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Electromyography Usefulness in Diagnosis of Functional Status of Pelvic Floor Muscles in Women with Urinary Incontinence

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1. Introduction

1.1 Stress urinary incontinence

1.1.1 Definition, epidemiology and economic impact

Urinary incontinence has been defined by the International Continence Society (ICS) as the involuntary leakage of urine through the urethra, objectively demonstrable and of such magnitude that it entails a social or hygienic problem (International-Continence-Society 1977; Abrahams, Blaivas et al. 1988). It makes up a significant morbidity, affecting the social and occupational life with repercussions for the psychological, physical and sexual health of the woman (Serrano 2003).

The stress urinary incontinence is an important public health problem. In Europe it affects up to 1/3 of women over 18 years old with increasing prevalence up to 45% at 60-years-old women (Hunskaar, Lose et al. 2004).

In the last 5 years at least 12 epidemiological studies of the prevalence of urinary incontinence have been done in the United States. In 9 studies performed with women we find very different results ranging between 15% with Latin women over 65 years old (Espino, Palmer et al. 2003), 18% with Asiatic women (Huang, Thom et al. 2006), and up to 40% with non-institutionalized women (Fultz, Girts et al. 2005; Melville, Katon et al. 2005; Minassian, Stewart et al. 2008). In Spain, epidemiological studies before 2003 show a prevalence of nearly 40% in women over 65 years old, but in later studies the amount was under 35.1% in persons over 64 years, 23% in women over 18 years old, 20% in working women and 14% in women between 40 and 64 years old (Martínez-Agulló, Ruiz-Cerdá et al. 2009). Approximately 50% of women after retirement age suffer some type of incontinence, but less than half of them consult with their physicians(Viana-Zulaica 2005). Up to 91% of psychogeriatrical patients are affected, and urinary incontinence is one of the primary motivating factors for women entering a nursing

home. Therefore, success in the treatment of urinary incontinence will allow women to remain in the community with independence for a longer period of time (Bidmead 2002).

This pathology creates an important economic problem. In 1996, the cost of consumption of absorbents in Spain was more than 160 million euros, 3.2% of the total amount of the pharmaceutical allowance of the National Health System. We also must consider the economic repercussions of other direct and indirect common costs in other cost-illness studies (SNS 1996). The absorbents used to ease stress urinary incontinence represent the primary expense of this problem to the public sanitary system (Médico-Interactivo-Diario-Electrónico-de-la-Sanidad 2003).

Social and cultural conditions make it difficult to properly deal with urinary incontinence, since nowadays the specific preventive measures could eliminate up to 90% of the stress urinary incontinence cases (Serrano 2003).

With regard to the quality of life issues associated with incontinence, we have several methods to evaluate it: King´s Health Questionnaire (Kelleher, Cardozo et al. 1997) and ICIQ-SF (Espuña, Rebollo et al. 2004). The importance of these instruments lies in their capacity to explain and describe the damage that urinary incontinence does to the quality of life of the person suffering it and also his/her ability to discern between the different types of urinary incontinence.

1.1.2 Anatomy and physiology of the pelvis floor for the urine continence

In order to properly treat stress urinary incontinence and the associated pelvic floor's dysfunction, it's essential to understand the functional anatomy of the female pelvic floor and the continence's control system. The stress urine continence's control system is formed of two main elements: the urethral abutment system and the sphincteric closing system **(Castro 2002).**

The urethral abutment system consists of the bladder's wall, the endopelvic fascia, the tendinous arch of the pelvic fascia and the levator ani muscles.

The endopelvic fascia is a layer of dense fibrous connective tissue surrounding the bladder and fixing it to the levator ani muscles and the tendinous arch of pelvis fascia laterally, providing structural stability (Halban, Tandler et al. 1907). During the intraabdominal rises in pressure, the urethra puts pressures on this suburethral abutment layer. When the endopelvic fascia is changed, the urethra and the bladder's base don't have a good abutment, altering the intraabdominal pressure's transmission to the urethra.

The tendinous arch of pelvis fascia is a bilateral tensor structure located on both sides of the urethra and the vagina. It's like a cable with a chained form, like a suspension bridge that gives the necessary abutment to fix the urethra to the front vaginal wall. In the beginning it's a well-defined fibrous band, but when it approaches the pubic bone it gets wider and forms an aponeurotic structure, going dorsally to the ischial spine. This band fuses with the pelvic fascia, which joins the levator ani muscles in turn.

The levator ani muscles are the pubococcygeus muscle, the puborectalis muscle and the iliococcygeus muscle.

In comparison with other skeletal muscles in the body, the levator ani muscle has a greater connective tissue formation that is involved in the direct abutment of the pelvis organs. (Raz, Rosenblum et al. 2003). The pubococcygeus and puborectalis muscles are set out in U-form, beginning at the pubic bone on both sides of the median line, and passing after the rectum in order to form a sling. This sling is composed by type I striped muscle fibres and they are prepared to maintain a constant tone in order to close the uro-genital hiatus (Castro 2002).

