SPECIAL SECTION

The Glazer Intrapelvic Surface Electromyography (SEMG) Protocol in a Case of Male Urinary Incontinence and a Case of Female Hypoactive Sexual Desire Disorder

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This paper presents two cases of the clinical application of a valid and reliable method of pelvic floor muscle evaluation (Glazer Protocol) using a computerized surface electromyography (SEMG) device. The authors present a male patient with urinary incontinence post–radical retropubic prostatectomy (RRP) and a female patient with hypoactive sexual desire disorder (HSDD) and primary dyspareunia. Radical retropubic prostatectomy is a surgical removal of the prostate through the abdomen. Dyspareunia refers to painful sexual intercourse. Intrapelvic SEMG evaluations were conducted before and after pelvic floor muscle training (PFMT) with biofeedback. Intrapelvic sensors were used with a fixed sequence of voluntary pelvic floor activities and continuous real-time recorded SEMG measures to determine electrophysiological abnormalities and their potential role in the symptomatic presentation. This analysis lead to the development of an individualized pelvic floor muscle SEMG biofeedback program for each patient, aimed at symptomatic relief and functional restoration.

Introduction: Post–Radical Prostatectomy Urinary Incontinence

Despite varying types and degrees of pelvic floor dysfunctions and the limits of our knowledge of their relationship to symptoms, assessment tools are necessary to identify those dysfunctions (Flisser & Blaivas, 2002). Clinical assessment is the key to the diagnosis of pelvic floor dysfunction-related disorders, as it provides data to develop treatment strategies, in order to relieve symptoms and to improve the patients’ quality of life and functional capacity (Staskin et al., 2009). Using appropriate assessment techniques may be particularly useful in the practice of specialized fields of health care (Schwartz & Andrasik, 2003).

The International Continence Society (ICS) classifies lower urinary tract symptoms into storage symptoms (overactive bladder, urinary incontinence, urgency urinary incontinence, mixed urinary incontinence, etc.), voiding symptoms (urethral stenosis, obstruction, hypotonic or atonic detrusor, etc.), and post–micturition symptoms (incomplete void sensation and post–micturition dribbling) (Milsom et al., 2009).

Urinary incontinence (UI) occurs in men and women at any age and can be characterized by type, frequency, severity, social, hygienic, and quality of life impact and functionality. Only a minority of sufferers with pelvic floor dysfunction seek any kind of treatment for their symptoms. The majority of patients do not seek treatment because of fear, shame, or ignorance (Lagro-Janssen, Smits, & van Weel, 1990).

In men, the main cause of UI is prostate surgery. Male UI prevalence, post–prostatectomy varies from 2–57%, and tends to decrease over the 1–2 year period following surgery. The main risk factors are age, decrease of physical and cognitive skills, neurological problems, and type of prostate surgery (Milsom et al., 2009). Male UI creates a significant impact on quality of life, and significantly interferes with cognitive and physical functions (Staskin et al., 2009), as well as sexual activity (Abrams, Cardozo, & Wein, 2010; Abdo, 2006).

The International Continence Society recommends conservative treatment as a first line intervention. The main tools are electrostimulation, anticholinergic medications, and behavioral therapy. Behavioral therapy is the integration of life style changes, pelvic floor muscle training (PFMT), and voiding behavior training to help achieve functional improvement in target behaviors such as voiding control and sexual behaviors (Smith et al., 2009).
PFMT with biofeedback, before radical retropubic prostatectomy (RRP), improves post-surgery incontinence related to time, severity, voiding symptoms, and pelvic floor muscle strength one year after RRP (Ribeiro et al., 2010). The European Association of Urology (EAU), based on published literature review articles since 2000, recommends the use of noninvasive therapies, PFMT, and biofeedback before and after RRP (Bauer, Bastian, Gozzi, & Stief, 2009).

