

## Effects Of Electrostimulation In The Treatment Of Stress Urinary Incontinence

## Efeitos Da Eletroestimulação No Tratamento Da Incontinência Urinária De Esforço

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### RESUMO

**Objective:** To investigate the effects of electrical stimulation (ES) and pelvic floor exercises (TMAP) on the anatomical and functional abnormalities of the pelvic floor and quality of life of women with urinary incontinence (UI). **Method:** An experimental study with 65 female participants with UI, aged between 30 and 55, divided into three groups, the exercise group (GKinesio), ES group (GElectro), and control group (GControl). The GKinesio and GElectro attended 16 sessions in accordance with their respective protocol, twice a week. All participants underwent ultrasonographic evaluation of the pelvic floor; muscle contraction ability using the AFA and EMG biofeedback, and application of King's Health Questionnaire. **Results:** The results revealed significant differences in favor of the GKinesio, namely bladder mobility ( $p = 0.001$ ), thickness of the pelvic floor muscles ( $p = 0.001$ ), EMG- test ( $p = 0.008$ ), and muscle strength by AFA ( $p = 0.015$ ). The GElectro demonstrated significant differences in the symptoms urgency and urge incontinence. The symptoms and scores of the quality of life questionnaire given by the percentage delta showed a positive difference in the quality of life of women in the experimental groups. **Conclusion:** The study concluded that the anatomical and functional abnormalities of the pelvic floor of the women in this study could be modified and improved through perineal exercises and ES, interfering positively in the quality of life of these women. Improvement in UI could not be objectively demonstrated; however the symptoms of both groups showed that subjectively the symptom of UI was reduced.

**KEYWORDS:** Bladder; Pelvic Floor; Quality of Life; Electrical Stimulation Therapy. Physical Therapy

### ABSTRACT

**Objetivo:** Verificar os efeitos da eletroestimulação e dos exercícios perineais nas alterações anátomo-funcionais do assoalho pélvico e na qualidade de vida de mulheres com incontinência urinária por esforço. **Métodos:** Estudo experimental com participação de 65 mulheres com incontinência urinária de esforço, idade entre 30 a 55 anos, divididas em três grupos, o de exercícios (Gcinesio), o de eletroestimulação (Geleetro) e o controle (Gcontrole). O Gcinesio e o Geleetro fizeram 16 atendimentos de acordo com seu respectivo protocolo, duas vezes por semana. Todas realizaram avaliação ultrassonográfica do assoalho pélvico; teste de capacidade de contração muscular do mesmo através do AFA e do biofeedback eletromiográfico Phenix (EMG-teste) e aplicação do King's Health Questionnaire antes e após o tratamento. **Resultados:** A comparação revelou diferenças significativas a favor do Gcinesio, a saber: mobilidade do colo vesical ( $p=0,001$ ), espessura dos músculos do assoalho pélvico ( $p=0,001$ ), EMG- teste ( $p=0,008$ ) e força muscular pelo AFA ( $p=0,015$ ). Geleetro obteve diferença significativa nos sintomas urgência e urge-incontinência. A sintomatologia e os escores do questionário de qualidade de vida dada pelo delta percentual apresentaram diferença positiva na qualidade de vida das mulheres dos grupos experimentais. **Conclusão:** O estudo permitiu concluir que as alterações anátomo-funcionais do assoalho pélvico das mulheres desta pesquisa, puderam ser modificadas e melhoradas através dos exercícios perineais e da eletroestimulação, interferindo de maneira positiva na qualidade de vida dessas mulheres. A melhora da incontinência urinária de esforço não pôde ser objetivamente demonstrada, porém a sintomatologia tanto do Geleetro quanto do Gcinesio mostra que subjetivamente o sintoma incontinência urinária de esforço reduziu.