The powerful levator ani aponeurosis is the most important element of the muscle-aponeurotic system which forms the abutment of the structures of the pelvis cavity. It surrounds the urethra and the bladder's neck and base, and it joins the tendinous arch of obturator internus. According to the anatomic-surgical principles postulated by Raz (Raz 1992) we find four different condensations of this fascia: the pubourethralis, the urethropelvic, the pubovesical (cervical) and the cardinal uterosacral ligaments.

Thanks to meticulous anatomic studies, the functional dynamics of the different vaginal ligament supports has become evident and the problems derived from its injury have been analyzed. DeLancey (DeLancey 1990) defines three urethral support levels dividing the vagina in three segments: *level I or of suspension, level II or of fixation and level III or of fusion.*

The sphinteric closing system consists of the striped muscle, the urethral smooth muscle and the vascular element of the submucosa layer. Each of these components equally contributes to the urethral closing pressure. The urethral most external layer is the striped sphincter muscle, which is found at an 80% of the anatomic urethra's length. It's composed of two parts: the paraurethral sphincter, in direct contact with the urethra and formed by slow contraction fibres which are able to maintain the basal tone, and the periurethral sphincter (the pubourethralis portion of levator ani) formed mostly by quick contraction fibres which can produce a voluntary compression of the urethra. When the intraabdominal pressure rises quickly, these fibres increase the urethral resistance with an active reflexive contraction.

The urethral striped sphincter is innervated by myelinic somatic fibres from level S2-S3, which run with the pudendal nerve (Castro 2002). In rest, the urethral basal tone increases with bladder's filling. When the intraabdominal pressure changes suddenly, a reflexive response of the quick spasm fibres increases the urethral closure and resistance. The reflex or voluntary contraction of the levator muscles increases the closure and the urethral resistance, improving the pelvis floor's support with a board effect and an efficient pressure's transmission to proximal urethra (Raz, Rosenblum et al. 2003).

The bladder's neck is closed in rest because of the distribution of the detrusor's smooth muscle fibres. One loop of detrusor's smooth muscle surrounds the front part of bladder's neck and can take part in its closure. The closure of the bladder's neck and proximal urethra are considered essential to maintaining continence and is more important than the external sphincter mechanism. However, it has been proven that many continent menopausal women have their bladder's neck open when coughing. It's also demonstrated that many nullipara women have their bladder's neck open in rest (Castro 2002).

Urethral length is determined by the distance between bladder's neck and the external urethral meatus. The urethral segment which receives higher pressures than the intravesical ones defines the functional length. Patients with stress urinary incontinence have a decreased functional length because of the failure of the proximal urethra.

1.1.3 Surgical treatment of stress urinary incontinence

At the present time we are experiencing a revolution in the treatment of stress urinary incontinence. Several surgical techniques have been considered. Distant seems the time when reefing sutures like those described by Nelly (1913), Stokel (1921) and Marion (1925) were suggested, until arriving at the suprapubic colposuspension described by Marshall, Marchetti and Krantz with many modifications and culminating in Burch's operation (Solà-Dalenz, Pardo-Schanz et al. 2006).

In 1995 tension-free transvaginal tape (TVT) was introduced (Ulmsten and Petros 1995). In 2001 another technique, suburethral transobturator tape (TOT) was introduced (Delorme. 2001). The main advantages were that the tape lays at a more anatomic position than in TVT, the needle doesn't cross the retropubic space, no abdominal incisions are made, there's a lower risk of vesical or intestinal injury and no cystoscopy is required (Solà-Dalenz, Pardo-Schanz et al. 2006; Delorme and Hermieu 2010).

The simplicity of these techniques and their reproducibility has dramatically increased their use, by both Urologists and Gynaecologists (Castiñeiras-Fernández 2005).
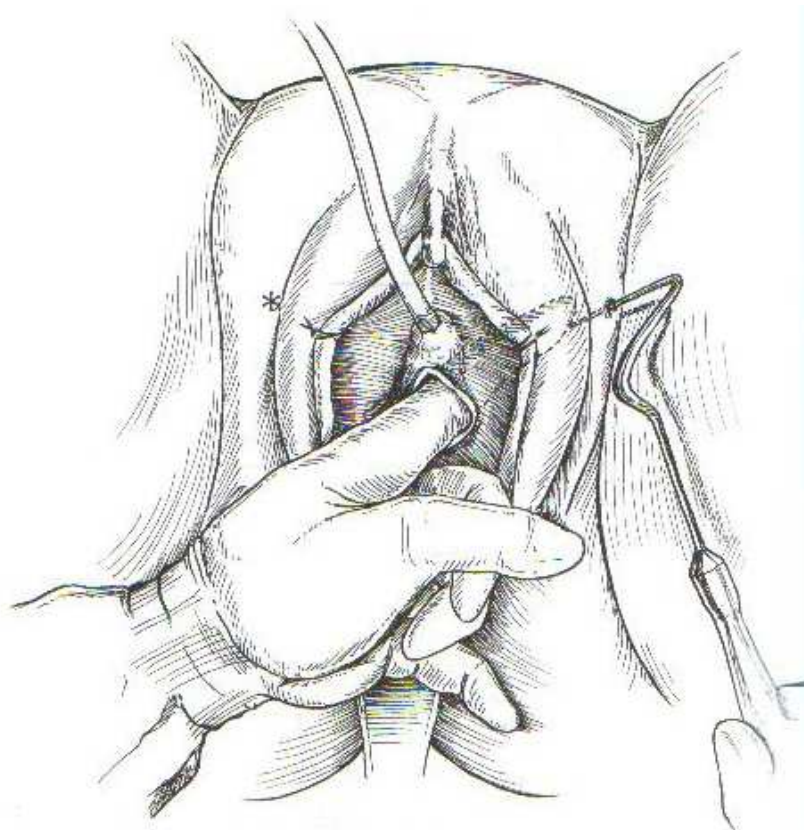

Fig. 1. Needle-passing during the TOT intervention (Castiñeiras-Fernández 2005).

