Glazer Intrapelvic SEMG Assessment for the Diagnosis & Treatment of Post Radical Prostatectomy Urinary Incontinence

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Introduction

Prostate cancer is one of the most prevalent cancers in western countries and is the third leading cause of death in men[1]. Radical Prostatectomy (RP) is the gold-standard treatment for prostate cancer. One of the biggest concerns regarding RP is urinary incontinence (UI). Depending on the definition, UI occurs in 8% to 87% of patients who undergo RP [2].

Post Radical Prostatectomy Urinary Incontinence

The International Continence Society has defined urinary incontinence as the involuntary loss of urine that is a social or a hygienic problem and which is objectively demonstrable[3]. However, the majority of studies define urinary incontinence after radical prostatectomy as the use of more than one pad a day.

Most practitioners would agree that the main cause of urinary incontinence after RP is sphincter or neurological damage or urethral shortening due to the surgery. The external striated sphincter is tubular and has broad attachments over the fascia of the prostate near the apex. Its innervations arise from the pudendal nerves and the autonomic nerves in the pelvic plexus[4]. Urinary continence recovery after RP can take up to 2 years[5]. Incontinence during this recovery period has tremendous impact on Quality of Life (QOL)[6]. Pelvic floor SEMG biofeedback is an effective non-invasive method of treating stress UI after RP, that can accelerate continence recovery time [5].

Pelvic floor biofeedback provides the patient with audio-visual feedback on the physiological activity that is undergoing training in order to achieve the therapeutic outcome[7]. In 2000, Franke at al[8] reported a randomized controlled study showing no difference in treatment efficacy between a group that received early post prostatectomy pelvic floor biofeedback and the control group. However, in the same year, Van Kampen et al.[5] used active pelvic floor muscle exercises and biofeedback in the treatment of urinary incontinence after RP and demonstrated a success rate of 88% after 3 months as compared to 56% in the control group. After one year, the treatment group improved in both duration and degree of continence over the control group. In 2003, Parekh et al[9] used pelvic floor exercise and education initiated prior to surgery showing that it is an effective noninvasive intervention useful for improving the early return of urinary continence, but patients with incontinence secondary to severe sphincter damage or significant bladder dysfunction may not benefit from this method.

SEMG Biofeedback Assisted Pelvic Floor Muscle Rehabilitation

Surface electromyography (SEMG) biofeedback provides readings of the electrical activity associated with neuromuscular activation of the external urethral sphincter. This signal is determined by anatomical and physiological properties of the striate muscle, central and peripheral nervous system control over the muscle and the instrumentation and signal processing used to measure the activity [10]. Sensors, made of electrically sensitive material, are placed on the body closest to the muscle under study, to permit detection of the motor unit action potential trains (MUAPT). In pelvic floor muscles, it can be performed by means of intra-anal or intra-vaginal sensors constructed with longitudinal sensor plates embedded in a probe which assures the orientation and location stability of the sensor plates relative to the pelvic floor musculature[11].

MyoTrac Infiniti™ Encoder

Intrapelvic SEMG biofeedback can be helpful in teaching the patient the correct activation of the pelvic floor muscles, and assist in the diagnosis of underlying pathophysiology. With adequate equipment it is possible to perform an intrapelvic SEMG evaluation, recording signal amplitude, variability, recruitment and recovery latencies, and power density spectral frequency analysis providing information on the type of muscle fibers contributing to the overall electrical activity [11].

Vaginal and Rectal Sensors

In 2005, Glazer at al.[12] reported a randomized controlled group study to identify differences in SEMG biofeedback readings of pelvic floor muscle between men with and without chronic pelvic pain syndrome. In this study, it was shown that men with pelvic pain syndrome presented higher resting pre-baseline mean amplitude, variability, and lower amplitude endurance contractions. This demonstrated that patients with chronic pelvic pain present a pattern of resting hypertonicity and instability and reduced muscular endurance capacity in pelvic floor muscles.