A Cochrane review of randomized or semirandomized groups with different types of UI reported on 24 trials involving 1,583 women showed that PFMT with biofeedback was significantly more effective than PFMT with verbal feedback, which showed no improvement in UI symptoms. The authors concluded that a supervised treatment tends to get better responses (Henderschee, Hay-Smith, Herbison, Roovers, & Heineman, 2011).

In all cases, the least invasive treatment is recommended first. The success of treatment depends on the correct diagnoses. The majority of treatments are aimed at a specific pathophysiology as a known cause of the incontinence. It is also important to understand that more than one type of incontinence may be present, and treatment based on pathophysiology of one type of incontinence may relieve non-related symptoms of another type of incontinence (Newman & Laycock, 2009).

**Introduction: Primary Female Hypoactive Sexual Desire Disorder and Dyspareunia**

Sexual activity and sexual problems have been studied in several large populations of women. Patel, Gillespie, and Foxman (2003) studied the sexual activity of a normative sample of 2,000 women in a phone survey. “Sexually active” was defined as oral (active or receptive), vaginal, or anal intercourse within the past three months. Sexual activity was reported in 66% of women aged 18–29 years, 70% of women aged 30–39 years, 65% of women aged 40–49 years, 46% of women aged 50–59 years, and 20% of women aged 60–94 years. In a separate study by Shifren, Monz, Russo, Segreti, and Johannes (2008), termed the PRESIDE study (The Prevalence of Female Sexual Problems Associated with Distress and Determinants of Treatment Seeking), a survey of 31,581 women in the U.S. found that 43% acknowledged sexual problems, including specific problems with desire (9.5%), arousal (5.1%), and orgasm (4.6%). A subset of 2,868 women in the PRESIDE study reporting low sexual desire showed 63.9% were premenopausal, 80.7% had a present partner, 52.5% had other sexual problems such as arousal, orgasm, or both, and 37.4% report extreme dissatisfaction with their sex life. In the PRESIDE study, only 33% of the women with a distressing sexual problem sought formal care. The National Health and Social Life Survey (NHSLS) found that sexual problems were associated with low physical and emotional satisfaction with one’s partner and low general happiness (Laumann, Paik, & Rosen, 1999). In a web-based survey conducted by Berman and colleagues (2003), 3,807 women responded to questions about their experiences seeking help for sexual problems from their physicians. Just over half of patients reported that they believed their physicians did not want to hear about the problem, 76% noted that they were not thoroughly examined by their physician with regard to their complaint, 85% of patients reported that their physician did not give them a diagnosis, and 87% of patients said their physician did not follow up on the complaint (Berman et al., 2003). In a study by Humphrey and colleagues, 73.1% of women with sexual problems did not report them due to embarrassment (Humphrey & Nazareth, 2001).

A MEDLINE® literature search using the terms “Biofeedback,” “Sexual Desire,” and all MEDLINE recommended related search terms starting in 1985 yielded no findings, either in research or review literature. A MEDLINE literature search using the terms “Biofeedback,” “Dyspareunia,” and all MEDLINE recommended related search terms starting in 1985 (research or review) yielded 19 citations, of which nine papers reported directly on Pelvic Floor SEMG Biofeedback and Dyspareunia. Two review articles concluded that: (a) Biofeedback shows promising results (Bergeron, Binik, Khalifi, & Pagidas, 1997), and (b) Biofeedback of pelvic floor muscles represents a first-line effective therapy (Mariani, 2002). The remaining seven papers were research articles. Four of these articles reported positive findings for pelvic floor muscle biofeedback in the treatment of dyspareunia (with no comparison treatments), and the remaining three articles compared biofeedback to other treatments. Of these three, two of the articles reported equal efficacy of biofeedback, cognitive behavior therapy, and surgery (Bergeron et al., 2001; Bergeron, Khalife, Glazer, & Binik, 2008) and the remaining article comparing biofeedback to topical lidocaine showed no difference (Danielsson, Torstensson, Brodda-Jansen, & Bohm-Starke, 2006).