When surgical treatment is indicated, the TOT procedure is chosen as the first-line election if there are no contraindications. This decision is backed up by the establishment of the TVT as a worldwide validated and demonstrated procedure for the surgical correction of the urinary incontinence. After the TVT, the transobturator treatment was accepted by the FDA. Autologous, heterologous or synthetic materials can be used.

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Fig. 2. Puncture sites.

Fig. 3. Suburtehral tape already passed.

1.2 Perineal electromyography
1.2.1 Definition

The electromyography evaluates and records the electrical activity produced by skeletal muscles (Rio and Montero 2004).

The electromyography of the pelvic musculature allows us to evaluate the function of these muscles like any other striped muscle.

The use of surface electrodes is a method of registering electrical activity in a non-invasive way. There are different types of surface electrodes such as:

- Anal cylindrical electrode: two surface electrodes over Teflon which are inserted in the anal canal.

- Surface electrodes: silver discs over an adhesive surface, used on children, and stuck on the perineal skin.
- Electrodes overlaping a probe or a Foley catheter.
- Vaginal electrodes, similar to the anal cylindrical (González-Hidalgo 1998).

Biofeedback: can be employed to evaluate and/or to train the pelvic floor muscles of the patients. The procedure gives a virtual representation of a change in the measure of one of the following channels or in the combination of two of them:

- Flow channel.
- Pressure channel.
- EMG channel.

The aim of the EMG- Feedback or biofeedback with electromyography (biofeedback EMG), is to register the electrical muscular activity of the body through surface electrodes. The results are shown to the patient and to the procedure's instructor. The feedback can be visual, as in an LCD screen or auditory. For the visual feedback several representation models can be chosen. For the auditory feedback we can choose between a proportional reproduction, a reproduction depending on the threshold or an abrupt signal reproduction (only audible with headphones).

In the present study, the visual method was used for a greater resemblance to the physiotherapeutical treatment. Patients had a biofeedback session with the EMG channel, using surface electrodes: two located over the musculature and another one, neutral or ground, located at the inner face of the thigh.

Regarding the needle electromyography, some authors consider it the most precise method of exploration. A coaxial needle with an electrode at the needle's end is used. It can detect the electrical activity of a group of muscular fibres belonging to several motor units (Rio and Montero 2004).

1.2.2 Described perineal electromyography protocols

Several different methods of evaluating and/or enhancing pelvic floor function have been developed and modified.

In a strict sense, there can't be any perfect protocol for every patient affected by changes in the pelvic floor's function, since each patient begins with different parameters of muscular function.

The best method would be the most personalized one and high success rate have been indicated with the "biofeedback-therapist-guided" treatment:where the procedure's instructor stays with the patient during the whole process (Lorenzo-Gómez, Silva-Abuín et al. 2008).

The described protocols have many modalities: three 20-minutes sessions per week over a seven-week period (Amaro, Gameiro et al. 2006), twice weekly for 8 weeks (Voorham-van, Pelger et al. 2006), stimulator is activated on demand only by a sudden increase in intra-abdominal pressure (Nissenkorn, Shalev et al. 2004), 30 minutes per session, twice a week for 6 weeks (Lee and Choi 2006), 12 sessions (Rett, Simoes et al. 2007), 12 consecutive weeks (Capelini, Riccetto et al. 2006), 12 weeks training (Di-Gangi-Herms, Veit et al. 2006), six weeks, two training sessions each week (Seo, Yoon et al. 2004)

2. Aims of the chapter

If we follow the definition of urinary incontinence, i.e. that it is a problem that seriously affects the patients' life and after several unsuccessful conservative treatment attempts

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(pelvic floor rehabilitation and drugs with variable efficacy), surgical treatment must be considered. The problem occurs when patients remain as incontinent as before. It is important to find a method of predicting which factors can cause a treatment's failure. Electromyographic research of the pelvic floor of each patient has been performed.

The aims of the chapter are:

1. To describe a perineal electromyography session (EMG) with surface electrodes without electro-stimulation to evaluate the functional status of the pelvic floor's muscles in patients with urinary incontinence.

2. To analyse the usefulness of the results produced in an electromyographic session as an evaluation of the pelvic floor muscles to predict a possible surgical treatment's failure.

