by the American Speech-Language-Hearing Association. Adapted with permission.

before the experiment begins. These studies are rated more highly than retrospective studies, in which data from previous research are analyzed, because it is difficult or impossible to control the reliability and accuracy of measures on a post hoc basis. Lower ratings of evidence are given to quasi-experimental studies, and evidence from nonexperimental studies (e.g., correlational studies and $N=1$ case studies) is rated even lower because of the lack of a control group. However, in the EBP framework, evidence from nonexperimental studies is ranked higher than statements of belief and opinion in EBP. In the technical report of ASHA's Research and Scientific Affairs Committee (ASHA, 2004a, p. 3), it is pointed out that "quasi- and nonexperimental studies can provide evidence that is crucially important to the early stages of investigation into a phenomenon and can lay the necessary groundwork for studies with larger samples, random assignment, and strict experimental control." In addition, Sackett, Straus, et al. (2000) pointed out that well-designed single-subject studies can be very useful in assessing the effectiveness of treatment for an individual client. Therefore, "carefully conducted single-subject studies should be recognized as having an important role to play in EBP although their results will always require confirmation via stronger designs" (ASHA, 2004a, p. 3).

- **Avoidance of subjectivity and bias.** An important criterion for credible evidence is *blinding*, or keeping those associated with a study, including investigators, unaware of information that could potentially influence, or bias, the findings of a study. Thus, blinding prevents the potential bias that SLPs may have toward believing that their efforts are helpful.
- **Effect sizes and confidence intervals.** EBP emphasizes the need to specify and justify the size of the effect found to be of clinical importance in clinical research as well as to provide evidence that statistical power is sufficient to detect an effect of this magnitude. There are numerous effect size indices (Huberty, 2002). Moreover, in addition to *statistical* significance (i.e., the probability that any obtained differences or effects were not the result of random, chance error), research studies should also include the *practical* significance of the results. Statistical significance does not necessarily imply clinical significance. For example, Dubois and Bernthal (1978) found a small but statistically significant difference between two types of articulation measures (spontaneous picture naming and delayed imitation sentence production), but the numerical difference in participants' average performance was less than two items on a 20-item task. Thus, because of the actual small numerical difference, the clinical significance of such findings is in question. Practical significance is usually expressed in the form of a standardized metric such as d or Ω^2 . EBP also stresses the need for reporting the *confidence interval (CI)*, a range of values within which the "true" value is expected to occur with a certain degree of probability. Narrower CIs provide stronger evidence than wider CIs. It has been found that studies with large sample sizes and small error yield narrower CIs, which is why evidence from studies with large sample sizes is often ranked higher than evidence from studies with smaller sample sizes.
- **Relevance and feasibility.** Relevance and feasibility are frequently considered in rating the quality of evidence.

Relevance is highest when the participants who are studied are typical of those who are commonly seen clinically. Moreover, feasibility or applicability is high when the activity being studied (e.g., screening, diagnostic, treatment) could be reasonably applied by SLPs in real-world situations.

The EBP orientation is relevant to many aspects of clinical practice in speech-language pathology and audiology. Increasing numbers of randomized controlled clinical trials as well as the work by the Academy of Neurologic Communication Disorders and Sciences to develop practice guidelines based on systematic evidence reviews (Yorkston et al., 2001a, 2001b) are very admirable, but more work applying EBP principles to communication disorders is needed in order to help resolve issues associated with controversial diagnostic categories. ASHA's Research and Scientific Affairs Committee (ASHA, 2004a, p. 5) concluded that "awareness of the principles of EBP by researchers and practitioners in speech-language pathology and audiology seems likely to improve substantially the quality of evidence available to support clinical decisions, one step in ongoing efforts to provide optimal care to people with communication disorders."

ASHA's Research and Scientific Affairs Committee has made suggestions to increase the quantity of credible evidence to support clinical activities in speech-language pathology and audiology, including the following:

- educational offerings on EBP to increase awareness of its potential contributions in regard to SLPs' and audiologists' clinical and scholarly activities, as well as for accountability to other health care providers and funding agencies (including third-party payors)
- conferences on EBP for the faculty in university training programs to encourage information inclusion on EBP in their curricula
- ensuring that editors, reviewers, and authors of publications in ASHA journals are familiar with the recommendations for improving the quality of published reports on studies concerned with diagnosis and treatment (Bossuyt et al., 2003; Moher, Schulz, & Altman, 2001).

Plante (2004, p. 390) concluded that,

At this time, the evidence-base for clinical practices does not begin to approach the breadth of practices within the field of communication sciences and disorders. However, if the situation is to change, professionals within the field must demand that these standards be met for commercial products used for diagnostic purposes. They must be proactive in looking for information to support clinical procedures and critical in assessing the available information.