**PALAVRAS-CHAVE:** Colo da Bexiga. Assoalho Pélvico. Qualidade de Vida. Terapia por Estimulação Elétrica. Fisioterapia

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### INTRODUCTION

Among the various types of urinary incontinence (UI), stress urinary incontinence (SUI) is the most frequently encountered. This is described as the involuntary loss of urine when the intravesical pressure exceeds the maximum urethral pressure in the absence of contraction of the detrusor muscle.<sup>1</sup>

UI is a disease that affects millions of women, yet it remains neglected. In Brazil, it is estimated that it affects 1 in 4 adult women, affecting 10% of women at 20 years, 35% at 50 years, and reaching 60% in women older than 70 years. The global prevalence of UI varies according to the definition, being 10-40% of women between 15 and 64 years old.<sup>2</sup>

There are two fundamental mechanisms in SUI: hypermobility of the urethra, a manifestation due to weakening of the proximal urethral support, and intrinsic sphincter deficiency of the urethra, which is a dysfunction of the urethral sphincter muscle.<sup>1</sup>

The etiology of SUI is multifactorial; however it is strongly related to pelvic floor muscle (PFM) dysfunction. Therefore, the International Continence Society recommends conservative treatment as a first line, of which physical therapy has been highlighted, presenting positive results in women with SUI.<sup>3</sup>

Several physiotherapy protocols aim to strengthen PFMs and promote motor control in order to recover this support platform, reducing bladder neck hypermobility and triggering the PFM during moments of sudden intra-abdominal pressure.<sup>4</sup>

Among the various reeducation techniques used to restore the function of the PFMs, is training of the pelvic floor muscles (TPFM), which may or may not be associated with electrostimulation (ES).

ES works through sensory stimuli and, in a proprioceptive event, informs the individual as to which muscles should be recruited in the movement, facilitating concentration on the muscles, a condition that allows the motor system greater adjustment and “focus” of transmission of more concomitant nerve impulses, improving levels of contractions and, consequently, strengthening the muscles involved.<sup>5</sup> On the other hand, there is no support for the use of intravaginal ES to treat SUI in women.<sup>6</sup> However, ES is especially indicated when women cannot voluntarily contract the PFMs.<sup>7</sup>

In another way, studies such as that of Sar and Khorshid demonstrate the efficacy of some therapeutic exercises in the treatment of SUI. The improvement indices are around 56% to 70%. Demonstration of favorable outcomes, low costs, and the virtual absence of complications and morbidity perceived from this form of treatment contribute to the adoption of such methods by several countries, possible as the preferred approach for incontinent women.<sup>8</sup>

The majority of studies in this area have not focused on anatomic-functional characteristics of the pelvic floor such as mobility of the bladder neck, thickness of the levator ani muscle, contraction capacity of the PFM, and quality of life of women with SUI. Therefore, it is relevant to ask: which of the two methods should be preferred in terms of effectiveness?

Thus, this study aimed to verify the efficacy of TPFM and TPFM associated with vaginal ES to treat women with SUI and, specifically, to verify which of the two methods is best to reduce mobility of the bladder neck, increase thickness of the levator ani muscle, and improve the contraction capacity of the PFMs, and quality of life in women with SUI.

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## METHODS

This is a randomized clinical trial that followed the norms of the National Health Council and was approved by the Research Ethics Committee Involving Humans of Castelo Branco University under opinion number 0176/2008.

All participants who complained of SUI were evaluated by urologist physicians or gynecologists and underwent urodynamic examination to verify pressure of urine loss under stress, whose importance in the etiological diagnosis of SUI has increased considerably, since it is used to analyze the behavior of the bladder and vesicourethral sphincter complex<sup>9</sup>, and transvaginal ultrasonography to determine the type of UI, mobility of the bladder neck, and thickness of the levator ani muscle.

The study included women between 35 and 55 years of age, with SUI due to hypermobility of the bladder neck diagnosed by the urodynamic examination. The following exclusion criteria were considered; women with SUI due to intrinsic insufficiency, detrusor overactivity, patients with drug use that may potentially interfere with UI, previous surgical repair of SUI and/or of genital prolapse, diabetics, pregnant women, and those with a body mass index (BMI) over 35 or with any type of neurological disease.