3. Method and tools used

In 302 women planning surgical treatment via transobturator vaginal tape for urinary incontinence between April 2003 and December 2010, ages ranged between 41 and 81 years old, a monitoring session was performed to evaluate functional status of perineal muscles by means of biofeedback with superficial electrodes without electro-stimulation prior to recommending surgical treatment.

Age, time suffering urinary incontinence, perineal electromyography, secondary diagnosis (allergy; arthritis, arthrosis, depression; IDDM, NIDDM; fibromyalgia; nicotine poisoning; HTN; obesity; osteopenia; intestinal disorders; respiratory disorders), concomitant treatments (antidepressant-anxiolytic; antihypertensives), obstetric and pathological antecedents (number of eutocic, distocic childbirths, nulliparity, multiparity, previous hysterectomy, anexectomy, Cesarean, colpocele, TVT o TOT) were evaluated. ICIQ-SF questionnaire (International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form) was used to assess the outcome of treatment.

Study groups: The electromyographic values and the pathologic and non-pathologic antecedents in two groups of patients were described: Group A (n=254): operated on stress urinary incontinence through TOT with a successful result (urinary continence); and Group B (n=48): urinary incontinence through TOT with an unsuccessful result (still incontinent).

Studied variables:

- Perineal electromyography (expressed in mVol): average of the electromyographic values obtained in two stretches of the registered sequence during a 20 minutes session of pelvic floor biofeedback without electro-stimulation: first 5 and last 5 contractions of this sequence. The session took place at the urodynamics office with a Medicina y Mercado™ equipment, the patient was lying supine, with light flexing of the hips and protection of the lumbar lordosis in order to avoid fatigue. In this position the patient could see the screen of the biofeedback equipment (figures 4 and 5). The electrodes used were paediatrics pre-gelled electrodes. After explaining the anatomy and physiology of the pelvic floor, the patient was instructed to contract the perineal musculature several times and these contractions were registered, reflecting the power and the muscular tone, as well as the contraction time in accordance with the perineal electromyography. Each signal was registered continuously with a polygraph (figures 6 and 7).

- Results were produced from the answers of the Spanish validated-version of the ICIQ-SF questionnaire (International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form).

Fig. 4. BFB session.

Fig. 5. Screen showing a scene for BFB.

Figures 6 and 7 show fragments of the graphics obtained from the EMG activity registry at a biofeedback session of two different patients.

Fig. 6. EMG registry at BFB session.

Fig. 7. EMG registry at BFB session.

All patients signed a consent form according to the specific legislation by Directive 2001/20/CE of the European Parliament and of the Council and to the performance of the Good Clinical Practise norms of the Ministry of Health and the Spanish Drugs Agency.
Qualitative and quantitative variables were analysed by NCSS-2000™ statistic program.
Descriptive and inferential studies were performed: analysis of cross tabulation, Fisher exact test, Chi-square, Student's t-test, Pearson correlation test. $p<0,05$ were accepted as statistically significant.

4. Results

4.1 A diagnostic perineal electromyography (EMG) session consists of a 20 minute session of biofeedback (BFB) of the pelvic floor (PF) with superficial electrodes without electro-stimulation, with contractions of 3-5 seconds, followed by a relaxation period of 8-10 seconds after each contraction. Perineal muscle voltage in millivolts (mV) was recorded during the contraction period, and the first five and last five intervals of the session were studied. Initial EMG average were called EMGi; and final AMG average were called EMGf.
4.2 Transobturator vaginal tape procedure was a success and achieved continence in 84% of women, while 16% continued with some grade or kind of incontinence (stress or de novo urgence).
4.2.1 Patients in Group A are younger on average (59,11 yearls old) than those in Group B (69.57 years al) in a statistically significant way (p=0.0001) (Table 1).

Age (years)	Group A	Group B
Mean	59.11	69.57
SD	11.47	9.14
SEM	1.12	49
N	254	48
Student's t-test: p<0.0001 Mean success age minus failure age= -10.45. CI 95% of this difference: from -15.51 to -5.40.		

Table 1. Age of patients with TOT being performed.

4.2.2 Patients in Group A were affected by incontinence on average for a shorter period of time (90.65 months) than those in Group B (195.17 months) (p= 0.0170) (Table 2).

Development time (months)	Group A	Group B
Mean	90.65	195.17
SD	86.61	159.06
	13.21	64.94
N	254	48
Student's t-test: p=0.0170 Development time in succeeded – time in failed= -104.52. CI 95% of this difference: from -189.49 to -19.54.		

Table 2. Development time of urinary incontinence in patients with TOT performed.

4.2.3 Development time of urinary incontinence wasn't correlated with patients' age (Table 3).

Pearson Product Moment Correlation – Ungrouped data		
Statistic	Age (years)	Development time of urinary incontinence (months)
Mean	69.57	195.17
Biased Variant	114.54545455	7278.545454
Biased Standard Deviation	10.702591020	85.31439183
Covarianza	100.8	
Correlation	0.1003590	
Determination	0.01007194	
T-Test	0.30260	
p-value (2 sided)	0.7690	
p-value (1 sided)	0.3845	
Number of observations	48	

Table 3. Relation between patients' age and development time of urinary incontinence.