Glazer at al.[13] interpreted these findings as higher endurance SEMG signal amplitudes representing a secondary compensatory result of the patient attempting to sustain a high amplitude contraction, thus initially leading to increased amplitude and to increased variability. With continued exercise the endurance variability and amplitude move downwards indicating a shift from type I glycolytic to type II aerobic fiber with lower amplitude, variability, and Median power density spectral (MEDFFT) indicative of improved control. This process also increases blood flow into the area served by the muscle, thus increasing access to beneficial properties of improved vascularity. Variability of both the resting and contractile SEMG measures are critical predictors of pelvic floor dysfunction. It appears that the healthy functioning of not only the muscle, but also the system in which it functions, is dependent upon electrophysiological stability, not amplitude.

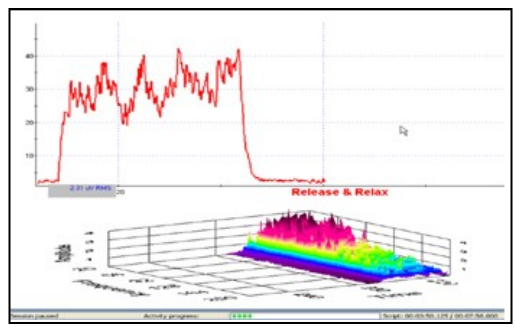
Of course, prior to training, signal variability measures were clearly noted to vary directly in proportion to amplitude, i.e. higher signal amplitudes, the more variable, both at rest and during contractions. This explains why signal amplitude initially appeared important, but only signal variability predicts improved function while signal amplitudes do not. Traditional pelvic floor muscle training for voiding dysfunction trains to strengthen and relax. The Glazer protocol trains specifically for electrophysiological stability, which is reduced signal variability, not amplitude. This represents a revolutionary change in the field since pelvic floor muscle rehabilitation from its inception by Arnold Kegel in 1948, and right up until the present, has focused only on strength and relaxation, whereas the Glazer Protocol focuses on stability and control. By focusing on direct training of the SEMG characteristics which best predict symptomatic benefit this approach shows promise for greater, faster and longer lasting results.

Glazer Intrapelvic SEMG Assessment

The "Glazer" protocol for pelvic floor muscle evaluation uses a five-segment evaluation sequence as follows:

- One minute rest, pre baseline.
- Five rapid contractions (Flicks) with a 10 second rest before each one (phasic).
- Five 10 second contractions with a 10 second rest before each one (tonic).
- A 10 second rest followed by a single endurance contraction of 60 seconds (endurance).
- One minute rest, post baseline.

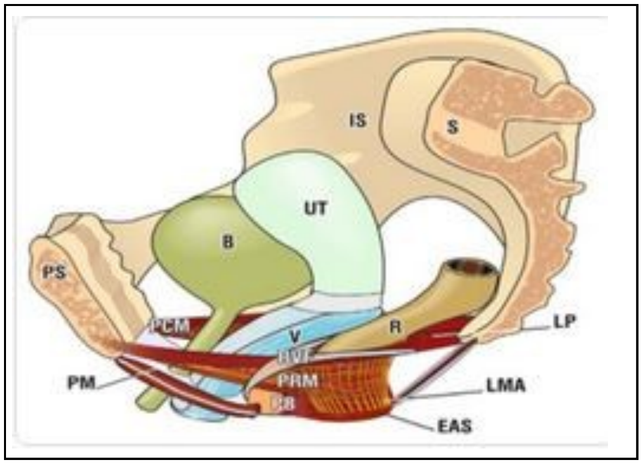
This protocol is a sequence that has been used traditionally in assessing sexual, sphincter and support functions of the pelvic floor muscles. The difference is not in the sequence of muscle actions but the measurements recorded. As mentioned earlier, traditionally the major goal in treating pelvic floor muscle related disorders has been increasing contractile amplitude to enhance external sphincter closure pressures or to release chronic resting hypertonicity to address retention disorders such as functional urinary retention. In the "Glazer" protocol, for each contraction and relaxation period, integrated SEMG amplitude and standard deviation is measured. In addition, coefficients of variability (standard deviation divided by amplitude) are taken as measures of muscle stability, rise and recovery times are taken at initiation and termination of each contraction and spectral frequencies using Fast Fourier Transformation (FFT) are taken for tonic and endurance contractions.