Overview of NSOMTs

Several early authors described the use of exercises to improve speech. Schoolfield (1937) recommended tongue and lip exercises "for strengthening the organs of speech" (p. 13). Similarly, Nemoj and Davis (1937) described exercises of the soft palate, jaw, lips, and tongue for "gaining control of the speech mechanism" (p. 28). A few years later, Froeschels (1943) used oral motor exercises to treat clients with dysarthria.

NSOMTs focus on nonspeech movements of the speech mechanism such as exercise, massage, blowing, positioning, icing, sucking, swallowing, cheek puffing, and other nonspeech activities.

They have been used by SLPs for many years to treat a heterogeneous group of speech problems, including cleft palate, dysarthria, autism, voice disorders, phonological disorders, dysphagia, and hearing loss. There also are other factors that further compound this heterogeneity that should be considered, including age of onset (congenital or acquired), etiology, systems affected (speech and/or swallowing), and severity.

Despite their widespread use for many years, NSOMTs are controversial because there is weak or limited evidence to support their use for improving swallowing and speech. Recommendations about NSOMTs are usually based on opinion and do not consider higher levels of evidence. Application of the best available evidence in the research literature should serve as the foundation for decisions about NSOMTs. Furthermore, the best available evidence can serve as the foundation for the development of practice guidelines. The purpose of this review is to help SLPs make evidence-based decisions about NSOMTs, especially in the treatment of phonological disorders.

METHOD

Rating of Evidence in NSOMT Studies

Contemporary practice demands that treatment be evidence based, that is, an integration of clinical expertise with the best available clinical evidence from systematic research (Sackett, Straus, et al., 2000). This allows SLPs to provide the most appropriate treatment to clients. The reasons for providing evidence-based treatment are threefold: (a) Clients expect this level of treatment, (b) professionals have a responsibility to provide the most efficacious treatment, and (c) health care administrators require the most effective outcomes at minimal cost (Law & Baum, 1998).

A five-step process for acquiring evidence (Boswell, 2005; Kully & Langevin, 2005; Lou, 2002; Sackett, Straus, et al. 2000) was used in this survey of evidence levels in NSOMT studies (Pannbacker & Lass, 2003). Table 2 outlines the steps in acquiring evidence and the outcome of each step.

Survey: Levels of Evidence in NSOMT Research

The literature was surveyed to determine the level of evidence of studies that use NSOMTs (Pannbacker & Lass, 2003). In addition, the search was expanded to include references through 2006.

A systematic literature search was conducted using the electronic databases of MEDLINE and CINAHL (Cumulative Index to Nursing and Allied Health Literature) within an unrestricted time period. These databases were searched because (a) MEDLINE is the database that is most commonly used in health care fields and is one of the largest databases in the world, and (b) CINAHL focuses on publications from the allied health professions. Key search terms were oral motor therapy, oral motor treatment, oral motor exercises, nonspeech exercises, phonological disorders, dysphagia, dysarthria, and speech exercises. In addition, reference lists from identified sources were also reviewed.

Two broad treatment categories were identified in the literature: speech and nonspeech activities. There were also some reports about the application and benefit of oral motor treatment for both speech and nonspeech activities. Reports were grouped according to the type of treatment outcome: speech, nonspeech, or both speech and nonspeech. Then the reports were critically appraised for levels of evidence according to criteria described by ASHA (2004a) (Table 1). The level of evidence was determined so that the strength of the evidence for the treatment could be identified. For example, the strongest level of evidence (Level Ia) is considered a meta-analysis of randomized controlled trials, and the weakest is an opinion (Level IV).

RESULTS

The search strategy yielded 9 articles concerned with NSOMTs that were published in journals. Hand searches yielded another 36 studies. A total of 45 articles/reports published/presented between 1981 and 2006 were included in this review. Twenty were published in a variety of peer- and non-peer-reviewed journals (see Table 3). Peer-reviewed journals have a policy of independent review by two or more knowledgeable professionals and usually are considered of higher quality than non-peer-reviewed journals (Polit & Beck, 2004). Non-peer-reviewed journals are considered less credible and more likely to be inaccurate than peer-reviewed journals (Lou, 2002).

The studies were grouped according to the outcome: speech: phonological disorders, nonspeech, and combined speech and nonspeech. The evidence for NSOMTs was found to be limited. Tables 4 and 5 contain details about each study, including the level of evidence (between I and III), study design (method), sample characteristics (participants), treatment approach, and results.

Table 2. Steps in finding the evidence for nonspeech oral motor treatment (NSOMT).