4.2.4 Age can work as a confusion factor for the analysis of the researched factors, so a stratification regarding age was performed until we had two homogeneousage groups. It was possible at a range of 48-68 years old, with the distribution shown in table 4:

Range 48-68 (años)	Group A	Group B
Mean	58.27	59.38
SD	7.78	7.17
SEM	0.90	1.99
N	150	24

Table 4. Patients' distribution in two homogeneous groups regarding age.

4.2.5 Correlation between the age of the whole sample including succses and failures, N=302) and the average electromyographic values at the beginning (EMGi) and at the end (EMGf) of the session (Table 5).
A general correlation between age and EMGi (-0,067670) or EMGf (-0,100230) was not found in the women in the entire sample (N=302).
**4.2.6** The correlation between age and the average electromyographic values at the beginning (EMGi-A) and at the end (EMGf-A) of the session was analysed in the group of succses (Group A) (Table 6).

```
                Pearson Correlations Section (Row-Wise Deletion):

            Edad      EMGi    EMGf
Age         1,000000 -0,067670         -0,100230
            0,000000 0,678223 0,538316
            40,000000          40,000000          40,000000
EMGi        -0,067670          1,000000 0,894848
            0,678223 0,000000 0,000000
            40,000000          40,000000          40,000000
EMGf        -0,100230          0,894848 1,000000
            0,538316 0,000000 0,000000
            40,000000          40,000000          40,000000
Cronbachs Alpha = 0,671004 Standardized Cronbachs Alpha = 0,489648
```

Table 5. Correlation between age and electromyographic values (in mVol) at the beginning (EMGi) and at the end (EMGf) of the session.

Pearson Correlations Section (Row-Wise Deletion)			
	Age A	EMGi-A	EMGf-A
Age Group A	1,000000	0,043438	-0,017339
	0,000000	0,822962	0,928864
	29,000000	29,000000	29,000000
EMGi-A 0,043438	1,000000	0,904445	
	0,822962	0,000000	0,000000
	29,000000	29,000000	29,000000
EMGf-A -0,017339	0,904445	1,000000	
	0,928864	0,000000	0,000000
	29,000000	29,000000	29,000000
Cronbachs Alpha = 0,696365 Standardized Cronbachs Alpha = 0,574281			
Spearman Correlations Section (Row-Wise Deletion)			
	Age A	EMGi-A	EMGf-A
Age Group A	1,000000	0,005289	0,087484
	0,000000	0,566915	0,491832
	64,000000	64,000000	64,000000
EMGi-A	0,005289	1,000000	0,567339
	0,566915	0,000000	0,000001
	64,000000	64,000000	64,000000
EMGf-A	0,087484	0,567339	1,000000
	0,491832	0,000001	0,000000
	64,000000	64,000000	64,000000

Table 6.

A correlation between age and EMGi (0,043438) and EMGf (-0,017339) was not found in women who were urinary continent after surgical treatment (Group A).

4.2.7 The correlation between age and the average electromyographic values at the beginning (EMGi-B) and at the end (EMGf-B) of the BFB session was analysed in the group of failures (Group B) (Table 7):

Pearson Correlations Section (Row-Wise Deletion)			
	Age B	EMGi-B	EMGf-B
Age Group B 1,000000	-0,743008	-0,263170	
0,000000 0,008792 0,434286			
11,000000	11,000000	11,000000	
EMGi-B -0,743008	1,000000	0,472372	
	0,008792	0,000000	0,142340
	11,000000	11,000000	11,000000
EMGf-B -0,263170	0,472372	1,000000	
	0,434286	0,142340	0,000000
	11,000000	11,000000	11,000000
Cronbachs Alpha =- 0,621773 Standardized Cronbachs Alpha =- 0,828724			

Table 7.

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There was a correlation between age and EMGi (-0,743008), but not with EMGf (-0,263170) in women with continued urinary incontinence after surgical treatment (Group B).

4.2.8 No statistically significant association was found (p=0.2813) between the EMG average initial values in the successful patients (Group A; mean 18.08 mVol) and in the failed patients (Group B; mean 27 mVol) (Graphic 1):
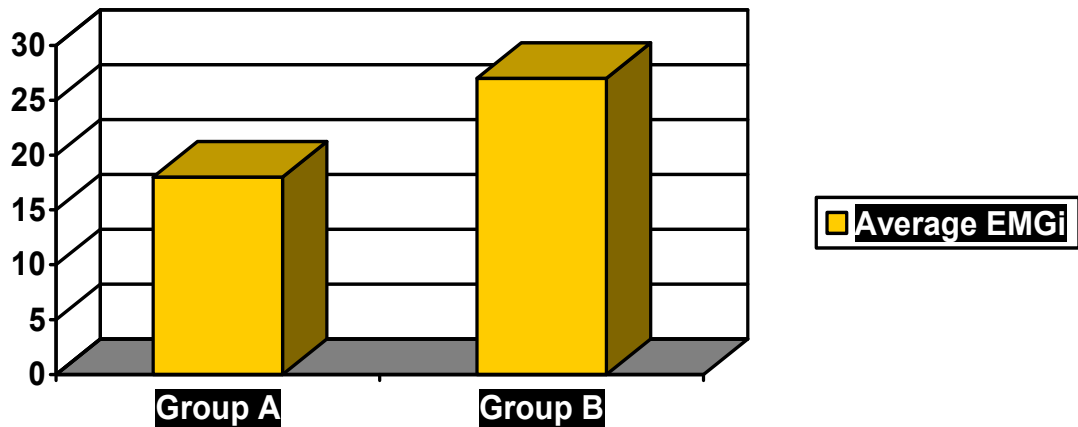
Graphic 1. Average initial EMG.