**Physiotherapy and PFM SEMG Biofeedback in the Diagnosis and Treatment of Related Disorders**

Physiotherapy, applied to pelvic floor dysfunction related disorders such as incontinence and inhibited sexual desire, is a noninvasive treatment used to decrease lower urinary and genital tract symptoms, improve interpersonal rela-
tions, and increase patients’ quality of life. As part of the assessment, the physiotherapist provides information about the patient’s symptoms and the role of pelvic floor muscle location, function, activation, deactivation, and relaxation to achieve functional coordination and to improve treatment outcomes through the rehabilitation process (Schwartz, 2003). Many patients experiencing pelvic floor dysfunction-related disorders demonstrate poor body awareness concerning pelvic floor muscles. Before the assessment, patients receive educational material on what to expect during the physical exam in order to avoid anxiety and embarrassment (Lagro-Janssen, Smits, and van Weel, 1990).

Surface electromyography (SEMG) assessment of the pelvic floor muscles is an important operationally defined and objective tool. It permits reading, recording, and analysis of motor unit action potential trains (MUAPTs). SEMG is administered before treatment, to plan an individual training program, and intermittently during the course of treatment to provide information (feedback) about pelvic floor muscle SEMG changes, and symptomatic changes, resulting from twice daily 20-minute at home training with biofeedback (Glazer & MacConkey, 1996).

**Biofeedback**

Biofeedback is the use of instruments to measure, processes, analyze and “feed back” biological information, using analogue or digital, audio or visual, real-time signals. Patients experiencing this information-rich feedback first develop greater awareness of the signal and the biological processes it reflects, and ultimately develop voluntary control of the underlying biological processes themselves (Schwartz & Schwartz, 2003).

In a recent review article, Glazer and Laine (2006) reported their conclusions on intrapelvic SEMG biofeedback in the treatment of pelvic floor related disorders. They found an almost complete absence of studies meeting evidence-based medicine criteria for research design and data analysis and an absence of standardization of both biofeedback technology and the methodology for its application to pelvic floor muscle assessment and rehabilitation. In response to these findings, the second author of this paper has dedicated his career as a researcher, clinician, and educator to the development of standardization within the field of intrapelvic SEMG biofeedback. These are the first steps towards bringing this field into compliance with evidence based medicine standards defined by Glazer and Gilbert (2011) as applying evidence from scientific methodology to health care practice. The following case histories demonstrate the early stages of development of the Glazer Protocol, which begins with the standardization of intrapelvic SEMG measures and its administration to patients. The protocol involves a series of six PFM activities, with continuous PFM SEMG data collection, as shown below. All statements characterizing PFM SEMG readings in the following case histories represent a comparison to the clinical, unpublished, normative data from the records of the second author.

The Glazer assessment protocol consists of five activities:

- Activity #1. One 60-second rest (prebaseline)
- Activity #2. Five rapid phasic (flick) contractions, with a 10-second rest (flick rest) between
- Activity #3. Five 10-second tonic contractions, with a 10-second rest between
- Activity #4. One 60-second endurance contraction
- Activity #5. One 60-second rest (postbaseline)
- Each activity is presented as an audiovisual instruction screen explaining the task

**Glazer SEMG Assessment Data:**

- Patient contracts the pelvic floor muscles for different durations (phasic, tonic, and endurance contractions)
- For each contraction and relaxation period, recordings are taken for:
  - The maximal amplitude
  - The minimal amplitude
  - Mean amplitude
  - Standard Deviation
  - Coefficient of Variability (CV, Standard Deviation divided by Amplitude)
  - Recruit and Recover Latencies
  - Sustained Contractions Median Power Density Spectral Frequency (MEDFFT)