<i>Step</i>	<i>Result</i>
1. Ask a clear focused question.	Are NSOMTs an effective treatment?
2. Find the available evidence.	MEDLINE, CINAHL, hand search
3. Critically appraise the evidence.	Identify levels of evidence
4. Integrate the evidence.	Conflicting and nonsupportive
5. Apply the evidence to clinical decisions.	Insufficient evidence exists to support NSOMTs Exclude from mainstream treatment Experimental treatment: informed consent Inform client, family, and other professionals

Table 3. Publication of reports in journals.

<i>Publication</i>	<i>No. of reports</i>
<i>Advance for Speech-Language Pathologists & Audiologists</i> ^a	9
<i>Developmental Medicine and Child Neurology</i> (Fucile et al., 2005)	1
<i>Dysphagia</i> (Morris, 1989)	1
<i>Florida Journal of Communication Disorders</i> (Beckman et al., 2005)	1
<i>International Journal of Orofacial Myology</i> (Ray, 2002, 2003)	2
<i>International Journal of Rehabilitation Research</i> (Guisti-Braislin & Cascella, 2005)	1
<i>Journal of Medical Speech-Language Pathology</i> (Cerny et al., 1997)	1
<i>Journal of Pediatrics</i> (Fucile et al., 2002)	1
<i>Journal of Speech and Hearing Disorders</i> (Christensen & Hanson, 1981)	1
<i>Logopedics, Phoniatrics, Vocology</i> (McAlister, 2003)	1
<i>Occupational Therapy Journal of Research</i> (Ottenbacher et al., 1981)	1

^aNot peer-reviewed; Bahr, 2006; Beckman, 2003; Campbell, 2000; Czesak-Duffy, 1997; Fogel, 2000; Plass, 2000; Rosenfeld-Johnson & Manning, 1999a, 1999b; Waldowski, 2002.

Evidence for Speech Outcomes: Phonological Disorders

Eleven studies about the application of NSOMTs for phonological disorders were reviewed (see Table 4). One study was classified as Class Ib, a randomized controlled study (Polmanteer & Fields, 2002), and one was classified as Class IIa, a controlled study without randomization (Christensen & Hanson, 1981). Seven were Class IIb, well-designed quasi-experimental studies using a single-subject experimental design (Abrahamsen & Flack, 2002; Bush, Steger, Mann-Kahris & Insalaco, 2004; Colone & Forrest, 2000; Gommerman & Hodge, 1995; Hayes, 2006; Occhino & McCann, 2001; Roehrig, Suiter, & Pierce, 2004). There were two Class III studies (Guisti-Braislin & Cascella, 2005; McAlister, 2003). Only 2 of the 11 studies suggested that NSOMTs were effective for improving speech (articulation or voice) (McAlister, 2003; Polmanteer & Fields, 2002).

Another consideration about the quality of evidence is whether or not the evidence has appeared in peer-reviewed publications. Three studies were published in peer-reviewed journals (Christensen & Hanson, 1981; Guisti-Braislin & Cascella, 2005; McAlister, 2003); the other studies have not yet been published but have been presented at ASHA annual meetings.

McAlister's study (2003) was a retrospective analysis of voice disorders and oral motor function in 38 children whose purpose was to study the effect of NSOMTs and articulation therapy on voice disorders. It was reported that (a) the occurrence of voice disorders in children with oral motor difficulties was somewhat lower than in children with normal articulation, and (b) NSOMTs influenced and improved perceptual voice ratings. However, retrospective research in which data are already on file may be incorrect or inaccurate (Schiavetti & Metz, 2002). This evidence-based appraisal revealed a general lack of support for NSOMTs in the treatment

of phonological disorders. That is, the available research does not support the use of NSOMTs.

Polmanteer and Fields (2002) reported that NSOMTs were effective for improving speech sound production. However, as Lof (2003) pointed out, the merit of this study is questionable because of methodological and statistical flaws. Specifically, the severity and gender distribution of the participants was unequal. The group that received only speech treatment appeared to have more serious problems, and the characteristics of the groups that received treatment as well as the equivalency of the sounds treated between groups were not reported.

The other studies provide evidence that NSOMTs are not effective for improving speech and should not be used as a treatment for phonological disorders (Abrahamsen & Flack, 2002; Bush et al., 2004; Christensen & Hanson, 1981; Colone & Forrest, 2000; Gommerman & Hodge, 1995; Gusti-Braislin & Cascella, 2005; Hayes, 2005; Occhino & McCann, 2001; Roehig et al., 2004). Details about these studies are summarized in Table 4.

Evidence for Nonspeech Outcomes

Eight of the nine studies related to nonspeech activities included muscle control and feeding (see Table 5). Two of the studies were Level I (Fucile, Gisel, & Lau, 2002, 2005), three were Level II (Cerny, Panzarella, & Stathopoulos, 1997; Ottenbacher, Scoggins, & Wayland, 1981; Sapienza, Davenport, & Martin, 2002), and four were nonexperimental studies or Level III (Beckman et al., n.d., 2005; Ray, 2002, 2003). Overall, these studies provide weak support of NSOMTs as an effective treatment for muscle control and feeding, with a small number of heterogeneous participants.