The participants were attended at the Urological Treatment Center, in the city of Belém, State of Pará, from October 2008 to May 2009.

All participants who met the eligibility criteria were evaluated by a blinded therapist (EFCN) who did not participate in the consultations. The volunteers were then referred to the physiotherapists who randomly divided them (through the randomization program, located on randomization.com) into 3 groups: electrotherapy group (GElectro), kinesiotherapy group (GKinesio), and Control group (GControl). After the randomization the protocols were applied.

The sample consisted of 30 women in each group based on the sample calculation of a total of 120 female users who were attended at the clinic annually, being within the inclusion and exclusion criteria of the research. Recruitment was performed by convenience.

The evaluation consisted of an evaluation form, containing a clinical history and physical examination of the participant, who was also instructed on the anatomical location of the pelvic floor, on the musculature of the pelvic floor, and its function, visualization of the perineum using a mirror, and digital auto-touch in the central fibrous nodule of the perineum. This guidance was aimed at the moment of training, in which adequate awareness about this part of the body is of extreme necessity for the effectiveness of the program.

The muscle contraction capacity of the pelvic floor muscles (PFMs) was evaluated by AFA through the scale of Ortiz, and by electromyographic biofeedback, Phenix (model usb 4, manufacturer VIVALTS PS, Paris-France).<sup>10</sup>

To evaluate the interference of SUI in the QoL of the individuals participating in the study, the respondents answered the King's Health Questionnaire (KHQ), which is specific to UI and validated and translated into Portuguese.<sup>11</sup> The KHQ consists of 21 questions organized into eight domains: general health perception, UI impact, physical and social limitations, personal relations, emotions, sleep and disposition, as well as two scales for self-attribution of UI severity and intensity of urinary symptoms. The score varies from 0 to 100, and the score and the QoL are inversely proportional.<sup>12</sup>

The intervention protocols were performed as follows: the GElectro participated in an ES program associated with voluntary contractions of the PFM. The ES device used was the Quat dualex 961, with a frequency of 50 Hz, pulse width 700µs, rise and fall time of 2 seconds, maintenance time of 6 seconds, and rest interval of 12 seconds,<sup>11</sup> totaling 20 minutes per session. The GKinesio performed a series of therapeutic exercises that included proprioception exercises on a therapeutic ball of 65 to 75 cm in diameter, making lateral movements and antero-retroversion of the pelvis; hopping over the ball and performing movements of eight with the pelvis, exercises in the supine position maintaining a medium ball with flexed knees and feet supported to the ground, and an exercise of potentiation of the pelvic floor, in which the volunteer was placed in the ventral position, with hands on the frontal region, one lower limb extended and the other semi-flexed with external rotation, for 20 minutes.<sup>13,14</sup>

None of the groups were instructed to perform exercises at home and there were no absences in the frequency of volunteer participation.

At the end of 16 sessions performed twice a week (two months) both the GElectro and GKinesio groups were referred for reevaluation. The parameters for reevaluation were contraction capacity, mobility of the bladder neck, thickness of the levator ani muscle, and the QoL. The GControl was also reevaluated at the end of the 2 months.

For data analysis, the categorical variables are presented as frequencies and the numerical variables by means of measures of central tendency and dispersion. The normality of the sample was evaluated by the Shapiro-Wilk test and the homogeneity of variance by Levene's test. For analysis of the response variables, the paired Student's t-test or the Wilcoxon test, when appropriate, was used in the intra-group analysis. For the inter-group evaluation, the non-parametric Kruskal Wallis test was used, followed by multiple comparisons using the Mann-Whitney test or the two-way ANOVA parametric test, followed by the Tukey Post Hoc test. The level of  $p < 0.05$  was adopted for statistical significance. The data were analyzed using the Excel program and the statistical package SPSS 14.0.