**Case #1: Post–Radical Prostatectomy Urinary Incontinence**

During a standardized intake, with history, systems review (a systematic questioning of the patient about the functioning of each organ system), and symptom presentation, a 56-year-old male patient, eight weeks post–radical retropubic prostatectomy (RRP), reported urinary incontinence during the day with any kind of movement. He was using three pads per day and one pad at night. Also, he reported urgency symptoms and nocturia (nocturnal urination, 2x per night). No other medical issues were reported, including HEENT (review of symptoms in head, ear, eyes, nose and throat), dermatologic, cardiac, vascular, pulmonary, gastrointestinal, joint, myofascial, neurological, psychiatric, allergic, or other surgeries.
Standardized Pretreatment Intra-anal SEMG Summary and Interpretation

Figures 1 and 2 below show graphic and numeric SEMG findings for the pretreatment Glazer Intrapelvic SEMG Protocol for Case #1.

The prebaseline rest was characterized by an elevated SEMG amplitude. The phasic contractions showed a slight slowing of contraction onset (recruitment) and much longer recovery times (latencies) following contractions. The tonic contractions showed a rapid onset to initial high amplitude, followed by a rapid decline to sustained low amplitude with mildly elevated variability for the remainder of the tonic contraction and slow recovery latency. This represents a rapid shifting from initially glycolytic type II fiber (fast acting, nonsustaining muscle fiber) to sustaining, but discoordinated aerobic type I fiber, consistent with the shift to lower median frequency (MEDFFT) and higher variability (CV). Tonic rest periods were marked by elevated amplitude. The endurance contraction showed normal onset and very slow recovery, further lowering sustained contractile amplitude and low MEDFFT, with normal variability. Postbaseline showed a rebound to elevated resting amplitude and variability. The most consistent findings in this patient were elevated amplitudes and variability, low MEDFFT, and slow recovery in sustained contractions.

Recommendation for Treatment

We recommended behavioral therapy, use of a voiding diary, and ten sessions of PFMT biofeedback with a focus on reduced variability and recovery latencies. In addition, we recommended posterior tibial nerve electrical stimulation (to improve nocturia symptoms) twice weekly, and PFMT biofeedback at home for 20 minutes twice a day with a portable SEMG unit.

Stress incontinence is often seen as the result of pelvic floor muscle contractile weakness. The urethra is not a passive tube, but actively supports the external urethral sphincter through a process known as coaptation, a process of self-sustaining closure. The important factor is not the strength of the contraction alone, but the rapid initiation and the stability to hold the contraction to support the coaptation. Imagine a hose and then turning on the tap, you need to not only kink the hose quickly, but also to sustain the closure of the hose with a minimal but steady external force in order to stop the flow of water. The recovery from dysfunctional coaptation requires a different PFM rehabilitation approach than maximum voluntary contraction training, which can also be highly variable (Delancey & Ashton-Miller, 2004). At a recent Urologic Brazilian Congress of the Brazilian Urologic Society, this approach was discussed by Barry Bagland, a physical therapist from the Netherlands, where this approach is used by many PTs for treating urinary incontinence (personal communication with the first author).

Figures 3 and 4 below show graphic and numeric SEMG findings for the posttreatment Glazer Intrapelvic SEMG Protocol for Case #1. Table 1 shows the summary pretreatment and posttreatment Glazer SEMG for Case #1.

Summary of Posttreatment SEMG Findings and Symptomatic Changes

Twelve weeks (three office sessions) and 20 minutes twice a day at home intrapelvic SEMG biofeedback resulted in a normalization of:

- prebaseline, flick rest, and postbaseline amplitudes,
- flick rest CV and recovery latency, and
- tonic contract CV and endurance MEDFFT.

These findings of reduced resting amplitudes, as well as both flick rest and tonic contract coefficients of variability, reduced flick recover latency, and increased endurance MEDFFT, indicate less chronic resting external urethral sphincter hypertonicity with improved contractile stability and recruitment of a wider range of fiber subsets, consistent with symptomatic improvement. After 12 weeks, the patient reported improvements with nocturia (0–1x per night) and the use of no pads during the day except a safety pad used during fitness and swimming exercise.