Combined Speech and Nonspeech Outcomes

Combinations of NSOMTs for the treatment of nonspeech (feeding) and speech activities have also been described by several authors (see Table 6). However, none of these reports included scientific, controlled data; the evidence for all of these studies is weak (Class IV only). Obviously, there is little scientific evidence for these opinions; this is not considered credible evidence.

DISCUSSION

The Evidence Base in NSOMTs

Despite their popularity, there is a paucity of evidence for NSOMTs as an effective method for improving speech and nonspeech activities. Sufficient evidence concerning their effectiveness does not exist. As Kamhi (2006c) pointed out, the greatest concern about the use of oral motor exercises is the absence of data indicating that they are effective in improving speech production skills. Nonetheless, NSOMTs continue to be used as a treatment by many SLPs. However, based on a lack of high-level evidence, NSOMTs should be excluded from use as a mainstream treatment until there are further data supporting their use. It is important that SLPs consider the evidence supporting or refuting a treatment method in order to make the best clinical decisions as well as for the appropriate allocation of resources rather than wasting time on less effective methods. Thus, NSOMTs should, at best, be

Table 4. Evidence for NSOMTs: Speech outcomes.

<i>Source</i>	<i>Level of evidence</i>	<i>Method</i>	<i>Participants</i>	<i>Treatment approach</i>	<i>Results</i>
Abrahamsen & Flack (2002)	IIb	single-subject baseline design	4-year-old with suspected developmental apraxia of speech	10 hr of NSOMTs	no evidence that NSOMTs changed speech production
Bush et al. (2004)	IIb	single-subject design	9-year-old boy	NSOMTs & articulation treatment	did not improve treatment outcome
Christensen & Hanson (1981)	IIa	control and experimental groups	10 children, 5–6 years of age	14 weeks, artic. treatment vs. artic. treatment & NSOMTs	both groups showed equal improvement
Colone & Forrest (2000)	IIb	single-subject design	2, 8- to 11-year-old twins	NSOMTs for one child, phonological treatment for other child	NSOMTs not useful in improving speech sound production
Gommerman & Hodge (1995)	IIb	single-subject design	16-year-old girl	myofunctional treatment, then articulation treatment	tongue thrust eliminated, no change (1995) until speech treatment
Guisti-Braislin & Cascella (2005)	III	descriptive study	4 first-grade students	15 half-hr sessions of NSOMTs	no real differences in speech production
Hayes (2006)	IIb	single-subject baseline design	6 children, 4–4;8 (years;months)	60-word probe list	traditional articulation treatment effective, NSOMTs not effective
McAlister (2003)	III	retrospective	38 children with voice disorders, 4–9 years old	perceptual ratings pre and post NSOMTs	voice problems less frequent if articulation normal; NSOMTs improve voice
Occhino & McCann (2001)	IIb	alternating single-subject design	5-year-old boy	treatments systematically alternated between NSOMTs and articulation treatment	NSOMTs not helpful
Polmanteer & Fields (2002)	Ib	control and experimental group; random selection	7 girls, 9 boys, ages 4–8 years	pre- and poststructured Photographic Articulation Test	fewer errors for those who received NSOMTs and speech treatment
Roehrig et al. (2004)	IIb	single-subject design	6 children, 3;6 to 6;0	15 hr of articulation treatment & NSOMTs	NSOMTs did not add to overall progress; NSOMTs not different than articulation treatment

considered “experimental” until there are well-designed institutionally approved research studies designed to assess their efficacy. SLPs are obligated to obtain informed consent for experimental treatment. This includes documentation of (a) the type of treatment to be provided, (b) the nature and purpose of the proposed treatment, and (c) possible risks and benefits of the treatment (Aiken, 2002).

Issues Related to EBP and NSOMTs: Ethical and Fiscal Considerations

There are several issues related to EBP and NSOMTs that warrant discussion. This discussion should be of assistance to SLPs when making decisions about the use of NSOMTs. The following paragraphs provide a description of these issues and their implications for professional practice.

Searching for and interpreting evidence-based scholarly publications, systematic reviews, and electronic databases. The first step in any evidence search is the formulation of a specific clinical question (Lou, 2002). The next step is the identification of different sources of evidence from the literature. The search should be comprehensive and should include scholarly publications,

systematic reviews, and electronic databases. The types of scholarly publications include books, non-peer-reviewed journals, and peer-reviewed journals. Peer-reviewed journals are considered more accurate and scholarly than non-peer-reviewed journals because they have been reviewed by experts for accuracy, relevancy, and quality. However, NSOMT outcomes rarely have been reported in the peer-reviewed literature (Bowen, 2005).

