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Effects of TENS and Physiotherapy on Chronic Constipation in Myelomeningocele

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ABSTRACT

Chronic constipation is a common symptom of Myelomeningoceles. TENS has been proven to be effective in treating constipation in different populations and parameters. Physiotherapy is a relatively recent treatment for constipation and has not been extensively studied in pediatrics and Spina Bifida. This study aimed to examine the role of TENS in Myelomeningocele and to increase the number of studies on physiotherapy for pediatric constipation. This study also aimed to determine a new treatment approach that can be applied to chronic constipation in children with Spina Bifida using physical therapy. Constipation symptoms, stool pattern, bladder and bowel dysfunction, muscle strength involved in defecation, pressure pain thresholds (ppt) in these muscles, severity of fecal incontinence, and quality of life were assessed prior to treatment. Physical Therapy (PT) group received manual physical therapy techniques and dietary therapy for six weeks while the Physical Therapy and TENS (PT+T) group also received TENS. The post-treatment evaluations were repeated. A total of 28 children, 14 in each group, were included in the study. The stool form in both groups of children was constipated. There was a significant difference in stool pattern only PT+T group ($p<0.05$). Myofascial trigger points (MTrPs) were significantly reduced in both groups ($p<0.05$). Ppt and muscle strength increased significantly in PT group ($p<0.05$). Severity of fecal incontinence, constipation symptoms, and bladder-bowel dysfunction decreased significantly in both groups, but satisfaction with treatment increased ($p<0.05$). PT group had a statistically significant improvement in quality of life ($p<0.05$). TENS and physical therapy are safe and effective approaches that can be executed in clinical practice to reduce the symptoms of chronic constipation in myelomeningoceles.

Keywords: Myelomeningocele, Spina Bifida, Constipation, TENS, Physiotherapy

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Miyelomeningosellerde TENS ve Fizyoterapinin Kronik Konstipasyon Üzerine Etkisi

ÖZ

Kronik konstipasyon, Miyelomeningosellerde sık görülen bir semptomdur. TENS'in farklı popülasyonlarda ve parametrelerde konstipasyonun tedavisinde etkili olduğu kanıtlanmıştır. Fizyoterapi konstipasyon için nispeten yeni bir tedavi yöntemidir ve pediatrik olgular ile Spina Bifida'da kapsamlı bir şekilde araştırılmamıştır. Bu çalışmada Miyelomeningosellerde TENS'in rolünün incelenmesi ve pediatrik olgularda konstipasyona dair fizyoterapi araştırmalarının sayısının arttırılması amaçlandı. Çalışmada ayrıca Spina Bifida'lı çocuklarda kronik konstipasyon için fizyoterapi uygulanarak yeni bir tedavi yaklaşımının belirlenmesi amaçlandı. Tedavi öncesi konstipasyon semptomları, dışkı formu, mesane ve bağırsak disfonksiyonu, dışkılamayla ilgili kas kuvveti, bu kaslardaki basınç-ağrı eşikleri (ppt), fekal inkontinansın şiddeti ve yaşam kalitesi değerlendirildi. Fizyoterapi (PT) grubuna altı hafta boyunca manuel fizyoterapi teknikleri ve diyet tedavisi uygulanırken, Fizyoterapi ve TENS (PT+T) grubuna ayrıca TENS uygulandı. Değerlendirmeler tedavi sonrasında tekrarlandı. Çalışmaya her grupta 14 olmak üzere toplam 28 çocuk dahil edildi. Her iki gruptaki çocukların dışkı formu konstipeydi. Sadece PT+T grubunda dışkı formu açısından anlamlı fark vardı ($p<0.05$). Miyofasiyal tetik noktalar (MTrPs) her iki grupta da anlamlı derecede azaldı ($p<0.05$). Ppt ve kas kuvveti PT grubunda anlamlı derecede arttı ($p<0.05$). Her iki grupta da fekal inkontinansın şiddeti, konstipasyon semptomları ve mesane-bağırsak disfonksiyonu anlamlı derecede azaldı, tedaviden memnuniyet arttı ($p<0.05$). PT grubunda yaşam kalitesinde istatistiksel olarak anlamlı iyileşme görüldü ($p<0.05$). TENS ve fizyoterapi, Miyelomeningosellerde kronik konstipasyon semptomlarını azaltmak için klinik pratikte uygulanabilecek güvenli ve etkili yaklaşımlardır.