## RESULTS

The randomization of the total number of volunteers, after screening for the inclusion and exclusion criteria, is described in Figure 1, based on the CONSORT flowchart.

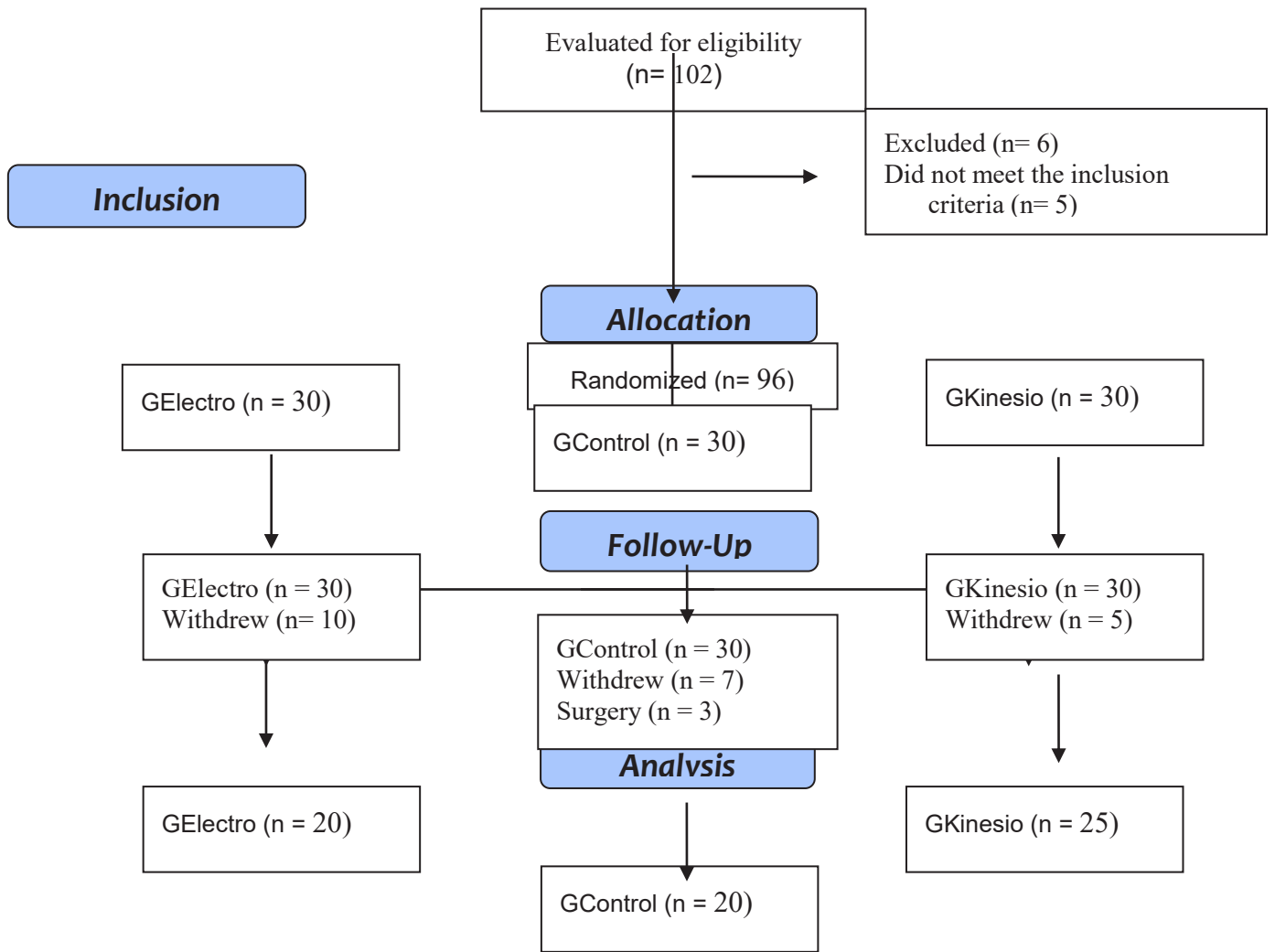


Figure 1 Randomization of study volunteers in the groups.