Systematic reviews provide an overview of available evidence through appraising and synthesizing evidence from studies. ASHA’s National Center for Evidence-Based Practice has implemented a registry of clinical practice guidelines and systematic reviews (Mullen, 2006a). The Center is in the process of developing systematic reviews about two areas of efficacy relative to oral motor exercises: articulation disorders and swallowing disorders (Mullen, 2006b). The Cochrane reviews are systematic reviews about the effects of health care. The Academy of Neurologic Communication Disorders and Sciences (ANCDs) has published several evidence-based reviews in the *Journal of Medical Speech-Language Pathology* about the treatment of communication disorders associated with neurological impairment (ANCDs, 2001).

There are several electronic databases that can be used, such as MEDLINE and CINAHL, and manual or hand searching of

Table 5. Evidence for NSOMTs: Nonspeech outcomes.

<i>Source</i>	<i>Level of evidence</i>	<i>Method</i>	<i>Participants</i>	<i>Treatment approach</i>	<i>Results</i>
Beckman et al. (n.d.)	III	retrospective mild to severe developmental delays	216, birth to 36 months	lip, cheek strength	effective for multitude of problems and populations
Beckman et al. (2005)	III	retrospective mild to severe developmental delays	223, birth to 36 months	NSOMTs	effectiveness “elucidated”
Cerny et al. (1997)	Ib	quasi-experimental study	10 hypotonic children	expiratory muscle control	improved respiratory movement control
Fucile et al. (2002)	Ib	experimental and control groups	32 preterm infants	oral motor stimulation, 10 consecutive days	NSOMTs group earlier oral feeding
Fucile et al. (2005)	Ib	randomized, controlled	32 preterm infants	oral motor stimulation, 10 consecutive days	NSOMTs group earlier oral feeding
Ottenbacher et al. (1981)	Ib	quasi-experimental	20 severely or profoundly retarded, 5–21 years old, control group (<i>N</i> = 10) & experimental group (<i>N</i> = 10)	NSOMTs to facilitate feeding patterns	no statistically significant difference between the two groups
Ray (2002)	III	correlation	16 children, spastic cerebral palsy	lip, tongue, jaw	significantly improved lip, tongue, jaw function, improved speech
Ray (2003)	III	non-experimental	6 adults, 18–23 years old, persistent articulation impairments	NSOMTs 6 weeks	5 of 6 showed significant progress in oral postures; speech sound production in single words, sentences, spontaneous speech
Sapientza et al. (2002)	Ib	quasi-experimental	40, 21 (+/–) years old	expiratory-specific speech training	effective for increasing expiratory pressure supply in high school band students

appropriate journals should be considered for newer journals that are not yet in the electronic system. After locating different sources of information, the information should be evaluated relative to the type and level of evidence such as that described by ASHA (2004a, 2005) in Table 1. The studies should be summarized in a table of evidence so that the results across studies can be reviewed and evaluated to determine the effectiveness of the treatment. This takes the form of a qualitative synthesis. Occasionally, a quantitative synthesis of the existing literature, known as a meta-analysis, is appropriate if a sufficient body of data exists (ANCDs, 2001; Maxwell & Satake, 2006; Robey, 1998).

Scientific, controlled studies aimed at documenting the efficacy of NSOMTs are essential. However, much of the evidence about NSOMTs has been generated by its developers. Thus, reports may be generated to promote products (i.e., materials, workshops, etc.). Furthermore, some developers have made misleading and/or unsubstantiated statements about NSOMTs. Product-oriented research creates the potential for a conflict of interest (Sininger, Marsh, Walden, & Wilber, 2003). Responsibility for conducting product efficacy clinical studies should be independent of the developers of these products.

Related to this discussion is the recently established Oral Motor Institute (OMI). The purpose of OMI is to publish monographs

about oral motor treatments for feeding and articulation. The first monograph, “Oral Motor Techniques Are Not New,” (OMI, 2007) reported the history of OMTs from 1912 to 2007 and was based primarily on textbooks. The next monograph, “A Topical Bibliography on Oral Motor Assessment and Treatment,” was published by OMI in 2008. The monographs were peer reviewed; however, the reviewers were developers of oral motor materials and providers of oral motor workshops. This may limit the credibility of the monographs as well as provide a limitation related to weak or low levels of evidence and failure to include contradictory findings that were incompatible with the evidence.

Testimonials. At best, testimonials are weak, secondary evidence that is not relevant to the efficacy of treatment in EBP. They are only opinions and should not be used as a basis for making clinical decisions about treatment. Furthermore, the ASHA (2003a) Code of Ethics, Principle of Ethics IV, Rule F addresses dissemination of information: “Individuals’ statements to colleagues about professional services, research results, and products shall adhere to prevailing professional standards and shall contain no misrepresentations” (p. 15).