Anahtar Kelimeler: Miyelomeningosel, Spina Bifida, Konstipasyon, TENS, Fizyoterapi

1 Introduction

Myelomeningocele or Spina Bifida (SB) is a neural tube defect that occurs on the 28th day of gestation. Due to weak innervation and slow defecation in these patients, feces stay in the bowel longer and the bowel cannot be completely emptied. In addition, medications, decreased muscle tone, and bladder problems can cause constipation [1].

Pelvic organs are connected to the pelvic wall by the pelvic fascia. The connections between the neural pathways of the pelvic organs form the working rhythms of the bladder and bowel. Dysfunction in any of these organs can lead to an effect in children with myelomeningocele that affects the sacral plexus [2]. Furthermore, myofascial trigger points (MTrPs) in the muscles that connects the deep frontal fascial line and the core and gluteal muscles, indirectly affect pelvic floor muscle function, leading to spasm and constipation [3]. Especially in children with SB, who have limited mobility and are seated in a wheelchair for a long time, MTrPs occur mainly due to muscle shortening in the abdominal and groin areas.

Pelvic floor rehabilitation aims to fully coordinate defecation with isometric contractions of the abdominal wall and eccentric contractions of the pelvic floor, resulting in the correct synergy of abdominal and pelvic relaxation [4]. The goal of patients with SB is to increase colonic passage without significantly altering stool consistency. In clinical practice, attempts have been made to overcome this problem with appropriate laxatives [5], but loose stools increase the risk of fecal incontinence. In addition, it can cause symptoms such as chronic constipation, bloating, abdominal pain, and irritability, which can affect the quality of life [6]. In our study, we examined the effect of physical therapy

techniques and TENS on constipation in myelomeningocele patients, which has valid results in different groups in the literature [7, 8].

Transcutaneous Electrical Nerve Stimulation (TENS) is one of the most preferred methods of electrical stimulation. TENS works by using electrical currents to activate neural structures in the central nervous system [9].

Electrical stimulation was first reported by Balcom et al. in myelomeningocele in 1997. It began to be used by families during night-time sleep. The effect of a current with a frequency of 55 Hz and pulse width of 280 μs on the bladder was studied in the abdominal and buttock regions. The study showed that, patients were able to better predict their bowel movements and develop a better sense of pelvic fullness [10].

Sacral nerve stimulation was attempted in children with slow transit constipation in a follow-up conducted in 2006. TENS was used to conduct sacral nerve stimulation at a frequency of 140 Hz and width of 300-400 microseconds, which is effective for severe constipation [7].

In clinical practice, we observed that strengthening the abdominal muscles is effective in emptying myelomeningoceles with weak pelvic floor muscles. Furthermore, it has been shown that physical therapy methods applied on MTrPs, such as ischemic compression, myofascial release, and posterior relaxation techniques, can adversely affect the effective function of these muscles, thereby reducing MTrPs activation [11].

This study aimed to elucidate the role of TENS and physical therapy, which have been reported to have beneficial effects in different populations of children with neurogenic bladder and bowel disorders. Although the children in our study had bladder and bowel problems, the purpose of our study was to discuss the effects of TENS and physical therapy approaches on constipation, constipation symptoms, stool patterns, MTrPs, pressure pain thresholds (ppt), muscle strength and quality of life in children with myelomeningocele who have chronic constipation problems.

