



The role of physical therapy in the treatment of children with chronic functional constipation

Uloga fizikalne terapije u lečenju dece sa hroničnom funkcionalnom opstipacijom

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Introduction

Constipation is the most common functional defecation disorder affecting up to 29.6% of children with the equal prevalence in both sexes^{1, 2}. In more than 90% of the children, it is functional disorder which means that it is not caused by an organic disease such as Hirschsprung's disease, neurological disorders, spinal and anal congenital abnormalities, inflammatory bowel disease, allergy, metabolic and endocrine diseases³. The diagnosis of functional constipation is made according to the Rome III criteria in a 4 year old child⁴. A child must experience at least 2 of the following features during the last 8 weeks: 2 or fewer defecations per week, more than one episode of fecal incontinence weekly, large stool in rectum palpable by rectal or abdominal examination, history of painful defecations, with holding behavior and occasional passing of large stools⁴. These criteria are also included in the recently published Rome IV criteria⁵. The duration of symptoms is one month instead of two months⁵.

By measuring colonic transit time, 2 different types of chronic functional constipation have been identified in children: slow-transit (ST) constipation and functional fecal retention (FFR)⁶. Children with ST constipation have delayed motility in the proximal and transverse colon, in contrast to FFR, where the hold-up is in the rectum and sigmoid colon. Although the children complain of similar symptoms in both types (decreased defecation frequency, fecal incontinence, abdominal pain), their treatment involve different protocols.

Regardless of the types, the management of chronic constipation in children is based on prescribing laxatives and behavioral approaches. Long-term follow-up studies have shown that the cure rates were 50% despite this treatment⁷. Since children with FFR have contractions of the pelvic floor muscles (PFMs) or inability to relax them during defecation, physiotherapy was introduced⁸.

Physical agents have mechanical and neurological effect on the colon function. Mechanical effect is reflected in stimulating peristalsis, improving fecal propulsion and tone of the abdominal muscles⁹. Neurological effects include stimulation of the parasympathetic nervous system to increase colonic motility and sympathetic stimulation, which leads to a reduction of anxiety and an increase of endogenous serotonin¹⁰.

However, few studies have investigated the role of physiotherapy in the treatment of children with chronic functional constipation. Therefore, the aim of this review was to analyze the effects of physiotherapy interventions in childhood constipation.

Slow-transit constipation

ST constipation was first described in children with severe constipation resistant to the standard treatment, and it is now regarded as a specific disorder of colonic motility⁶. It is associated with the deficiency of substance P or vasoactive intestinal peptide in the enteric nervous system and abnormalities of the interstitial cells of Cajal¹⁰. The symptoms oc-

cur early in infancy and stools are not so hard despite the long intervals between the bowel movements¹¹.

In these children constipation can be unrecognized, as fecal mass can not be identified on digital rectal or ultrasound examination¹². Additional diagnostic procedures such as radiopaque marker studies or colonic scintigraphy may identify transit delay at the proximal and transverse colon⁶.

Children with ST constipation respond poorly to laxatives, dietary and behavioral modifications, and toilet training. They may benefit from other treatments, such as interferential current therapy, and even surgical intervention including appendicostomy for antegrade continence enemas, colostomy, or colectomy¹³.

Interferential current therapy

Interferential current therapy (IFT) utilizes two medium frequency currents which pass through the tissues simultaneously and their paths interfere with each other. At the cross-over point within the tissues, this interaction gives rise to an interference current (or beat frequency), which has the characteristics of low frequency stimulation.

IFT has been used in the treatment of chronic treatment-resistant constipation and fecal incontinence in children¹³. Two electrodes, one from each channel, were placed on the anterior abdominal wall below the costal margin of the child. The other two electrodes were placed paraspinally over the muscles between T9 and L2. IFT was administered using a carrier frequency of 4 kHz and a beat frequency sweep covering 80–120 Hz, for 20–30 min, 3 times weekly, during 4 weeks. In 7/8 children fecal incontinence disappeared, while the frequency of spontaneous defecations increased in 5/8 patients.

In the study of Yik et al.¹⁴, it has been shown that IFT had superior effect in decreasing colonic transit time over placebo. In a randomized controlled study, 46 children were assigned to active or sham IFT during the first month of treatment (12 procedures). After 8 weeks, during a second month of treatment, all children received 12 active IFT. After the first month of treatment, transit speed was only increased in children who received active stimulation. After the second month of stimulation the number of responders treated with sham IFT in the first month was significantly increased after active stimulation.

Clarke et al.¹⁵ investigated the quality of life in children with ST constipation before and after IFT. After a short treatment period (12 sessions for 4 weeks) of IFT, there was a significant improvement in a child self perceived quality of life.