BFE-Glazer Intrapelvic SEMG Assessment Software Displaying FFT measures

Another difference between the "Glazer" protocol and previous protocols is that accessory muscles (often monitored with a second SEMG channel on lower abdominals) are not necessarily minimized. Each patient is assessed with the use of different combinations of accessory muscles. This is done in order to determine the best balance between keeping the patient's focus on the internal "lifting" sensation and, at the same time, maximizing the use of the correct muscle contraction to result in a reduction in variability.

Many patients with only increased contractile amplitude and reduced resting amplitude show little therapeutic benefit. Spectral frequencies, rise and recovery times and coefficients of variability are related to the predominant fiber type being recruited and the coordination of that fiber type. The critical combination of lower amplitude sustained contractions, lower Median power density spectral frequency (MEDFFT), and faster recruitment/recovery times and reduced coefficients of variability suggest a predominance of coordinated slow twitch fiber. In the presence of this phenomenon (increased coordination), the consequence is reduced amplitude and variability during rest and a reduction of the hypertonicity and instability associated with chronic uncoordinated discharge of fast twitch fibers as seen in the resting SEMG of untreated patients[14].



Graphic taken from online class on Glazer Intrapelvic SEMG Assessment (Permission Pending).

Treatments for Urinary Incontinence

Male Urethral Sling
This surgical procedure is based on ventral portion compression of the bulbar urethra. Using this technique, patients with low/moderate levels of urinary incontinence (UI), without previous radiotherapy seem to have better results than other patients. Larger controlled and longer term studies are expected[16].

Artificial Urethral Sphincter (AUS)
This is the gold standard surgical treatment for male UI. This technique is based on urethral compression system that allows patient to make urethral decompression by himself at the moment of micturition. The AUS is applied around of the bulbar urethra and the open/close valve is implanted in the subcutaneous tissue of scrotum[16.]

Behavioral Therapy
Behavioral therapy includes biofeedback treatment, and education regarding pathophysiology (pelvic floor function, the significance and process of treatment and the timing of treatment), in order for patients to understand their own conditions.

Electrotherapy
There are few SEMG biofeedback equipment manufacturers combining electrical stimulation (E-stim) and SEMG biofeedback to permit SEMG triggered stimulation, helping patients to improve pelvic floor muscle fiber activation. There are literature reports that exclusive use of E-stim may have a short term benefit with less efficacy. No peer-reviewed literature was found that established whether the use of E-stim combined with biofeedback provides a faster or longer-lasting results. Further research is needed.

SEMG Biofeedback Treatment
There is a literature review of pelvic floor muscle biofeedback in the treatment of urinary incontinence that includes 28 randomized studies with parametric statistical analyses published in reviewed journals from 1975 to 2005. Seven of these studies treated incontinence related to radical prostatectomy. In 21 of 35 paired group comparisons, biofeedback demonstrated greater symptomatic improvement[3]. Further research is needed. There are no known risks involved for patients receiving SEMG Biofeedback pelvic floor training. Patients may benefit directly from this treatment with improvements in urinary continence and pelvic floor function. This treatment benefits the professional team, by providing objective external urethral sphincter SEMG data and it's relation to medication, diagnostic test results, and patient history.

The "Glazer" intervention procedure employs an exercise position, contraction type, contraction duration, and number of repetitions which maximize the exercise to normalize the patient's SEMG muscle measurements relative to their asymptomatic referenced control group.

- All patients are started on two 20 minute exercise sessions a day, each one consisting of 60 repetitions of 10 second contractions alternated with 10 second relaxation periods.
- All patients are required to use home training feedback devices and intra-vaginal or intra-anal sensors in the conduct of their home exercises.
- Patients return for office evaluations every two weeks for their second and third visits and then, monthly, for subsequent visits. The frequency of office visits is determined by the observation of SEMG changes by the professional, and compliance of the patient in the conduct of home exercises.

Over time, with continued training, we look for changes in contractile amplitudes and spectral frequencies and other key indicators such as contractile coefficients of variability and rise and recovery times. In relaxation measures, we look for changes in amplitude and coefficients of variability. Amplitude changes alone are not sufficient.

HOME TRAINING

After assessment, clients can continue to train at home.

Dr. Glazer recommends the use of a single-channel U-Control™ unit. This is an accurate, reliable and easy-to-use single channel SEMG trainer for pelvic floor muscles for incontinence. It enables users to self-train with prescribed exercises using either an intra-vaginal or intra-anal probe, or surface electrode patches.

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