There was no statistical difference (p= 0,2813) between continent women EMGi (average 18.08mV) and incontinent women EMGi (average 27.00mV).

4.2.9 There was a statistically significant association (p=0.0406) between the final average values in success (Group A; mean 39.67 mVol) and in failure (Group B; mean 13.20 ,Vol) (Graphic 2):
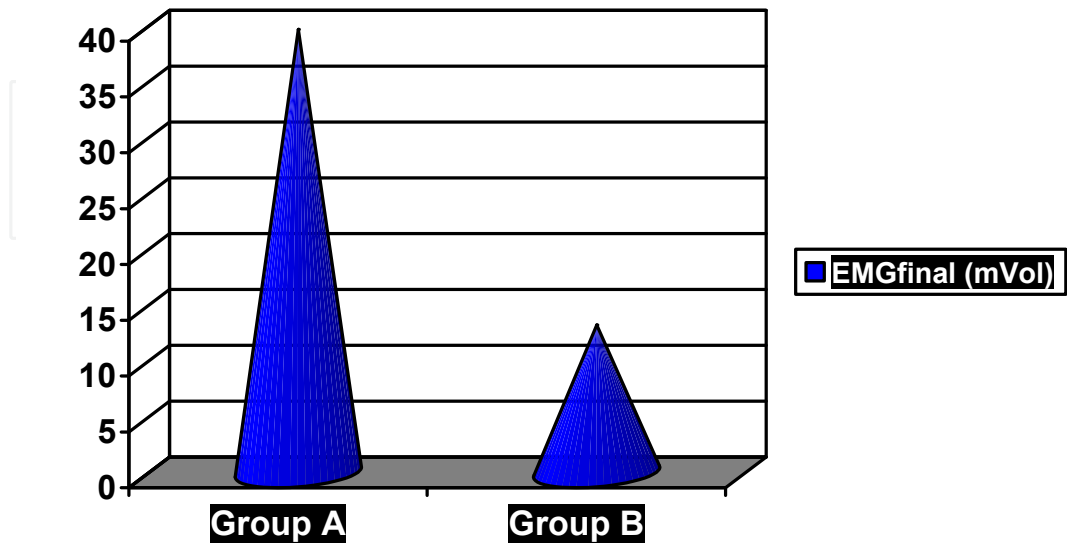
Graphic 2. Average final EMG.

4.2.10 Graphic 4 shows the distribution of the "gain" (we say difference in the graphic) between the initial EMG value and the final one in Group A age-stratified (N=150).
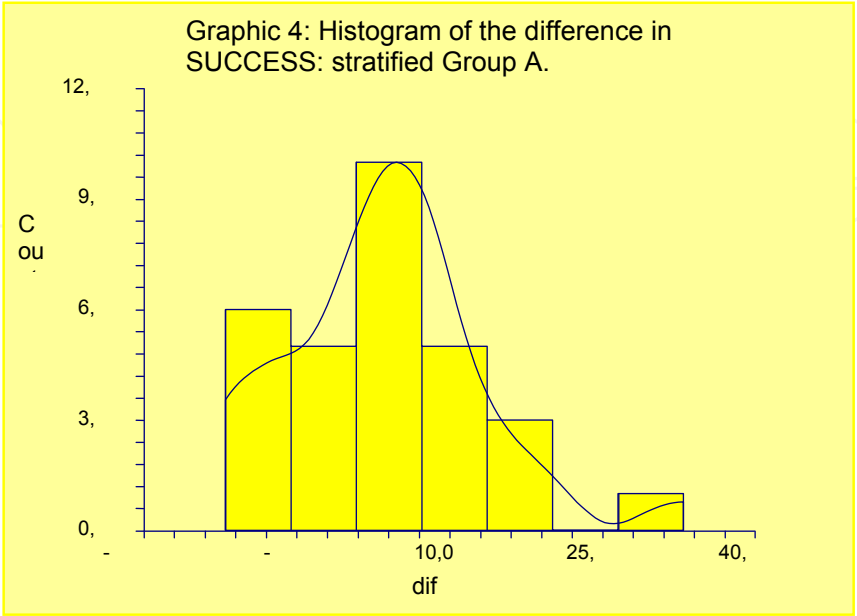
Graphic 4.