Although the mechanism of IFT action is not fully understood, it can be attributed to activation of the sensory nerves in the skin, spinal nerves (sensory and motor T9-L2), sympathetic and parasympathetic nerves to the intestine, enteric nerves, pacemaker cells (interstitial cells of Cajal) or smooth muscle cells in the intestinal wall¹². Also, IFT increased frequency of colonic propagating sequences and colonic motor activity on waking and after meals 2–7 months after stimulation¹⁶.

Leong et al.¹⁷ investigated long-term effects of IFT. IFT was applied in 39 children for 1–2 months. The proce-

dures was continued in 15 children for additional 2 months at home. The results were evaluated after a mean follow-up period of 3.5 years. Improvement in clinical symptoms occurred in 67% of children. They reported improved rectal sensory perception and feeling the urge to defecate. Besides, fecal incontinence and laxative use decreased. These positive effects lasted more than 2 years in 33% of patients. Symptoms recurred after 6 months in 25% to 33% of children.

Functional fecal retention

The most common etiology factor is stool-with holding behavior. Changes in habits or diet, stressful events, the unavailability of toilets or delaying defecation due to lack of interest or attention, lead to stool retention. As a result of delayed defecation, rectal mucosa absorbs water from the fecal mass which becomes progressively hard and voluminous. There is a "vicious circle" in which the rectum significantly expands, resulting in the development of fecal incontinence, the loss of rectal sensation and, ultimately, loss of normal urge to defecate¹⁸. Besides, stool retention in the rectum provokes prolonged external anal sphincter contraction which causes pelvic floor non-relaxation during defecation¹⁸.

In children with FFR, standard medical treatment involve education, disimpaction, prevention of reaccumulation and follow-up¹⁸.

Education and behavioral modifications

Education about the normal bowel and anorectal function and constipation highlights importance of high-fiber diet, regular fluid intake and genital hygiene. Behavioral interventions include toilet training. Children are recommended to defecate regularly, to go to the toilet after major meals 3 times daily, to sit on a toilet seat for 5–10 minutes and try to defecate. An optimal defecation posture include an upright and forward leaning sitting position¹⁹. This position facilitates defecation by lengthening the anal aperture and widening the anorectal angle¹⁹.

Disimpaction

Rectal fecal impaction is present in up to 30% of children with chronic functional constipation. Fecal disimpaction can be accomplished by oral and rectal agents. Children tolerated well rectal enemas for 3–6 days without any side effects. Polyethylene glycol was administered orally during 3–6 days, and disimpaction occurred in up to 92% of the patients^{20,21}.

Maintenance treatment

In order to prevent recurrent fecal impaction, oral laxatives in combination with behavioral modifications are prescribed over long periods. However, only 60% of children were treated successfully at 1 year follow-up. A third of the children continued to be constipated beyond puberty and a fourth in adulthood¹⁸.

Physiotherapy interventions

The normal function of the PFMs is essential for the establishment of normal function of the bowel. The muscles of the pelvic floor are part of the abdominal capsule that surrounds the abdominal and pelvic organs²². The structures that form this capsule are the diaphragm, lower abdominal muscles and PFMs. These muscles act synergistically²³. Their relaxation is essential during defecation. Otherwise, their contraction during defecation leads to the development of constipation.

More than 50% of children with FFR have abnormal defecation¹¹. They contract the external anal sphincter and *musculus puborectalis* during defecation¹¹. This form of abnormal defecation is considered to be learned resulting from the habit of delaying defecations.

Physical therapy starts with the education and behavioral interventions including an adequate position during defecation, diaphragmatic breathing exercises, pelvic floor exercises with or without biofeedback, in order to educate a child to relax the external anal sphincter and the PFMs during defecation. In refractory cases, even botulinum toxin injections are administered into the external anal sphincter²⁴.

Diaphragmatic breathing exercises

Diaphragmatic breathing exercises (DBE) are applied in order to teach children the abdominal and PFMs relaxation. During defecation, it is important that the lower abdominal muscles (*m. transversus abdominis* and *m. obliquus internus abdominis*) and the PFMs are relaxed as they act synergistically²². In diaphragmatic breathing, during inspiration, the diaphragm moves caudally and the abdominal organs are pushed forward. The anterior abdominal wall bulges outward and relaxes. It has been shown that this action improves defecation²³. Holding the abdomen in the bulged position increases intraabdominal pressure without an increase in external anal sphincter activity²².

In the study of Zivkovic et al.²⁵, children with voiding dysfunction and chronic constipation were assigned DBE and PFM retraining. DBE were practiced in supine, both side lying and sitting positions in front of the mirror. Children were watching the anterior abdominal wall bulging during inspiration and they were asked to repeat the same exercise on the toilet seat and try to initiate defecation. These exercise were practiced at the clinic for 2 weeks, and then were continued daily at home for 6 months. After 6 months follow-up period, constipation was cured in all the patients.