2 Methodology

2.1 Study design

Twenty-eight children with myelomeningocele and chronic constipation aged 5-15 years were randomized into two groups of 14-14 after obtaining parental consent. In the “physical therapy” group (PT group) children received manual abdominal massage, trigger point release, breathing exercises, rib mobilization, sensory stimulation of the gluteus maximus and rectus abdominis and strengthening exercises in the 'core' area muscles for 6 weeks, 3 days a week. Awareness of the pelvic floor muscles, which may be a sensory defect in the majority of myelomeningoceles, was increased by diaphragmatic breathing and normal voiding and defecation patterns were taught. Diaphragmatic breathing exercises were performed by explaining to the patients that they should breathe deeply through their nose and direct their breath towards the diaphragm, contracting the pelvic floor eccentrically and pushing their anus down. While doing this, the patient was not allowed to hold their breath or actuate the valsalva mechanism. In addition, in the first session, individual diet therapy was provided by a specialist dietitian, considering the patient's eating habits, anthropometric measurements and comparing the percentile curve that should be based on their age.

In addition, TENS received to “TENS and physical therapy” group (PT+T group) for 6 weeks with a frequency of 10 Hz and a current width of 400 ms for 20 min [9].

The study included children with SB who had suffering from chronic constipation and had regular urodynamic clinical follow-ups until our treatment. The International Continence Society (ICS) defines constipation as a complaint that bowel motions are infrequent and/or incomplete and/or there is a need for frequent straining or manual assistance to defecate (Rome IV criteria) [12]. Children with mentally retardation who had undergone pelvic surgery and those with active infection at study entry were excluded. The ethics committee for this study was approved by the Clinical Research Ethics Committee of the Marmara University Faculty of Medicine (protocol number 09.2020.07).

2.2 Outcome measures

The stool pattern classification of the 28 children with SB included in the study was determined using the Bristol Stool Scale (BSS). The Bristol Stool Scale is a simple and understandable scoring method for subjective evidence of constipation. In this stool type score explained with pictures to parents or caregivers caring for patients, it can be seen that the stool types of constipation, such as type 1 and type 2. Types 3 and 4 refer to the normal type of poop, and types 5, 6 and 7 refer to the liquid stool types. The Patient Assessment of Symptoms of Constipation (PAC-SYM) questionnaire was used to assess symptoms due to constipation, and the Patient Assessment of Constipation and Quality of Life Scale (PAC-QOL) was used to determine the impact of chronic constipation on the quality of life, severity of constipation symptoms over the past 2 weeks, their impact on daily life, mood changes, and how their lives continued. The Children's Bladder and Bowel Dysfunction Questionnaire (CBBDQ) was used to assess bladder and bowel dysfunction in children. In addition, the Fecal Incontinence Severity Index (FISI) was filled in to assess the severity of fecal incontinence possibly caused by constipation. A decrease in the PAC-QOL (first part), CBBDQ, and FISI scores indicates improvement. Besides, manual muscle testing was performed to measure the strength of the exercise-treated muscles and the pain pressure threshold (ppt) of the same muscles was measured using a J-Tech Algometer Commender™ device.

2.3 Statistical Analysis

In classifying the data obtained in the study, qualitative and quantitative statistical methods were evaluated with 80% confidence intervals using the SPSS 22 statistical program, and the significance was evaluated at $p<0.05$. Nonparametric tests were used for data that did not follow normal distribution. The significance of before and after data was tested using the Wilcoxon Signed test.

3 Results and Discussion

There were no significant differences between the groups in terms of sex, level, wheelchair use, and age (Table 1).