There are testimonials about NSOMTs on the Web sites of some SLPs. Boshart (n.d.) said that “personal testimonies express the value of this type of therapy and of the countless numbers of

Table 6. Sources of Level IV (opinion) evidence for NSOMTs.

<i>Author</i>	<i>Year</i>	<i>Title</i>
Bahr	2001	Oral Motor Assessment and Treatment
Bahr	2006	Coordinated Oral-Motor Treatment
Beckman	1986	Oral Motor Assessment and Treatment
Boshart	1998	Oral Motor Therapy
Boshart et al.	2000	Great Therapy Ideas: Oral Sensory Motor Tools-Toys Techniques
Campbell	2000	An Exercise in Better Sound Production
Czesak-Duffy	1997	Oral-Motor Approach to Resistant, Lateral Emission
Dworkin-Culatta	1996	Oral Mechanism Examination and Treatment System
Earnest	2000	Preschool Motor Speech Evaluation and Intervention
Fogel	2000	Preliminary Exercises for Articulation Therapy
Gangle	1993	The Source for Oral-Facial Exercises
Loncar-Belding	1998	Take Home Oral-Motor Exercises
Mackie	1996a	Oral-Motor Activities for School-Aged Children
Mackie	1996b	Oral-Motor Activities for Young Children
Marshalla	2001	Oral Motor Techniques in Articulation and Phonological Therapy
Morris	1989	Development of Oral-Motor Skills in the Neurologically Impaired Child Receiving Non-Oral Feedings
Orr	1998	Mouth Madness: Oral Motor Activities for Children
Pehde, Geller, & Lechner	1996	The Complete Oral-Motor Program for Articulation
Plass	2000	Remediating the /r/ Sound
Rosenfeld-Johnson	2001	Oral-Motor Exercises for Speech Clarity
Rosenfeld-Johnson & Manning	1999a	Using Simple Tools in Oral-Motor Therapy: Part I, Straws
Rosenfeld-Johnson & Manning	1999b	Using Simple Tools in Oral-Motor Therapy: Part II, Horns
Roth & Worthington	1996	Treatment Resource Manual for Speech-Language Pathology
Strode & Chamberlain	1997	Easy Does it for Articulation: An Oral-Motor Approach
Waldowski	2002	Preface to Speech Development

children and adults that now communicate more effectively and whose lives have been enriched.” Talk Tools (n.d.) lists several “testimonials and success stories.”

Certification. Some implicitly or explicitly suggest that certification in NSOMTs is a necessary prerequisite to using the techniques. Moreover, this certification may be at a substantial cost. In an unpublished study, Beckman and associates (n.d.) stated that “all clinicians must hold a certificate for Beckman Oral Motor Assessment & Intervention” (p. 16). Rosenfeld-Johnson’s (2005) certification training has requirements that include completion of Talk Tools Levels 1 and 2 feeding; ASHA’s certificate of clinical competence or state licensure; use of techniques included in courses for a minimum of 6 months; submitting a video; and owning a copy of Oral-Motor Exercises for Speech Clarity (Rosenfeld-Johnson, 2001; Talk Tools, n.d.). In some instances, a certificate may confirm only that a person has attended a course or seminar for a certain number of hours. Furthermore, some people incorrectly believe that ASHA approves the continuing education (CE) instructor’s right to certify competence (Brown, 2003). There is a similar misunderstanding about ASHA CE units (CEUs), which do not imply endorsement of course content.

Heterogeneous populations. There are differences between and within studies of NSOMTs. Such studies involving clinical speech intervention have included participants with suspected developmental apraxia of speech (Abrahamsen & Flack, 2002), voice disorders (McAlister, 2003), tongue thrust (Gommerman & Hodge, 1995), and articulation/phonological problems (Colone & Forrest, 2000; Christensen & Hanson, 1981; Forrest, 2002; Guisti-Braislin, & Cascella, 2005; Hayes, 2006; Occhino & McCann, 2001; Polmanteer & Fields, 2002). Moreover, the nature and severity of the articulation problems may or may not be described.

Studies of the use of NSOMTs for feeding problems are heterogeneous relative to several participant characteristics, including age, diagnostic category, and etiology (see Table 5). Ages ranged from preterm infants (Fucile et al., 2002, 2005) to adults (Ray, 2002; Sapienza et al., 2002). For example, Bahr (2001) described oral motor assessment and treatment from birth to adolescence and adulthood. Diagnostic categories have included mild to profound developmental delays (Beckman et al., n.d.; Cerny et al., 1997; Ottenbacher et al., 1981), hypotonia (Cerny et al., 1997), and cerebral palsy (Ray, 2002). Moreover, a number of methodological issues confound this evidence. Among these issues are lack of controls, lack of replication, and failure to specify outcome measures and type of treatments.