Silva and Motta⁹ combined DBEs with abdominal muscle training, abdominal massage and laxatives in the treatment of children with chronic functional constipation. The children had 12 individual sessions (2 weekly) at the hospital. The results were compared with the patients who had only laxatives. After 6 weeks of the therapy, the frequency of bowel movements was significantly higher in the physiotherapy group compared to children treated with laxatives only.

Pelvic floor exercises and biofeedback

The aim of the pelvic floor exercises is to increase children's awareness of their PFM function. Children are thought to contract and relax the PFMs at will. To improve the voluntary control of the PFMs, pelvic floor exercises are usually combined with biofeedback. It can be tactile (palpation of the pelvic floor or *m. transversus abdominis*), electromyography (EMG), and anorectal manometry. During EMG biofeedback, anal or perineal probe electrodes are used for the registration of muscle activity of the pelvic floor. It is displayed in the form of the curve which a child can watch on the monitor of a device. During PFM contraction, the curve is rising, while in the relaxation it is descending. In this way, by watching, a child is aware of the degree of contraction or relaxation of the PFMs.

The significance of biofeedback training in constipated children remains controversial. Some studies have reported positive effects of biofeedback and the success was attributed to restoration of normal defecation pattern²⁶⁻²⁸. In the study of Kajbafzadeh et al.²⁶, children with chronic constipation and/or fecal incontinence and voiding dysfunction were assigned pelvic floor exercises and biofeedback using animated computer games. The exercises consisted of 10 seconds contractions followed by 30 seconds relaxation period. Biofeedback therapy was performed twice weekly. All the children with fecal incontinence and 68% of patients with constipation were symptom-free within 6 months and 1 year after treatment.

Manometry biofeedback attempts to improve rectal sensory perception. Sensory training involves inducing intrarectal pressure using a balloon feedback device. A manometric balloon probe is inserted into the rectum, and the balloon is inflated with air to simulate the presence of feces. Defecation dynamics is studied by observing the ability of a child to expel the intrarectal balloon. A child is asked to contract the abdominal muscles and to relax the pelvic floor during an attempt to expel the balloon. A normal response occurred when the anal sphincter pressure decreased during straining. A paradoxical anal response was characterized by increased anal sphincter pressure during the defecation maneuver. In the study of van der Plas et al.²⁹, additional training using manometry did not result in higher success rates compared to conventional therapy in chronically constipated children. Similar results were obtained in the study of van Ginkel et al.³⁰.

In the recently published study, effectiveness of the pelvic physiotherapy was compared with standard medical care in children with functional constipation⁸. Pelvic physiotherapy included balance and stability exercises, abdominal breathing, and PFM exercises. Myofeedback and rectal balloon training were assigned only in the children with dysfunctional PFMs. The treatment period lasted 6 months, and children had maximum 6 sessions. The treatment was effective in 92% of children treated with physical therapy compared to 63% of children who received standard medical care. Also, in the first group, more children stopped using laxatives.

Zivkovic et al.³¹ combined IFT with DBEs and behavioral modifications in the treatment of children with chronic constipation and bladder dysfunction who failed primary ca-

re interventions. Children were divided into 3 groups. Group A underwent IFT with DBE and behavioral modifications. Group B had DBE and behavioral modifications, while group C received only behavioral modifications. IFT was administered to the abdomen, 20 min, five times weekly, during two weeks at the clinic, using a carrier frequency of 4 kHz, and a beat frequency sweep covering 80–120 Hz. DBE were practiced for 2 weeks at the clinic, and were continued at home for 1 month. After 6 weeks of the treatment, the results were compared among the groups. Significant improvement in defecation frequency and fecal incontinence was noticed only in the patients with the additional IFT.

Abdominal massage

Abdominal massage is performed using clockwise movements over the abdomen, starting from the ascending colon and moving toward the sigmoid colon. The positive effects include increase in intraabdominal pressure and rectal loading, stimulation of colonic movements, reduction of constipation symptoms and pain⁹.

Conclusion

Chronic constipation is a common, frustrating and time consuming problem in childhood. Despite the standard medical treatment, 50% of children continued to be constipated after a five-year follow-up. Since dysfunction of the PFMs is the major reason for FFR in children, physiotherapy interventions might play an important role to increase the success rate. They include diaphragmatic breathing, pelvic floor exercises with or without biofeedback to teach children awareness, proper muscle function and relaxation during defecation. Although the mechanism of interferential current action is not completely understood, positive effects include increase in defecation frequency, improvement in rectal sensory perception, reduction in fecal incontinence and abdominal pain. As these effects might last up to 2 years, interferential currents are considered to be effective modality in the management of chronic functional constipation in children.

New, randomized, controlled clinical trials are needed to confirm the promising role of physical modalities in the treatment of constipated pediatric patients.

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