Table 1: *Demographic Features*

		PT group (n=14)		PT+T group (n=14)		Total (n=28)		*p* value
		n	%	n	%	n	%	
Gender	Male	10	%71.4	8	%57.1	18	%64.3	X^2=0,62 p=.347[a]
	Female	4	%28.6	6	%42.9	10	%35.7	
Level	Lumbosakral	2	%14.3	4	%28.6	6	%21.4	X^2=1,00 p=.607[a]
	Torakolomber	7	%50.0	5	%35.7	12	%42.9	
	Lomber	5	%35.7	5	%35.7	10	%35.7	
Using wheelchair	Yes	10	%71.4	7	%50.0	17	%60.7	X^2=1,34 p=.220[a]
	No	4	%28.6	7	%50.0	11	%39.3	
Age		14	Mean	14	Mean	28		p=.585[b]
			7.86±2.03		8.36±2.70			

PT Physical therapy, *PT+T* Physical therapy+TENS
[a] Chi-square test, [b] Indipendent *t* test

The form of stool in both groups of children was constipated according to BSS. Although almost every child achieved a normal stool pattern after treatment, only PT+T group showed a statistically significant change in stool pattern (p=0.02, Table 2). The BSS scores of the patients before and after treatment did not differ significantly between groups (p>0,05, Table 2).

Pre- and post-treatment values for questionnaires and scales asking about stool type, constipation-related symptoms, fecal incontinence, bladder-bowel dysfunction, and constipation-related quality of life are shown for the PT and PT+T groups (Table 2).

Table 2: *Outcome Results*

Scales	**PT group**			**PT+T group**			**Diffence Between Groups[a]**	
	Before	**After**	***p* value**	**Before**	**After**	***p* value**	**Before *p* value**	**After *p* value**
BSS	2.71±1,.2	3.50±0.65	.085	2.43±1.15	3.21±0.80	**.021**	.612	.031
FISI	16.4±8.86	12.43±7.61	**.002**	30.0±16.48	25.50±16.00	**.007**	**.010**	**.001**
PAC-SYM	7.14±5.48	3.57±3.63	**.010**	11.29±7.72	8.14±7.09	**.004**	.114	**.04**
CBBDQ	18.79±9.22	15.79±9.21	**.000**	26.43±12.17	24.00±11.48	**.001**	.072	**.047**
PAC-QOL (first part)	7.50±9.64	6.43±9.42	**.015**	11.93±10.23	9.93±8.22	.056	.249	.305
PAC-QOL (satisfy part)	6.36±3.71	10.36±2.43	**.000**	6.50±3.08	9.93±2.86	**.000**	.913	.674

BSS bristol stool scale, *FISI* fecal incontinence severity index, *PAC-SYM* patient assessment of constipation symptoms questionnaire, *CBBDQ* childhood bladder and bowel dysfunction questionnaire, *PAC-QOL* patient assessment of constipation quality of life questionnaire
Values in bold indicate a significance of p<0.05
[a]Independent groups t-test

Consequently, there was a statistically significant reduction in the severity of fecal incontinence in both groups (p=0.00). Likewise, a reduction in the severity of incontinence resulted in a significant reduction in the symptoms caused by constipation (p=0.01; PT group, p=0.00; PT+T group). Thus, in line with the positive results obtained for constipation and fecal incontinence, bladder-bowel dysfunction assessed using the CBBDQ questionnaire was improved in both groups (p=0.00). Meanwhile, there was a negative correlation between bladder-bowel dysfunction and treatment satisfaction (r=-0.54; p=0.00), while a positive correlation was found between constipation-related symptoms (r=0.47; p=0.01) and fecal incontinence severity (r=0.58; p=0.00). While the PAC-SYM values of the patients before treatment did not differ significantly according to the group (p>0.05), the PAC-SYM values after treatment showed a significant difference between the groups ($t_{(26)}$=2.147; p=0.041<0.05). The PAC-SYM values of PT+T group after treatment ($\bar{x}$=8,140) were higher than PT group ($\bar{x}$=3,570). The FISI values of before and after treatment showed a significant difference between the groups (before treatment $t_{(26)}$=2.770, p=0.010<0,05; after treatment $t_{(26)}$=2.087; p=0.047<0,05). The FISI values of PT+T group before treatment ($\bar{x}$=30,000) were higher than the values of PT group ($\bar{x}$=16,140). The FISI values of PT+T group after treatment ($\bar{x}$=25,500) were higher than the values of PT group ($\bar{x}$=12,430). The CBBDQ values after treatment showed a significant difference between the groups ($t_{(26)}$=2.087; p=0.047<0,05). The CBBDQ values of PT+T group after treatment ($\bar{x}$=24,000) were higher than the values of PT group ($\bar{x}$=15.790), (Table 2).