There is also a broad range of etiologies. Beckman and associates (n.d.) stated that “oral motor-treatment is effective for a multitude of populations” (p. 16). The etiology of these problems included trisomy 21, premature microcephaly, drug exposure, hydrocephalus, hypotonia, seizures, and holoprosencephaly (Beckman, 2003; Beckman et al., n.d., 2005). An article on NSOMTs by Beckman (2003) focused on a 1-year-old child with holoprosencephaly, which is a major congenital defect caused by failure of the prosencephalon to divide into hemispheres during embryonic development. Fernicola (2003) indicated that the child’s condition was immaterial because the Beckman method does not require a specific cognitive level. Rosenfeld-Johnson and Manning (1999a) described NSOMTs as a method “to correct articulation disorders, deal with deficiencies in phonetics and breath control, work with cleft palate repair, teach velopharyngeal function, and improve speech clarity” (p. 20). Bahr (2001) also indicated that NSOMTs were appropriate for a variety of etiologies such as hypotonia, Moebius syndrome, traumatic brain injury, pervasive developmental disorder, and

developmental apraxia. To date, there has been weak evidence (Class IV) for the usefulness of NSOMTs with heterogeneous populations. Opinion increases at the risk of bias (i.e., opinions biased toward the expert's point of view). Furthermore, NSOMTs have been undertaken with little consideration of any other important components, including number and length of treatment sessions, outcomes measures, and so forth.

Clark (2003, 2005) stated that understanding neuromuscular impairment is important in making clinical decisions about NSOMTs for speech and swallowing. Furthermore, failure to consider neuro-motor status could influence clinical decisions. There is an inverse relationship between heterogeneity of a population and the usefulness of clinical evidence in making decisions about diagnosis and treatment (Ylvisaker et al., 2002). Inferences are increasingly tenuous as the heterogeneity of the population increases. Furthermore, failure to consider factors such as diagnostic category and etiology may result in inflated or inaccurate prognosis and/or inappropriate clinical decisions about treatment. Such factors must be considered in relation to the potential for improvement, which is addressed in Principle I, Rule G of the ASHA (2003a) Code of Ethics: Services should be provided "only when benefit can reasonably be expected" (p. 14).

Cost–Benefit Analysis

There is a need to determine who benefits from NSOMTs and at what cost. Evaluation of NSOMTs should include a cost–benefit analysis to determine whether the benefits outweigh the costs. Costs are not restricted to monetary costs but also include the time, effort, and emotional involvement of the client and family, as well as possible creation of unrealistic expectations resulting in defeatism or frustration (Ylvisaker et al., 2002). Cost–benefit should be evaluated; this type of analysis should facilitate the best clinical outcome while expending the fewest dollars (Bolnick & Merson, 1998). Furthermore, this analysis is especially important when there is limited or no evidence to support a specific approach (Reilly, 2004).

Typically, cost–benefit analysis compares the cost of treatment to the benefit to the client. However, it would seem appropriate to also analyze cost–benefit relative to cost to the professional (certification, workshops, materials) and benefit to the presenter and/or author. In addition, level of evidence warrants consideration relative to cost–benefit. It would seem that any cost would be substantial if there is no evidence of benefit.

Related to cost–benefit analysis are ethical concerns about misrepresentation. The ethics of clinical practice require a complex balancing of commitment to EBP and the rights of clients/families to be accurately informed and protected from risks, harm, and exploitation. Lof (2006) stressed that parents should be told that oral motor exercises have not been found to be effective and therefore they must be considered experimental in nature.

Criteria for Evaluating Expert Opinion

The quality of information from experts varies considerably from high quality and credible to low quality (i.e., biased and even deceptive and misleading). Thus, expert opinion should be evaluated. The following questions, developed by the authors, should be considered in determining the level of expert opinion.

- What is the expert's training and experience?
- Is the expert trained in EBP?

- What is the level of evidence?
- Has the treatment been published in peer-reviewed journals?
- Is the expert's opinion consistent with known facts, previous research, and theory?
- Did the expert make full disclosure of any financial interests related to products such as materials and publications?
- Is the expert objective and free of bias?
- Does the expert consider counter evidence?
- Does the expert provide up-to-date information?
- Does the expert provide a logical basis for his or her opinion?
- Does the expert provide a comprehensive overview (i.e., both "sides")?
- Does the expert mainly cite his or her own work?