Case #2: Female Hypoactive Sexual Desire Disorder and Primary Dyspareunia

Standardized Intake with History, Systems Review and Symptom Presentation

This 22-year-old Caucasian female was referred by her gynecologist to assess her symptoms of hypoactive sexual desire. The patient presented as mildly dissociated and poorly related (poor engagement with the practitioner, minimal eye contact, and somewhat distracted manner). She reported a history within her first-degree family (parents and siblings) of arthritis, thyroid, migraines, heart disease, and diabetes. She reported no surgical history. She had been prescribed fexofenadine hcl 180mg and boric acid suppositories, as well as nonprescription supplements vitamin D3, probiotic, and acidophilus. She reported allergic reactions to Cefclor, Augmentin, and amoxicillin. She also reported frequent colds and other illnesses, sleep disturbance, chest pain, skin sensitivity, dysmenorrhea, painful swollen breasts, vaginal discharge, vaginal pain and itching, difficulty achieving arousal and orgasm, pelvic pain, and introital dyspareunia (pain during penile insertion). She denied psychiatric history,
Figure 1. Pretreatment Glazer intra-anal SEMG protocol screens. Prebaseline rest (A), phasic contractions (B), tonic contractions (C), endurance contraction (D), postbaseline rest (E).
but reported persistent anxiety. She denied a history of abuse, did not smoke, used alcohol socially, and denied the use of recreational drugs. She was unable to report any specifics of her sexuality including desire level, arousal, capacity to orgasm, and masturbation or partner sexual experiences. She could not recall masturbating, was unsure if she had ever experienced an orgasm, and denied spontaneous arousal or fantasy. She had never achieved penetration due to primary introital dyspareunia and reported point localized vulvar pain on palpation at 4 and 8 o’clock, described as a sharp, stabbing pain, on attempted penetration for intercourse, speculum, or tampon, and variable erythema (redness and swelling). She reported having an older sister diagnosed with vulvar vestibulitis syndrome.
Figure 3. Posttreatment Glazer intra-anal SEMG protocol screens. Prebaseline rest (A), phasic contractions (B), tonic contractions (C), endurance contraction (D), postbaseline rest (E).
Figure 4. Posttreatment Glazer intra-anal SEMG report.
Standardized Pretreatment Glazer Intravaginal SEMG
Summary, Interpretation, and Rx

Figures 5 and 6 below show graphic and numeric SEMG findings for the pretreatment Glazer Intravaginal SEMG Protocol for Case #2.

This protocol shows low amplitude and high normal CV pre- and postbaseline, normal recruitment amplitudes, and normal recover latencies following phasic, tonic, and endurance contractions, with high normal CV and low MEDFFT on tonic and endurance contractions (these ratings of normal or high normal are in reference to the Glazer normative databases discussed earlier). The predominant SEMG abnormalities were low amplitude rest and contract with tonic and endurance low MEDFFT. This pattern represents pervasive, stable, hypotonic pelvic floor muscle, which is consistent with low sexual desire, arousal, and orgasmic capacity (Lowenstein, Gruenwald, Gartman, & Vardi, 2010).

Treatment was prescribed twice a day for 20-minute periods of intrapelvic SEMG feedback with a home SEMG trainer, focusing on increasing resting and contractile amplitude, and sustaining contractile MEDFFT (the patient accomplishes this by focusing on lower variability at higher contractile amplitudes). We also recommended use of vaginal dilators to reduce introital hypersensitivity, vibrator assisted orgasms two to three times per week, and sexual counseling. Figures 7 and 8 below show graphic and

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The training uses a vaginally inserted SEMG sensor/probe, in the office and at home. The probe is specifically designed for vaginal insertion and patients are given instruction on the method of insertion. They then self-insert privately. Use of smaller sensors or surface perianal sensors is possible, but this is rarely necessary.
Figure 5. Pretreatment Glazer intravaginal SEMG protocol screens. Prebaseline rest (A), phasic contractions (B), tonic contractions (C), endurance contraction (D), postbaseline rest (E).
numeric SEMG findings for the posttreatment Glazer Intrapelvic SEMG Protocol for Case #2 and Table 2 shows the summary pretreatment and posttreatment Glazer intrapelvic SEMG for case #2.