In our study, the quality of life assessed using the PAC-QOL improved in both groups. Statistically significant results were obtained only in PT group (p=0.01, Table 2). The quality of life decreased as the scores obtained from the questionnaire increased. Constipation symptoms were positively correlated with quality of life (r=0.39; p=0.03). Satisfaction scores for parents and patients who were satisfied with the treatments used in the study were statistically significant in both groups (p=0.00, Table 2). The PAC-QOL (first part) and PAC-QOL (satisfy part) values of the patients before and after treatment did not differ significantly between the groups (p>0,05; Table 2).

Before treatment, the total number of MTrPs in the core muscles decreased significantly after treatment in both groups (p=0.01; PT group, p=0.00; PT+T group, Table 3). The pressure-related pain threshold (ppt) and muscle strength of some of these muscles significantly increased only in the PT group (p<0.05; Table 3), (Figure 1). The number of MTrPs negatively correlated with satisfaction after treatment (r=-0.44; p=0.01). There was no statistically significant correlation between the ppt values and muscle testing (r > 0.05). Furthermore, there was no statistically significant difference between the groups in MTrPs and manuel muscle test values (p>0.05).

This is the first study to compared with physical therapy techniques and addition of TENS in Myelomeningocele on constipation. The results of this study show that the TENS and physical therapy combination is an effective tool for assessing the severity of fecal incontinence, symptom of constipation, bladder and bowel dysfunctions and changes in stool form.

Veiga et al. reported that TENS was effective in children with complaints of constipation in their research on constipated children aged 4-14 years [8]. In parallel with the results of this study, we observed that the symptoms of constipation were reduced in the PT + T group. Furthermore, Dinning et al. emphasized the need to optimize TENS parameters in children with slow colon transit and reported promising potential as a therapy.

In a study emphasizing the importance of bowel management in myelomeningoceles with constipation, it was stated that electrical stimulation is available in adults but limited in children [6]. We also examined the results of myelomeningocele with constipation using TENS.

As the symptoms of constipation are subjective in nature, they can be evaluated using questionnaires [8]. We assessed mainly constipation using PAC-QOL, PAC-SYM, BSS and other associated constipation questionnaires/scores.

Acar stated that SB is one of the diseases accompanied by constipation and that SB can be seen as a cause of chronic constipation [4]. More than half of both groups included in our study had forms of type 1 and type 2 stool at baseline according to the BSS (n=9 PT group, 64.2%; n=8 PT+T group, 57.14%). In addition to constipation, 1 child in the PT group had form a type 6 stool, 1 child had a type 7 stool, and 1 child in the PT+T group had a type 5 stool. In our study, there were no children in the form of type 1, type 5, type 6 or type 7 stool in either groups. In the PT group, 1 child (7.14%) remained in the form of type 2 stool, while the other 13 children reached the form of type 3 and type 4 stool. In the PT+T group, 3 children (21.4%) remained in the form of type 2, 11 children reached form of type 3 and type 4 stool. In conclusion, our study showed that stool forms changed from type 1-2 to type 3-4 in the PT group (n=5; 35.7%) and PT+T (n=9; 64.2%) according to BSS with no significant difference between the groups. According to the results, physiotherapy and TENS can be used to change stool forms.

Although Cameron et al. reported that in a study in which 13% of patients with spina bifida did not find a relationship between BSS score and constipation symptoms, in our study, it was observed that abdominal discomfort and fullness caused by constipation in the both of groups turned into a normal feeling of stool, and the families reported that their children told them that they wanted to go to the toilet for defecation [13].