To maintain sample homogeneity, some variables described in table 1 were evaluated.

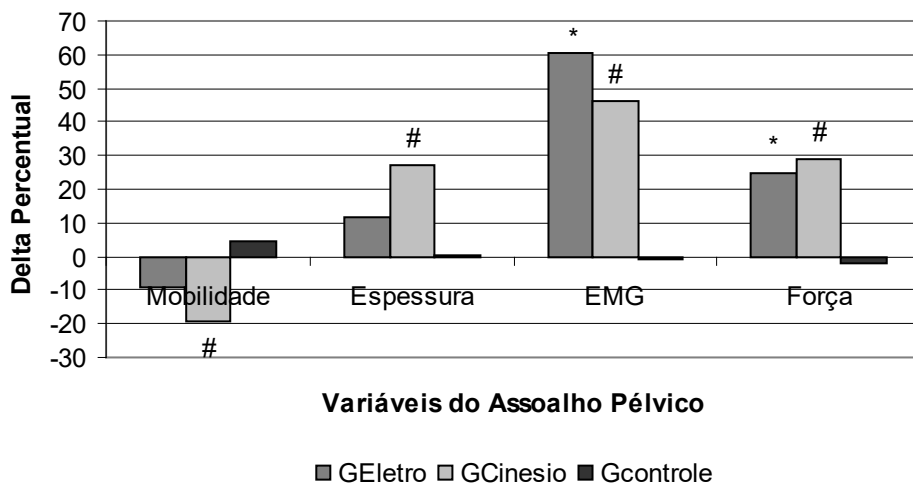
Table 1: Distribution of sample homogeneity

	GElectro	GKinesio	GControl	p-value
AGE	47.35	49.24	45.25	0.292
NORMAL BIRTH	3.15	4.00	3.70	0.364
CESAREAN BIRTH	0.80	0.92	1.00	0.807
TIME OF SUI	1.65	1.36	0.75	0.693

Age (years); Stress urinary incontinence time (years)

The intergroup evaluation revealed that the GElectro demonstrated statistically significant success ( $p < 0.05$ ) when compared to the control group in electromyographic activity ( $p = 0.007$ ) and muscular strength ( $p = 0.006$ ), while for muscle thickness ( $p = 0.355$ ) and mobility ( $p = 0.147$ ) no significant difference was observed compared to the control, as can be seen in figure 2.

Figure 2: Inter-group comparison by percentage variation between the GElectro, GKinesio, and GControl groups.

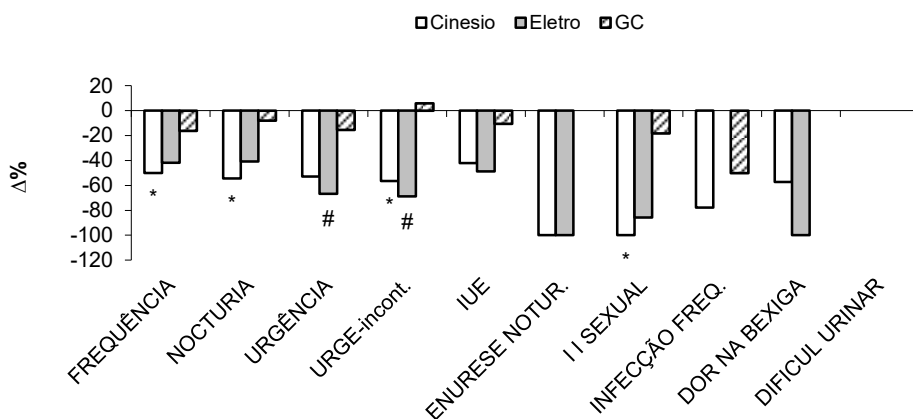


\* $p < 0.05$ ; GElectro x GControl; # $p < 0.05$ ; GKinesio x GControl; Mobility: Mobility of the bladder neck (mm); Thickness: Thickness of the pelvic floor muscle (mm); EMG: PFM contraction capacity assessed by electromyographic activity ( $\mu\text{V}$ ); Strength: PFM contraction capacity assessed by AFA (degree); GElectro: electrotherapy group; GKinesio: kinesiotherapy group; GControl: control group