**Summary Pre- and Posttreatment Intravaginal SEMG**

Eighteen weeks of twice daily 20-minute pelvic floor muscle rehabilitation with SEMG biofeedback yielded normalization of amplitude for all five contractile and resting segments in the Glazer Protocol. This is consistent with the hypothesis that sexual desire, arousal, and orgasm disorders can be musculogenic, and that hypoactive pelvic floor muscles may cause vaginal hypoestheisia. The most recent study in this area (Lowenstein et al., 2010) demonstrated that pelvic floor exercises enhanced sexual desire, arousal, and orgasm, assessed by the female sexual function index (FSFI), and pelvic floor muscle strength, as measured by a perineometer. Sexual function improved
Figure 7. Posttreatment Glazer intravaginal SEMG protocol screens. Prebaseline rest (A), phasic contractions (B), tonic contractions (C), endurance contraction (D), postbaseline rest (E).
Figure 8. Posttreatment Glazer intravaginal SEMG report.
with improvement of pelvic floor muscles strength ($p < 0.05$), and pelvic floor muscle strength affected sexual function (desire, arousal, orgasm, all $p < 0.05$) in this study.

**Summary of Posttreatment Glazer Intrapelvic SEMG Findings for Case #2**

After 18 weeks of twice daily 20-minute pelvic floor muscle rehabilitation with SEMG biofeedback, daily use of progressively larger vaginal dilators with increasing thrusting motions, and three times weekly use of a vibrator for orgasm, using orgasmic delay technique, the patient reported progressive reduction of introital dyspareunia and thrusting pain, increased episodes of spontaneous desire and arousal, and improved sense of interpersonal relatedness. Social skills training and systematic desensitization will likely be required to move the patient toward initiation of partner-related sexual behavior.

**Conclusion**

The Glazer protocol has wide applicability in the assessment and treatment of all pelvic floor muscle related disorders such as gastrointestinal, gynecological, urological, and sexual disorders of pain and dysfunction. The protocol utilizes an evidence-based medicine approach, yet retains

| Table 2. Summary pre- and posttreatment Glazer intravaginal SEMG |
|---------------------------------|------------------|------------------|
| Pretreatment                    | Posttreatment    |
| Prebaseline                     | L Amp            | N Amp            |
| Normalized                      | N CV             | N CV             |
| Flicks                          | N Recruit        | N Recruit        |
|                                | L Amp            | N Amp            |
| Normalized                      | N Recover        | N Recover        |
|                                | N Rest Amp       | N Rest Amp       |
|                                | N Rest CV        | N Rest CV        |
| Tonic                           | N Recruit        | N Recruit        |
| Normalized                      | L Contract Amp   | N Contract Amp   |
|                                | N Contract CV    | N Contract CV    |
|                                | L Contract MEDFFT | L Contract MEDFFT |
|                                | N Recover        | N Recovery       |
|                                | N Rest Amp       | N Rest Amp       |
|                                | N Rest CV        | N Rest CV        |
| Endurance                       | N Recruit        | N Recruit        |
| Normalized                      | L Contract Amp   | N Contract Amp   |
|                                | N Contract CV    | H Contract CV    |
|                                | L Contract MEDFFT | L Contract MEDFFT |
|                                | N Recover        | N Recover        |
| Postbaseline                    | L Amp            | N Amp            |
| Normalized                      | N CV             | N CV             |

*Note. H = high, N = normal, L = low, Amp = amplitude, CV = coefficient of variable, MEDFFT = Sustained Contractions Median Power Density Spectral Frequency.*
the integrative traditions of biofeedback. The protocol remains a work in progress, but offers hope to many patients with troubling conditions.

References


