portant members of the treatment team. They are responsible for ensuring that appropriate food consistencies are given to the patients and help them to remember performing their swallowing techniques. Often, there are only a few speech-language pathologists in our hospital and just one in the field of dysphagia. Meanwhile, we have a great number of patients suffering from dysphagia and we require assistance in managing their care.

Every year we arrange a course in basic knowledge in dysphagia and nursing staff from all parts of Sweden, Norway, and Finland use to participate.

Scientific projects are ongoing. Performing scientific studies in collaboration with radiologists has proved to be very interesting. At the moment, we are evaluating different swallowing techniques by means of video-manometry. In the field of Dysphagia, more studies are needed to evaluate different therapeutic strategies.

We often have visitors from the Scandinavian countries. In these countries there is great interest in learning how to take care of the patient with dysphagia and, especially, how to perform the videoradiographic swallowing examination.

Dysphagia management is a challenging field to deal with, often it means a lot of hard work but also patients that show great gratitude.

This article is co-authored by Gabe Sella, M.D., MSc. ,MPH. Dr. Sella is a life member of SESNA (S-EMG Society of North America). He has published extensively and has given over 40 international seminars on the subject of S-EMG. He is a Board Diplomat in pain management, independent medical examiner, and a Fellow of the American Academy of Disability Evaluating Physicians, Academy of Family Physicians, College of Preventive Medicine, Board of Forensic Medicine, Board of Forensic Examiners, Board of Disability Analysts and American Back Society. He is actively involved in research on the subject of S-EMG investigation and neuromuscular re-education.

Objective Evaluation of Dysphagia

Peter Johnson and Gabe Sella

By definition, dysphagia is a pathological condition that precludes normal deglutition and swallowing. Consequently, food boluses may remain in the oral and/or pharyngeal recesses, ending up in the glottis and/or trachea, or may not be propulsed properly through the esophagus. There are several etiologies resulting in dysphagia. At the present time, neuromuscular relationships in this condition will be discussed from the investigative and treatment point of view with the advent of S-EMG.

A number of muscular parameters are relevant from the functional point of view in dysphagia. Such parameters include the following:

1. Normal muscular contractility, at unison, bilaterally;
2. Normal muscular ability to rest, at unison, bilaterally; and
3. Normal muscular electrical activity, at unison, bilaterally.

Surface electromyography (S-EMG) is an electrophysiological motor modality which endeavors to assess the summation of action potentials (amplitude) and/or frequency spectrum of electrical conduction in living skeletal muscle, during a given activity or rest (Basmajian, 1985). The vantage point of assessment is the cutaneous level. Electrodes are placed in specific ways on the skin overlying the target muscles (Sella, 1997}. The equipment, modernly computerized, can assess electrical activity and display such on the monitor in pictorial or digital display.

A Myo-Track II, by Thought Technologies, Montreal, Canada is a hand-held piece of equipment with digital display that provides biofeedback. This type of instrument can be used at home or in a clinical setting and the data may be transferred to a computer for further utilization.

Statistics (Sella, 1998) are available and necessary through the software. These statistics can serve as an objective measurement of the efficacy of dysphagia treatment (Sella, 1998). Third-party payers are no longer accepting subjective clinical impressions of dysphagia severity or clinical changes in the disorder as a result of clinical intervention. "Therefore it has become a clinical necessity to be able to objectively document small changes in the focused treatment outcomes, as well as long term functional outcomes. Accurate documentation to referring physicians, clinicians and facilities is critical for insuring of an appropriate continuum of care once the patient leaves the diagnostic session" (Martin-Harris, 1999, p. 5).

The FlexComp, by Thought Technologies, Montreal, Canada is a battery operated, belt-held piece of equipment, which can be used for investigation or treatment on eight channels. The monitor display may vary according to the software program. It represents the amplitude of contraction of homologous bilateral muscles and equilibrium within a given pair.

(Note: We do not intend to endorse the above-cited equipment; rather, these are examples of available technology.)