Table 3: *Myofascial Trigger Points, Pressure-Pain Threshold and Muscle Strength Testing Values*

Number of Myofascial Trigger Points (MTrPs)		**PT group**			**PT+T group**			**Manual Muscle Strength Test Values (ACSM)**						
								PT group				**PT+T group**		
		Before	**After**	***p* value**	**Before**	**After**	***p* value**	**Muscles**	**Before**	**After**	***p* value**	**Before**	**After**	***p* value**
		5.43±3.32	2.86±2.71	**0.01**	4.50±2.56	3.00±2.77	**0.00**							
Pressure Pain Threshold Values (ppt)	M. İliopsoas	1.89±0.69	3.75±0.97	**0.02**	2.08±0.68	2.88±1.35	0.06	M. İliopsoas	1.92±2.09	1.85±2.03	0.33	3.21±1.84	3.28±1.85	0.33
	M. Rectus abdominis	1.82±0.54	3.11±0.69	**0.00**	2.67±0.98	3.16±1.17	0.23	M. Rectus abdominis	3.07±0.82	3.42±1.01	**0.01**	3.35±1.21	3.57±1.15	0.08
	M. Obliquus externus abdominis	1.94±0.82	3.35±1.05	**0.00**	2.49±0.92	3.04±1.24	0.52	M. Obliquus externus abdominis	2.92±0.82	3.21±0.97	**0.04**	3.07±1.20	3.14±1.23	0.33
	M. Quadratus lumborum	2.62±0.33	3.80±0.28	0.20	4.10±0.43	4.13±1.61	0.96	M. Quadratus lumborum	1.57±2.24	1.50±2.17	0.33	2.21±2.19	2.28±2.19	0.33

ACSM *American Collage of Sports Medicine*
Values in bold indicate a significance of $p<0.05$