SUMMARY

Evidence is either weak (based on reports of clinical experience and opinion) or lacking to support NSOMTs for the treatment of speech sound disorders. Furthermore, NSOMTs are often considered based only on confirming evidence without regard to contradictory evidence (Finn, Bothe, & Bramlett, 2005). SLPs should know how to manage treatment EBP that focuses on the use of current best evidence from the clinical literature (ANCDs, 2001). There are also checklists, such as those by ASHA (n.d.) and Duchan, Calculator, Sonnenmeier, Diehl, and Cumley (2001), for critically reviewing treatment programs. In addition, the level of evidence for the treatment warrants consideration. ASHA (2005) provides examples of levels of evidence for treatment(s). However, expert opinion and/or clinical experience may be the highest level of evidence available. There is no guarantee that expert opinion would consider the latest information, would be unbiased, and/or would result from critical appraisal of the existing literature (Reilly, 2004).

In addition, SLPs have an ethical responsibility to provide accurate information to clients, families, and other professionals. This information should indicate if the evidence is incomplete or weak (i.e., if the treatment is experimental and has not yet met scientific standards as a mainstream treatment).

CLINICAL IMPLICATIONS OF EBP FOR THE USE OF NSOMTs

There are experimental data that suggest that NSOMTs do not improve speech sound production (Abrahamsen & Flack, 2002; Bush et al., 2004; Colone & Forrest, 2002; Gommerman & Hodge, 1995; Guisti Braislin & Cascella, 2005; Hayes, 2005; Occhino & McCann, 2001; Roehrig et al., 2004). Others also have concerns about NSOMTs. Forrest (1998) suggested that NSOMTs are not a solution for the treatment of phonological disorders. Lof (2003) asserted that there is little, if any, justification for using NSOMTs, and that it is puzzling why clinicians continue to use these exercises. Lof (2004) also stated that there is no evidence to support NSOMTs, and that NSOMTs will not produce speech changes. In a study of 537 participants, Lof and Watson (2008) found that the majority (85%) of participants believe that research supports the use of

NSOMTs and that these techniques were learned from CE workshops. The need for evidence-based CE is obvious. According to Shuster (2004), "It seems premature for clinicians to use clinical time to treat nonspeech oral behaviors in the absence of efficacy data when there are treatment studies documenting the effectiveness of various approaches which use speech tasks" (p. 24). Peterson-Falzone, Trost-Cardamone, Karnell, and Hardin-Jones (2006) assert that "Unfortunately, despite a lack of supportive evidence, a number of SLPs have 'jumped on the oral motor bandwagon' and have capitalized on this trend by marketing simple blowing and sucking toys and devices" (p. 115). Golding-Kushner (2001) stressed that oral motor exercises are ill advised and should be avoided, and Forrest (1998, 2002) voiced similar concerns. In a comprehensive review of the literature, Ruscello (2008) concluded that there is no credible evidence to support the use of NSOMTs for treating developmental speech sound disorders.

There is a proliferation of NSOMT workshops that provide CEUs. At this time, most information presented at these workshops is either anecdotal or expert opinion. Recently, Lof (2006) said that "the goal of speech therapy is NOT to produce a tongue wag, to have strong articulations, to puff out the cheeks, etc." (p. 7). Rather, the goal is to improve speech. There is also some confusion about ASHA's CEUs; some presenters and attendees incorrectly assume that if ASHA offers CEUs, it approves the content of a CE offering or activity. For example, Markel-Piccini (2004) stated that "oral motor techniques are being approved by the American Speech-Language-Hearing Association." In fact, ASHA CEUs do *not* imply endorsement of course content, specific products, or clinical procedures (Brown, 2003; Waguespack, 2004).

Sufficient evidence does not exist for NSOMTs' effectiveness in improving speech, and therefore NSOMTs should be excluded from use as a mainstream treatment. This means that SLPs should be knowledgeable about EBP and the status of NSOMTs. It also means that a number of issues need to be resolved. Among these issues are:

- informed disclosure to clients, families, and other professionals that NSOMTs are, at best, experimental, which involves institutionally approved research protocols, including informed consent
- selection of treatment based on the best available evidence (i.e., the highest levels of available evidence)
- more complete description of treatment practices such as frequency and duration of treatment of clients' problem(s) and cost-benefit analysis
- documentation of NSOMT outcomes independent of participating clinician(s)
- description of evidence level for educational activities on NSOMTs

ASHA should consider reviewing existing data on NSOMTs and developing a technical report and position statement about the use of NSOMTs for speech and swallowing disorders.

CONCLUSION

Despite many years of use, NSOMTs as a standard treatment for developmental speech sound disorders is not supported by the available evidence. Furthermore, NSOMTs continue to be used

even in spite of counterevidence. SLPs should be cautious about the unsubstantiated class of evidence (Class IV, opinion). The greatest concern is the widespread use of NSOMTs for treatment of a wide variety of speech problems in both children and adults. SLPs should consider the current research literature and the principles of EBP in making decisions about NSOMTs. This should result in the best treatment outcomes and reduce wasting time on ineffective methods.

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