The modality has a dual utilization: diagnostic assessment of muscular dysfunction and neuromuscular re-education (S-EMG biofeedback) of the affected muscles (Basmajian, 1985). In fact, S-EMG was singular among the electrophysiological modalities in terms of the duality of utilization until the advent of EEG neurofeedback. Numerous studies have shown the efficacy of using biofeedback in combination with traditional dysphagia treatment, including motor oral exercises and compensatory strategies. Sukthanker and colleagues (Sukthanker, Reddy, Canilang, Stephanson, & Thomas; 1994) noted that patients with dysphagia treated with biofeedback, when compared to a group treated only with exercises or a group who utilized transducers without audiovisual feedback, reported significant progress. Crary (1995) investigated six patients who suffered brainstem stroke with severe dysphagia. All six patients were on gastrostomy tubes prior to treatment. The patients received direct dysphagia management along with S-EMG monitoring of the exercises. The results showed that 5/6 patients resumed oral intake. Post-therapeutic follow- up of the patients demonstrated continued full oral intake without gastrostomy tube. Huckabee (Huckabee & Cannito, 1999) successfully replicated and extended the Crary study by using 10 brainstem patients with severe dysphagia. The patients received 10 hours of direct dysphagia treatment along with a home program with S-EMG biofeedback monitoring. Huckabee reported that 8/10 patients were able to return to complete oral intake and termination of the gastrostomy tube feedings 13). These studies appear to indicate that efficacy of S-EMG biofeedback monitoring is a significant adjunct to traditional dysphagia management. In addition, S-EMG provides an objective, quantifiable methodology to assess and measure the efficacy of the therapeutic intervention. This objective measurement is important to third-party payers as a means of proving the efficacy of the treatment. Certainly, the authors suggest additional studies in order to continue to investigate the most effective use of S-EMG for the investigation and treatment of dysphagia in addition to the traditional management.

In terms of dysphagia, S-EMG can be utilized to assess several bilateral muscles, which are involved in the deglutition and swallowing process. These muscles include the following: Temporalis, masseter, orbicularis oris, zygomaticus, the supra-hyoid, and infra-hyoid muscles. The muscles of the tongue proper and the pterygoids have been tested with less precision. They will be amenable to closer examination in the near future. New instrumentation is currently reported to be successful in indirectly measuring tongue movement. For example, Robbins (Robbins, 1997) describes a protocol for the simultaneous collection of tongue pressure data, submental S-EMG and video-fluoroscopy.

The dysphagia assessment follows the general pattern of protocols described in the literature (Sella, 1997). It is done bilaterally through a number of classic mandibular motions and necessary periods of rest. The interpretation depends on the following:

1. The clinical picture;
2. The findings of normal or abnormal electrical parameters of muscular contraction.

The electrical parameters of muscular contraction have likewise been described in the literature. They include the following:

1. Normal;

   a. Normal bilateral activity through any given segment of the ROM involved in the deglutition/ swallowing process;

   b. Normal resting pattern in between any given motion;

   c. Equilibrium between the homologous contra-lateral muscles during activity or rest, i.e. activity amplitude/ median frequency value differences < 20%.

2. Abnormal;

   a. Pattern of muscular spasm, defined as an elevated amplitude of contraction during any given motion or resting period;

   b. Pattern of hypertonus, defined as an elevated amplitude of contraction during any given motion with tendency to return to normal resting values, however, inability to do so during any resting period;

   c. Pattern of hypotonus, defined as a lower amplitude of contraction during any given motion with tendency to return to normal resting values, however, inability to do so during any resting period;

   d. Pattern of co-contraction, defined in this case as a unilateral electrical activity in a muscle supposedly at rest during a period when contra-lateral muscles are in motion;

   e. Myofascial myotatic units which act in disequilibrium either unilaterally or bilaterally;

   f. Fasciculations, ie spontaneous large spike contractions, not consciously controlled or controllable;

g. Contracture, ie muscular silence, usually unilateral (after artifacts have been ruled out);

h. Disequilibrium, ie activity values > 20% difference between homologous contra-lateral muscles during motion or rest;

i. Evidence of fatigue as defined in the literature as a median frequency decrement of rapid appearance, usually unilateral;

j. Changes from normal activity patterns to abnormal activity patterns such as spasm, hypertonus, hypotonus or bizarre waveforms.

It must be relevant to be stated at this point that S-EMG may show abnormal findings of muscular electrical activity in the presence of normal needle EMG findings. It is essential to understand that needle EMG assesses the neuromotor junctional activity in skeletal muscle while S-EMG assesses the pattern of activity of the traveling action potentials from the surface vantage point and does not assess directly any junctional activity. Thus, one can not substitute for the other and "normal" findings with one technique do not preclude "abnormal" findings with the other.

Once the clinician identifies dysfunctional muscular patterns through the necessary motions, e.g. deglutition or swallowing, the findings can be utilized to understand better the pathological process and to enable the clinician and the patient to proceed with a number of treatments, especially that of reeducation (Sella, 1996).

The neuromuscular re-education can be accomplished with S-EMG biofeedback protocols. The protocols defined by the author include the following learning curve sequence:

1. Re-learning of the relaxation or resting process. This involves the following loop: muscle (e.g. masseter® skin electrode® preamplifier® wire® equipment ® computer® screen® visual interaction of the patient and the screen® oculomotor pathways® cortico-motor relays® motor-neurons pathways® muscle. In this process, the affected individual learns how to decrease the electrical activity curve of the normal homologous contra-lateral muscle first, or, occasionally of a normal target muscle first. This relaxation process is rehearsed as necessary. The learning curve is usually very good and can be accomplished in 1-2 sessions of approx. 20 minutes. It is of note that the target muscle may start showing a learning curve of relaxation during this process although the patient may not necessarily focus on it. The final step in the relaxation process is that of consciously learning to decrement the electrical activity curve of the target dysfunctional muscle.