4.2.11 Graphic 5 shows the distribution of the "gain" between the initial EMG value and the final one in Group B age-stratified (N=24).
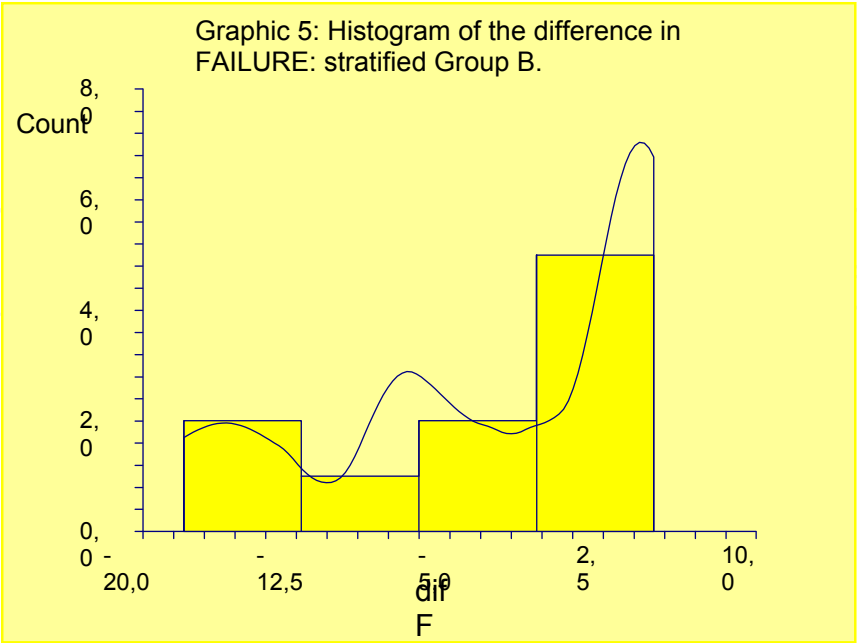
Graphic 5.

Variable	Count	Mean	Standard Deviation	Standard Error	95% LCL of Mean	95% of Mean
difE	150	4,6	9,838699	1,796292	-7,383062E-02	7,27383
difF	24	-3,7	8,472833	2,679345	8,761099	3,361099

Note: T-alpha (difE) = 2,0452, T-alpha (difF) = 2,2622

Table 8. Descriptive Statistics Section.

A statistically significant difference between the EMG gain at the BFB session in Group A and in Group B was found.

5. Discussion

5.1 Perineal electromyography

Electromyography entails the electric registry of the muscular activity. It's useful to distinguish between normal and myopathic muscle.

Some authors consider needle electromyography the most precise method of exploration. A coaxial needle with an electrode at the needle's end is used. It can detect electrical activity in a group of muscular fibres belonging to several motor units, analysing the so-called motor unit potentials.

Contact electromyography is performed locating the electrodes on the skin surface. It's a non-invasive method. Some authors criticize that the registry can be contaminated with other muscles' activity and that the amplitude of the registered activity is too low (Rio and Montero 2004).

The drawback with needle electromyography appears to be that the needle also works at the motor units of the muscle or muscular group we want to explore and at the amyelinic fibres which collect the pain caused by the prick. This painful stimulus can condition local reflexes which can affect the results of needle electromyography.

That being said after explaining the procedure and the perineal anatomy briefly to the patient surface electromyography is still completely viable. It must take place in a safe and comfortable climate, using a standarized electrode-locating method while rigorously respecting the anatomical references and understanding that the perineal electromyographic registry has proven trustworthy in the explored muscular activity.

Knowing the usefulness of surface electromyography in measuring the pelvis floor's biofeddback in incontinent women, we researched the functional status of the perineal muscles in women with genuine stress urinary incontinence who were scheduled to undergo a TOT. A 20-minute biofeedback session with surface electromyography attending to an established and rigorously observed protocol was performed; 3-5 seconds of contraction following 6-10 second of relaxation. The average electromyographic values of the first 5 and the last 5 contractions of this session were calculated. We observed a statistically significant difference in the average electromyographic values at the end of the biofeedback session; patients who remained incontinent after the surgical treatment had a lower average value, but the general average value of every contraction (the first and the last ones) was homogeneous in continent and incontinent patients. Therefore, the perineal muscular status research must be sufficiently precise to detect a possible muscular fatigue in those patients who are still incontinent after an anatomical correction. These patients with a failure of the surgical treatment could also have a defect at the muscular function of the perineum. Following this line of research, we offered many patients the convenience of

rehabilitating the pelvic floor, almost 20 sessions with a therapeutic character, before considering the surgical treatment.

5.2 Stress urinary incontinence's treatment

At the present time there is a revolution in stress urinary incontinence treatment with several surgical techniques being considered, less invasive but very efficient, using synthetic materials and with few complications, which can be performed with spinal anesthesia and with only one day of admission if no complications occur.

It has been reported that six months after the surgical approach for urinary incontinence, 95% of patients felt better, but only 57% were objectively asymptomatic (Pacanowski 2002). In our sample, we have confirmed a subjective and objective improvement (totally dry) in an 84% of patients during the complete follow-up time (>6 years).

The treatment with tension free vaginal tape is, according to some authors, the first-line election in moderate to severe stress urinary incontinence (Serrano 2003). The Polypropylene tape will be covered by collagen 6 weeks after surgery, with no rejection (Serrano 2003).

The method of implantation of the tape could influence the results after correcting the incontinence. The transobturator technique seems to have less perforation risks, making unnecessary the intraoperatory vesical endoscopic exploration. This suspension type reproduces in a more physiological way the anatomic suspension of the urethra (Galmes-Belmonte and Diaz-Gómez 2004).