Still in Figure 2, for the GKinesio, on the other hand, the inter-group results demonstrated a significant decrease in the mobility of the bladder neck ( $p = 0.001$ ) and in the other anatomic-functional variables of the PFM, the GKinesio group also presented significant differences in thickness ( $P = 0.001$ ), electromyography ( $P = 0.008$ ), and AFA ( $0.015$ ) compared to the GControl.

The presentation of the percentage delta of the symptomatology of the GElectro, GKinesio, and GControl are shown in figure 3.

Figure 3: Inter-group comparison by the percentage delta of the GElectro, GKinesio, and GControl.



\*p<0.05; GKinesio VS GControl

#p<0.05; GElectro VS GControl

Figure 3 shows that the differences between the GKinesio occurred in the symptoms frequency, nocturia, urge-incontinence, and incontinence in sexual intercourse, and the GElectro only demonstrated significant differences in the symptoms urgency and urge-incontinence.

Table 2 presents the means pre and post-test of the research groups, remembering that the values of the answers in the KHQ range from 0 to 100. Values close to zero correspond to good QoL, and values close to 100 indicate poor QoL.

Table 2: Descriptive of the domains of the 3 groups

	GKinesio		GElectro		GControl	
	pre-test	post-test	pre-test	post-test	pre-test	post-test
	Mean	Mean	Mean	Mean	Mean	Mean
Dom1	34.00	28.33	40.00	20.00	28.75	28.75
Dom2	52.66	34.66	64.97	29.14	55.41	55.41
Dom3	32.22	14.00	26.62	6.66	26.63	26.63
Dom4	21.11	16.66	42.48	11.10	31.66	29.16
Dom5	13.11	12.89	24.09	7.49	18.83	18.83
Dom6	13.99	11.99	32.48	4.58	27.50	27.50
Dom7	19.78	15.99	33.28	9.16	30.52	30.52
Dom8	21.66	15.33	26.65	7.49	25.55	25.55
Dom9	26.66	22.64	40.56	10.83	34.61	34.61

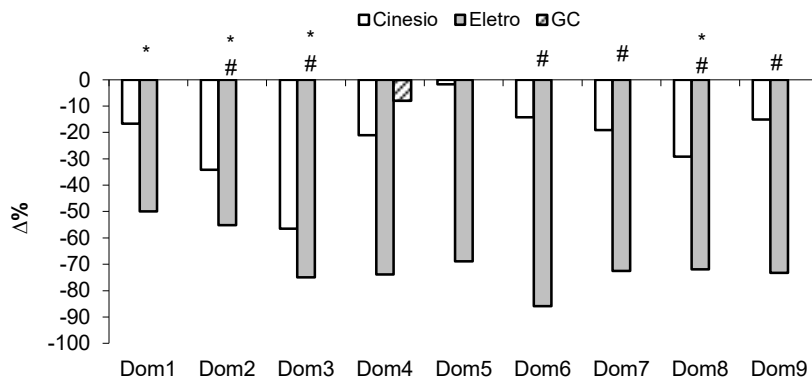
Dom1: general health; Dom2: impact of incontinence; Dom3: limitations of daily activities; Dom4: physical limitations; Dom5: social limitations; Dom6: personal relations; Dom7: emotions; Dom8: sleep and disposition; Dom9: measures of severity.

(p<0.05) in bold

In Table 2 we observed that the post-test values of the GElectro and GKinesio reduced, whereas in the GControl these values remained practically unchanged.

Figure 4 demonstrates the inter-group comparison by the percentage delta of the KHQ scores.