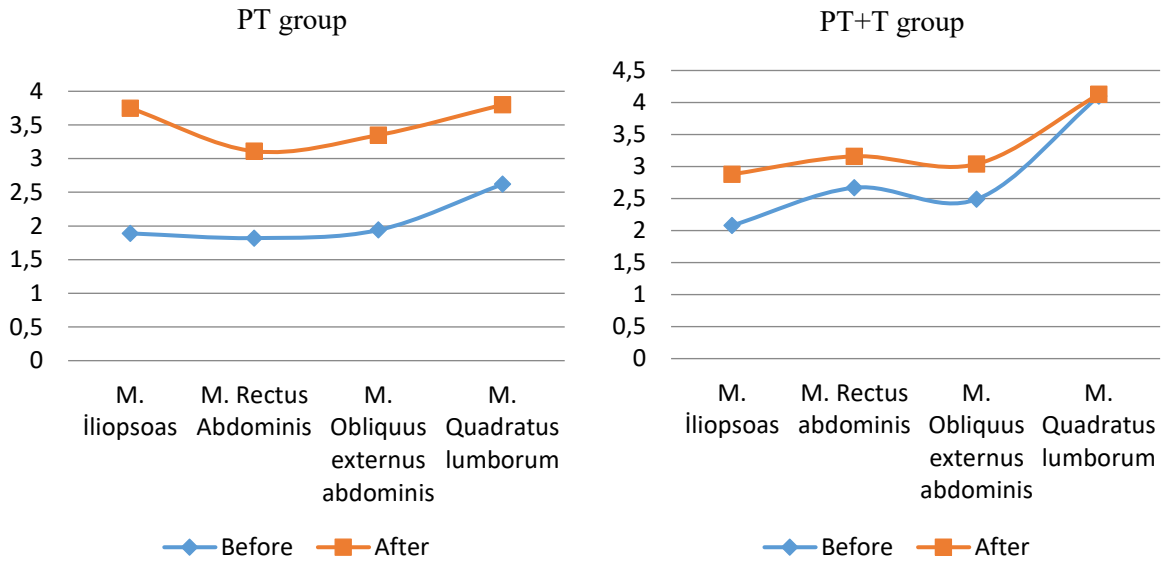

Figure 1: Pressure-Pain Threshold Values

An article on conservative management of spina bifida in children older than 5 years states that the treatment chosen should minimize the risk of constipation in patients with constipation due to bladder and bowel dysfunction [14]. Therefore, we tried to minimize constipation in our study and all the children with chronic constipation who participated in our study had bladder dysfunction (overactive neuropathic bladder). According to the literature, one of these methods is to provide conscious and correct bowel movements by training the pelvic floor muscles [15]. The aim of our study was to enable children with myelomeningocele to consciously urinate and defecate by sensing the pelvic floor muscles through correct diaphragmatic breathing. For this purpose, these children were toilet trained by our study's physiotherapist. Regular voiding and bowel movements were managed through this training. In an evaluation of this education, the Childhood Bladder and Bowel Dysfunction Questionnaire (CBBDQ), which asks about both bladder and bowel problems, was used to draw parents' attention to the relationship between bladder and bowel problems. Although the CBBDQ questionnaire has not been used in patients with spina bifida before, the questionnaire can be confidently used in clinical practice to evaluate and quantify symptoms of bladder and bowel dysfunction in pediatric patients [16]. As a result of our study, although improvement was observed in both groups according to CBBDQ values, greater improvement was observed in the PT group.

We observed that parents in the PT+T TENS group were more interested in TENS than physical therapy techniques; therefore, toilet training and other manual techniques, which we recommended in our treatment approach, remained in the background. The reason parents in the PT+T group were more interested in TENS might be that it was applied to the sacral region. This may have caused the PT+T group to benefit less from our treatment according to the PAC-SYM and CBBDQ questionnaires. However, according to the results of our study, physical therapy has positive effects on constipation with or without TENS; therefore, the treatment method can be determined according to the preference of the patient and/or therapist.

Pediatric gastroenterologists and surgeons have reported that chronic constipation seen in patients with spina bifida may lead to fecal incontinence and therefore should be included in the bowel management program from the age of 5 years [14]. In our study, a decrease was observed in the severity of fecal incontinence along with a decrease in constipation symptoms 8 children in PT group and 10 children

in PT+T group. However, improvement and initial status were greater in the PT group. If there were no differences between the groups, different results would have been obtained.

The severity of fecal incontinence that we assessed using FISI included symptoms of gas, mucus, liquid and solid fecal incontinence. According to our experience, gas accumulation in the abdomen and intestines is one of the symptom that patients often suffer from. In our study, we observed that abdominal massage and strengthening exercises of the abdominal muscles increased gas output in both groups.

Brochard et al. stated that appropriate management strategies for bowel problems in adults with spina bifida, revealed that 85% of patients, regardless of their neurological level, had a negative impact on their quality of life due to chronic constipation [7]. The results of our study showed that, the quality of life improved in both groups (50% PT group; 42.8% PT+T group). Although there are different quality of life questionnaires for children with SB in different age groups in the literature, common questionnaires have also been administered for 5-21 years [5], 3-12 years [17]. The quality of life questions evaluated with the PAC-QOL in our study may have been insufficient to question the emotional states and symptoms of children. According to our clinical observations, there may also be a possibility that the answers given in the children's questionnaire about embarrassment are not correct. The results of our study would have been more impressive if there had been a questionnaire on children's changing cognitive capacity, reading skills and emotional development in our language. Nonetheless, satisfaction with our treatment approach was high in both groups without difference, based on responses to the last 4 questions of this questionnaire, which questioned their satisfaction with toileting patterns and received treatments.

Ashrafi et al. stated that MTrPs can negatively affect the muscle function in area that assist with bowel movements in patients with chronic constipation compared to healthy people [3]. Therefore, in our study, ischemic compression was applied to the MTrPs found in the abdominal muscles that support defecation. It was observed that these muscles had an increase in ppt as assessed after treatment and a reduction in the total number of MTrPs in both groups. The reduction in the number of MTrPs may have enabled the muscles to maintain normal function, and consequently, improvement in constipation-related symptoms in both groups.