Urinary continence in women mainly depends on the position and the mobility of the urethra and the urethro-vesical union. The pelvis floor muscle and the endopelvic fascia are the principal elements in maintaingin the correct position and mobility of the urethra. When making an effort these muscles increase their resistance. An efficient contraction can compress the urethra onto the pubic symphysis, increasing the intraurethral pressure, with a subsequent involuntary urine leakage. The effect on urethral pressure of the voluntary contraction of the pelvis floor muscles has been reported with urodynamical studies (Espuña-Pons 2002).

Some authors have studied the knowledge that women had of their pelvis floor muscles and their ability to contract them after a theoretical explanation on how to do so. They monitored the result with vaginal touch and perineometry, and they observed that after a verbal instruction, only a 68% of 60 women studied were able to make a correct contraction. In a similar study, Bump reported that only a 41% of 47 women studied were able to contract the pelvic floor muscles after a verbal explanation made by an expert (Bump, Hurt et al. 1991). So, before beginning a pelvis floor muscle rehabilitation program it is essential to evaluate the ability that a woman has to efficiently and voluntarily contract these muscles. The evaluation methods for this objective are vaginal touch (muscular testing), perineometry and electromyography (Espuña-Pons 2002).

There is a delicate balance of physiological reflexive mechanisms that take place in each miccional cycle. Any deficiency or change of any element of this chain can follow a miccional dysfunction and alteration of the continence mechanism (Arlandis-Guzmán, Martínez-Agulló et al. 2002).

The roll of the pelvis floor musculature in this balance is essential. The pelvic floor's place in the miccional cycle is the beginning or finishing of it under a cortical control. The voluntary relaxation, cortically mediated and canalized by the pudendus nerve, is crucial in begining the drainage phase, with the subsequent reflex activation of the parasympathetic (pelvic nerve), following the detrusor's contraction, and with the sympathetic inhibition (hypogastric nerve) that relaxes the vesical neck, achieving a coordinated micturition. On

the other hand, during the filling phase, the continuous contraction of the pelvic floor inhibits reflexively the detrusor's contraction, maintaining the sympathetic tone that keeps the vesical neck closed, and at the same time the periurethral muscular tone increases, which is necessary for continence during this phase, when the detrusor's stability and high urethral resistances are required (Arlandis-Guzmán, Martínez-Agulló et al. 2002).

The most complex biofeedback equipment, like the one used in this study, have three surface electrodes, two registering the activity of the pelvic floor and another registering the activity of a "control" muscular group (surface electrodes on the abdominal wall or on the inferior extremity): the information at the patient's disposal is more complex, being able to contract or relax a concrete muscular group and to observe if the exercise is being well performed or not. Not only will the inadequate performance of the exercise not reach a clinical improvement, it will aggravate the problem by strengthening antagonist musculature (Llorca-Miravet 1990). Biofeedback helps to achieve the correct performance of the exercises and is especially useful in those patients who have difficulties in locating their perineal musculature. The results reported with the vesical-sphincterian biofeedback treatment ranged from 42-80% recovery an approximately 22% improvement (Sugar and Firlit 1982; Rapariz 1994). We find an improvement rate of up to 75% in women with pelvic floor biofeedback treatment using surface electrodes, without electro-stimulation through a therapist-guided protocol (Lorenzo-Gómez, Silva-Abuín et al. 2008).

The transobturator method should remain the first-election technique for the stress urinary incontinence correction with urethral sphincter insufficiency. It is the best way to help the recovery of the functional anatomical position of the urethra and the vesical neck. But the striped external urethral sphincter and the vesical neck, composed of smooth muscle fibres, are included in a complex muscular surrounding of fine muscular bundles arranged obliquely like a lounger, which must support the column weight in bipedalism, not only of the pelvis viscera but of the whole abdomen. While seated, the direction of the tension power those perineal muscles are subjected to, changes versus a supine position. The stress-response status of the perineal musculature may require the running of a foreign material tape that is placed in order to reinforce the lounger. After the statistical correlation analysis, age was reported as the independent factor most responsible for the condition of the tone and the function of the pelvic floor muscles. Ergo the surgical treatment's result is more related to the functional status of this musculature than to concomitant illnesses or drugs which act at the vesical neck and/or the urethra.

6. Conclusion

6.1 Perineal electromyography can evaluate basal muscle tonicity and stress or exercise adaptation capacity in women planning surgical treatment by transobturator vaginal tape for urinary incontinence.

6.2 Stress and muscle fatigue due to continued exercise are more determinant of transobturator vaginal tape procedure failure that basal perineal muscle tone.

6.3 Muscle fatigue found in a perineal EMG session is associated with transobturator vaginal tape procedure failure, therefore we must offer another treatment option.

7. Concerns of the chapter

In the investigation of the excellence of surgical treatment of urinary incontinence, the perineal EMG can be included in the arsenal of tools for the evaluation of patients, as well as

in the investigation of the functional status of perineum in each one of conditions or secondary diagnosis of the patients.

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