Figure 4: Inter-group comparison by the percentage delta of the KHQ scores



\*p<0.05; GElectro x GControl; #p<0.05; GKinesio x GControl; Dom1: general health; Dom2: impact of incontinence; Dom3: limitations of daily activities; Dom4: physical limitations; Dom5: social limitations; Dom6: personal relations; Dom7: emotions; Dom8: sleep and disposition; Dom9: measures of severity.

Significant differences between the GElectro, GKinesio, and GControl were observed in the domains of impact of incontinence, limitations of daily activities, and sleep and disposition. In the general health domain only the GElectro demonstrated a satisfactory difference. In the domains of personal relations, emotions, and measures of severity, the GKinesio presented a satisfactory difference from the GControl, while in the scores for physical limitations and social limitations neither the GElectro nor the GKinesio demonstrated differences.

## DISCUSSION

Pelvic floor muscle training is an effective method for relieving the signs and symptoms of women with stress urinary incontinence, with consequent improvement in quality of life.<sup>15</sup>

Bertoldi et al. previously conducted a review of the literature with articles published between 2003 and 2014, comparing physiotherapeutic approaches in SUI patients, and concluded that pelvic floor kinesiotherapy promotes the strengthening of the elements of sustentation and elevation of intra-urethral pressure, reducing urinary losses, this being the most effective method.<sup>16</sup>

Knorst et al. carried out a study with 55 women diagnosed with Urinary Incontinence (36.4% of whom presented with Stress Incontinence) who underwent a physical therapy protocol involving ES and kinesiotherapy for a maximum of 15 sessions, being interrupted when each patient reported continence. After 13 sessions, on average, 91% of the sample reported being satisfied with the treatment and demonstrated improvement in almost all KHQ domains. Similar results were found by Da Silva et al. in 2014, also using a mixed protocol (ES and kinesiotherapy) of 10 sessions in their case report with SUI patients; both studies corroborate the results found in the present study.<sup>17</sup>

The mobility of the bladder neck and the pelvic floor muscle function were studied by Thompson et al. to evaluate



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the association between different measures of PFM function using transperineal ultrasound, manual muscle testing, and perineometry. The authors evaluated muscle contractions of the pelvic floor in continent and incontinent volunteers, using transperineal ultrasound, the manual muscle test (AFA), and perineometry, finding that depression of the bladder neck during attempts to perform a muscle contraction of the PFMs occurred in 17% of continent and 30% of incontinent women. The continent women were stronger in the manual muscle strength test ( $p = 0.001$ ) and in perineometry ( $p = 0.019$ ) and presented higher resistance of the PFMs ( $p < 0.001$ ) than the incontinent women. In addition, there was a strong tendency for the continent women to present a higher degree of bladder neck elevation than the incontinent women ( $p = 0.051$ ).<sup>9</sup>

In the present study, the mobility of the bladder neck decreased significantly and satisfactorily ( $p < 0.05$ ) in the inter-group post-test in the GKinesio ( $p = 0.001$ ), whereas the GElectro ( $p = 0.147$ ) demonstrated no significant difference compared to the GControl. The GControl presented an unsatisfactory difference, since it presented an increase in the mobility of the bladder neck ( $p < 0.05$ ).

Balmforth et al. investigated the impact of a 14-week PFM rehabilitation program on bladder neck mobility and QoL of women with SUI in a prospective observational study. To assess the mobility of the bladder neck, the authors used ultrasonography and to evaluate the QoL the KHQ. Their results allowed the conclusion that training of the PFMs is effective for SUI, since it resulted in a significant elevation of the position of the bladder neck, suggesting an increase in rigidity of the PFMs. These alterations in functional anatomy were associated with a statistically clinically significant reduction in urine output and improved quality of life.<sup>12</sup>

Regarding the thickness of the perineal musculature, Grosse and Sengler report that the thickness tends to decrease with age and, consequently, so does muscle strength, and incontinent women present a decrease in the thickness of the perineal musculature and perineal muscle strength.<sup>18,19</sup> This finding can be observed in the inter-group analysis (Figure 2) of the present study, in the GKinesio we observed a significant increase in thickness ( $p$ -value  $< 0.001$ ) after treatment, while in the GElectro we did not observe any significant response ( $p = 0.355$ ).