Although the number of MTrPs decreased in both groups, an increase in ppt was observed only in the PT group. In the PT+T group, TENS had no advantage over the threshold of the abdominal trigger points. There were no significant differences between the groups before and after treatment. It is considered that the ppt of the PT+T group of cases may be lower. In response, it is stated in the literature that TENS may vary depending on whether the area where the ppt is measured is the most painful and the parameters of TENS [18].

According to the results of a study on healthy volunteers by Çelik D and Yeldan İ in 2011, it was observed that those with MTrPs had lower muscle strength than those without [19]. In our study, manual muscle testing was performed on the innervated muscles according to the neurological level of the patients, and it was observed that the ppt of the rectus abdominis and external oblique abdominis muscles increased in PT group the PT group while this benefit was not observed in the PT+T group. Although there was no statistical difference in ppt values between the groups, the difference between the two groups in this regard is thought to be due to the increased muscle strength of patients in the PT group, who had an increased ppt for pain. This suggests that the reduction in pain due to applying pressure to the MTrPs has a positive effect on muscle function. In addition, pediatric gastroenterologists or surgeons are frequently present in the region for surgical procedures to ensure continence, improve quality of life, and for emergency reasons [20]. Therefore, destruction of these muscles occurs through surgical

incision. This can negatively affect the function of muscles in the abdominal and groin areas, increasing the risk of chronic constipation**.**

These findings show that PT and TENS can be used to treat myelomeningocele with chronic constipation.

4 Conclusions

Chronic constipation is common in patients with myelomeningoceles. In general, only TENS and physiotherapy techniques have been studied. Our study is the first randomized trial in which TENS was added to the physiotherapy methods. As a result of this study, the physical therapy approaches included manual abdominal massage, ischemic compression of trigger points, breathing exercises, rib mobilization, sensory stimulation of the gluteus maximus and rectus abdominis muscles, and strengthening exercises of the "core" area muscle techniques, is effective on the symptoms of chronic constipation, severity of fecal incontinence, quality of life and the number of myofascial trigger points. In addition, TENS is effective on stool form, TENS has no superior effect on symptoms of chronic constipation, severity of fecal incontinence, or bladder-bowel dysfunction, we believe that TENS may have a potential effect with physical therapy.

5 Declarations

5.1 Study Limitations

All questionnaires were filled in by the families by asking 4 illiterate children in the PT group and 5 illiterate children in the PT+T group.

Secondly, our study should be carried out in difficult conditions and with hygiene measures due to the COVID pandemic.

5.2 Acknowledgements

There is no person or institution contributing to this research other than the authors.

5.3 Funding source

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5.4 Competing Interests

There is no conflict of interest in this study.

5.5 Authors' Contributions

Corresponding Author Özge ÖZDEMİR AYLA: Developing ideas for the research and article, planning the materials and methods to reach the results, taking responsibility for the experiments, organizing and reporting the data, taking responsibility for the explanation and presentation of the results, taking responsibility for the literature review during the research, taking responsibility for the creation of the entire manuscript or the main part.

Gönül ACAR: Developing hypotheses for the research and article, taking responsibility for the creation of the entire manuscript or the main part, reworking not only in terms of spelling and grammar but also intellectual content or other contributions

Şeyhmus Kerem ÖZEL: Planning the materials and methods to reach the results, taking responsibility for the experiments, organizing and reporting the data.

Emine ATICI: Taking responsibility for the literature review during the research, taking responsibility for the creation of the entire manuscript or the main part, reworking not only in terms of spelling and grammar but also intellectual content or other contributions.

6 Human and Animal Related Study

6.1 Ethical Approval

The ethics committee for this study was approved by the Clinical Research Ethics Committee of the Marmara University Faculty of Medicine (protocol number 09.2020.07).

6.2 Informed Consent

Informed consent form was obtained from all participants for the study that they agreed to participate in the study.

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