2. Re-learning of the activity or motion process. This involves the same loop as above. It may be of relevance to note that the learning process probably involves renewing a motor engram or modifying it according to the availability of vasculo-motor pathways. Thus, in the case of strokes, the archaic neuro-motor pathways, not utilized since very early infancy may be called into play by the new learning curve process. This has to be kept in mind within the field of dysphagia neuro-motor re-education.

   In this process, the affected individual learns how to increase the electrical activity curve of the normal homologous contralateral muscle first or, occasionally of a normal target muscle first. This increase in amplitude value, e.g. from 2mV (resting values) to 10, 20 or 30mV is rehearsed as necessary. The learning curve is usually very good and can be accomplished in 1-2 sessions of approximately 20 minutes. It is of note that the target muscle may start showing a learning curve of increasing amplitude during this process although the patient may not necessarily focus on it. The final step in the relaxation process is that of consciously learning to increment to set levels the electrical activity curve of the target dysfunctional muscle.

3. Re-learning of the activity or motion process. This involves the same loop as above. In addition, the modulation in the learning process involves also limbic components. This is true for the learning of motion and of rest. It may be of relevance to note that the learning process probably involves renewing a motor engram or modifying it according to the availability of vasculo-motor pathways. Thus, in the case of strokes, the archaic neuro-motor pathways, not utilized since very early infancy may be called into play by the new learning curve process. This has to be kept in mind within the field of dysphagia neuro-motor re-education.

   In this process, the affected individual learns how to increase the electrical activity curve of the normal homologous contralateral muscle first or, occasionally of a normal target muscle first. This increase in amplitude value (e.g. from 2mV [resting values] to 10, 20 or 30mV) is rehearsed as necessary. The learning curve is usually very good and can be accomplished in 1 to 2 sessions of approximately 20 minutes. It is of note that the target muscle may start showing a learning curve of increasing amplitude during this process although the patient may not necessarily focus on it. The final step in the relaxation process is that of consciously learning to increment to set levels the electrical activity curve of the target dysfunctional muscle.

Jo Puntil is the sort of burr that should reside under all saddle blankets. She is definitely under mine, constantly reminding me that I should not only aspire to be better but to do something about it. Jo is the reason that I became managing editor of the Division 13 Newsletter. She sat behind me at the meeting and held up my arm when I was not paying attention. I now know better and only sit behind her. One day I ***will*** *exact my revenge. Jo is a Dysphagia Clinical Specialist/Speech-Language Pathologist and past President of the California Speech Pathologists/Audiologists. She also maintains a private practice and serves as the Director of Orange County, California Speech and Hearing Association. Jo is also a an author and member of the Dysphagia Research Society.*

Medicare Funding for Rehabilitation Cut to the Bare Bones, All Other Insurance Companies to Follow

Jo Puntil

I am a speech-language pathologist who works at two community hospitals in California. For the past 17 years I have provided services in the evaluation and treatment of adult patients with communication and swallowing disorders. The patients I treat are in the hospital because of strokes, respiratory disorders, head injuries, head and neck cancer, and neurological diseases, such as Parkinson's. Their swallowing problems at times can be severe enough to cause respiratory distress, pneumonia, or even death from aspiration of food/fluid into their lungs. Hence, problems must be recognized and treated quickly or the

Continued on page 14

4. The individual spends at least one session reviewing the learning of the resting and motion process. In this session, activity and rest are repeated sequentially till learned adequately.
5. The individual learns to proceed with activity and rest through functional type activities. In the case of dysphagia, such activities may include a sequence of mandibular motions and tongue motions as related to opening and closing the mouth initially, to be followed by tongue movements, deglutition and swallowing.
6. The individual may need "boosting" sessions for enhancement of the process and of the engram. Such boosting sessions need to stress the types of motion or patterns of rest that may not be completely normal.

Conclusion

S-EMG is a dual electrophysiological motor test/treatment modality. The investigation and interpretation of results is paramount to the treatment decision. The treatment decision may be multilateral and may include several modalities. The S-EMG biofeedback or neuromuscular re-education treatment modality and protocol are paramount to the learning process, which must be renewed in the dysphagia condition. Efficacy studies have generally been positive and conclude that S-EMG biofeedback enhances traditional dysphagia treatment. The objective, quantitative data are also favored by third-party payers. Continued research in this area is suggested.

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