The electromyographic (EMG) activity and muscle strength in the present study was evaluated through Phenix biofeedback and AFA. Both the GElectro and GKinesio demonstrated improvement in muscle strength after application of the protocol. In the EMG the GElectro obtained  $p = 0.007$  and the GKinesio  $p = 0.008$ , while in the AFA the GElectro obtained  $p = 0.006$  and the GKinesio  $p = 0.015$ , compared to the GControl. We note that this increase in pelvic floor muscle strength is also related to improvement in SUI.<sup>17,20</sup>

Moreira performed a study with 101 women in two groups: one with continent and one with incontinent women, in order to compare the value of objective and subjective propaedeutic evaluation in the diagnosis of UI. It was observed that the muscular strength and perception of the pelvic floor in the women with urinary loss were significantly impaired when compared to the group of continent women.<sup>21</sup>

Castro et al. compared exercises for the pelvic floor, ES, and vaginal cones in SUI, and concluded that all three methods are equally effective in the treatment of SUI, observed by the pad test, QoL questionnaire, urodynamic testing, number of daily losses, and subjective responses.<sup>22</sup>

QoL is greatly affected by urinary losses; SUI contributes significantly to an individual's low self-esteem.<sup>19</sup> Among the various limitations caused by SUI are problems of a social order and hygiene, limitations in physical levels, in social,

occupational and domestic activities, in emotional state, and sexual life.<sup>24-26</sup>

As in the work of Rett et al. some of the questionnaire responses were expected, since we also pre-selected women with SUI.<sup>19</sup> Symptoms such as recurrent urinary tract infections, nocturnal enuresis, difficulty urinating, and bladder pain were rarely mentioned in the GKinesio, GElectro, and GControl.

It was observed in the present research that there was a reduction in frequency, nocturia, urge incontinence, and incontinence in sexual intercourse in the GKinesio, and the GElectro demonstrated a significant difference in urgency and urge incontinence symptoms compared to the GControl in the post-test. In addition Rett et al. observed symptom improvement after applying a protocol of exercises to strengthen the PFM associated with electromyographic biofeedback, Myotrac 3G.<sup>19</sup>

The mean of the KHQ scores decreased in the post-test (Table 2), revealing an improvement in the QoL of the GElectro and GKinesio. Significant differences occurred between the GElectro and GControl, and the GKinesio and GControl in the domains of impact of incontinence, limitations of daily activities, and sleep and disposition. In the general health domain only the GElectro demonstrated a satisfactory difference. In the domains of personal relations, emotions, and measures of severity, the GKinesio presented a satisfactory difference compared to the GControl, while for physical limitations and social limitations, despite decreases, neither the GElectro nor the GKinesio demonstrated a difference (Figure 4).

Oliveira et al. in their study aiming to characterize urinary symptoms and correlate them with the QoL of 34 women with UI, concluded that the incontinent women evaluated reported that urinary symptoms were frequently associated with the complaint of loss due to stress. It was observed that the majority of women complaining of SUI and urge-incontinence reported that QoL was at least somewhat compromised.<sup>24</sup> While not limiting their daily, physical, and social activities, most recognize that UI affects their perception of health and has a negative impact on, especially, compromised sleep and disposition.

## CONCLUSION

The results of the present study enabled us to conclude that the anatomical-functional alterations of the pelvic floor of the women in this study could be modified and improved through perineal exercises and electrostimulation, interfering positively in the quality of life of these women. The improvement in stress urinary incontinence could not be objectively shown, however the symptomatology of both the GElectro and GKinesio demonstrated, subjectively, that the stress urinary incontinence symptom had reduced.

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