

The Stimulation of Polymodal Sensory Perception by Skarżyński (SPPS-S): comparison of stationary and remote therapy results

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Abstract

Hearing is a sense, which has a significant impact on a child's development. Disorders connected with hearing can have impact in a various form and affect each area of life. Hearing disorders may concern peripheral auditory system as well as its parts responsible for central processing. It is estimated that central auditory processing disorders in its isolated form concern 2-3% of the population of school-age children, however, the problem co-occurring with other disorders may affect even several dozen percents of children. According to the available recommendations, there are three main therapeutic approaches in the treatment of patients with auditory processing disorders: transforming the school environment, teaching the child strategies how to compensate his or her difficulties or using hearing trainings focused on a specific deficit.

The main aim of the study is to present the results of SPPS-S therapy dedicated to patients with central auditory processing disorders who have completed the remote version of the method in comparison with patients performing therapy in a rehabilitation center.

The Stimulation of Polymodal Sensory Perception by Skarżyński (original name in polish SPPS-S) is a treatment applicable for many different groups of disorders showing comorbidity with central auditory processing disorders. Solutions present in SPPS-S offer multifaceted therapy activating different perceptual modalities (hearing, vision and touch) at the same time, as well as their integration and coordination. Patient may receive the SPPS-S therapy either in the rehabilitation center or at home.

The material used to assess the effectiveness of SPPS-S-based therapy included the results of 100 patients who received remote SPPS-S therapy compared to the results of 100 patients who performed therapy at a specialized center.

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Statistical analysis of the results obtained, which showed that the therapy used resulted in a statistically significant improvement in all auditory functions studied. Results confirm the high effectiveness of The Stimulation of Polymodal Sensory Perception by Skarżyński, both in stationary and remotely implemented form. The quality of telerehabilitation interventions was maintained at the same level as in therapeutic work at the therapeutic center, which was confirmed by the results of patients. Remote SPPS-S therapy as an effective telerehabilitation method has become an effective form of supporting patients in their own homes.

Keywords: audiology, rehabilitation

Introduction

The sense organs connect people to the outside world. Thanks to them, we have direct contact with the environment. We perceive the incoming stimuli and then analyze them. The hearing organ significantly influences human communication with the environment. Abnormalities within its structure and function, occurring mainly in childhood, may result in difficulties in speech acquisition or cognitive function development and consequently translate into problems in practically all areas of life [1]. Hearing is a sense, which has a significant impact on a child's development. Hearing disorders may concern peripheral auditory system as well as its parts responsible for central processing. It is estimated that central auditory processing disorders in its isolated form concern 2–3% of the population of school-age children, however, the problem co-occurring with other disorders may affect even several dozen percents of children [2–7]. Due to its specificity, a broad group of specialists deal with central auditory processing disorders, including a physician, speech therapist, pedagogue, and psychologist [8,9]. The diagnosis is made by an audiologist or otorhinolaryngologist, and the rehabilitation process of a patient, depending on needs, includes work with various specialists.

Many authors discuss the diagnostics and effectiveness of various rehabilitation interventions for the above-mentioned group of patients and in various disorders co-occurring with central auditory processing disorders [10,11]. They demonstrate significant effectiveness of rehabilitation actions both in terms of the leading disorder, e.g. reduction in the degree of stuttering and improvement of central auditory processing [10].

According to the available recommendations, there are three main therapeutic approaches in the treatment of patients with auditory processing disorders: transforming the school environment, teaching the child strategies how to compensate his or her difficulties or using hearing trainings focused on a specific deficit [11–13].

Aim

The main aim of the study is to present the results of SPPS-S therapy dedicated to patients with central auditory processing disorders who have completed the remote version of the method in comparison with patients performing therapy in a rehabilitation center.

Material and methods

The Stimulation of Polymodal Sensory Perception by Skarżyński (original name in Polish SPPS-S) is a treatment applicable for many different groups of disorders showing comorbidity with central auditory processing disorders. Solutions present in SPPS-S offer multifaceted therapy activating different perceptual modalities (hearing, vision and touch) at the same time, as well as their integration and coordination. Patient may receive the SPPS-S therapy either in the rehabilitation center or at home. SPPS-S is carried out using an innovative device used to conduct multi-sensory therapy. In its miniature form (Figure 1), it contains a number of modern technological solutions, thanks to which the auditory training conducted on the device is rich in a number of modern solutions in the field of sound modification, including various types of filtrations, separation of the air and bone path, as well as changes in intensity and duration sounds. The first stage is medical consultation, where an interview with the parent/caregiver is conducted. Next, the patient is referred for audiometry, impedance examination, tests evaluating

central auditory processing, the Auditory Attention and Lateralization Test to assess auditory attention and psychological and pedagogical consultation. After analyzing the results, the patient is qualified for auditory training when their evaluation indicates auditory attention difficulties and auditory processing difficulties.

Therapy is developed for six groups of patients with: delayed speech development; articulation disorders; deficit attention; difficulties in reading and writing; voice disorders; stutter co-occurrences with central auditory processing disorders. The figures below show the scheme of operation (Fig. 2) and stages of SPPS-S therapy (Fig. 3). SPPS-S therapy consists of several stages. After performing thorough diagnostics, the therapist locates all the obtained data to the SPPS Panel. Then the therapist programs the SPPS set, which is afterwards used by the patient in order to undergo the therapy. The SPPS set includes headphones for air and bone conduction with a built-in microphone, an SPPS adapter that modifies sounds used in therapy, and an iPad for multimedia and psycho-educational games.



Figure 1. SPPS-S device.

The therapy usually consists of 3 levels, each lasting from 5 to 15 days. Each day there are therapy sessions that last 2-3 hours and consist of three parts: passive listening of specially modified sounds, relaxation, multimedia, and psycho-educational games, and working with a microphone. The passive part does not require the active participation of the patient. It consists in listening to the processed sound material. The middle ear muscles, perceptual-motor process, auditory attention, and lateralization are stimulated. During this part of the therapy patients can play e.g., stack blocks, draw, paint or play board games.

The active part includes stimulation and attention, concentration, and auditory-visual, auditory-motor and auditory-visual-motor coordination. Various human senses (hearing, vision, touch, balance, proprioception) and cognitive and language processes are involved in specially designed games. SPPS therapy can be carried out in a therapeutic facility or at the patient's home. The choice depends on the patient's ability, individual needs, or the economic and organizational aspects. It is convenient for the patient to rent the equipment and use it at home without coming to the center every day.

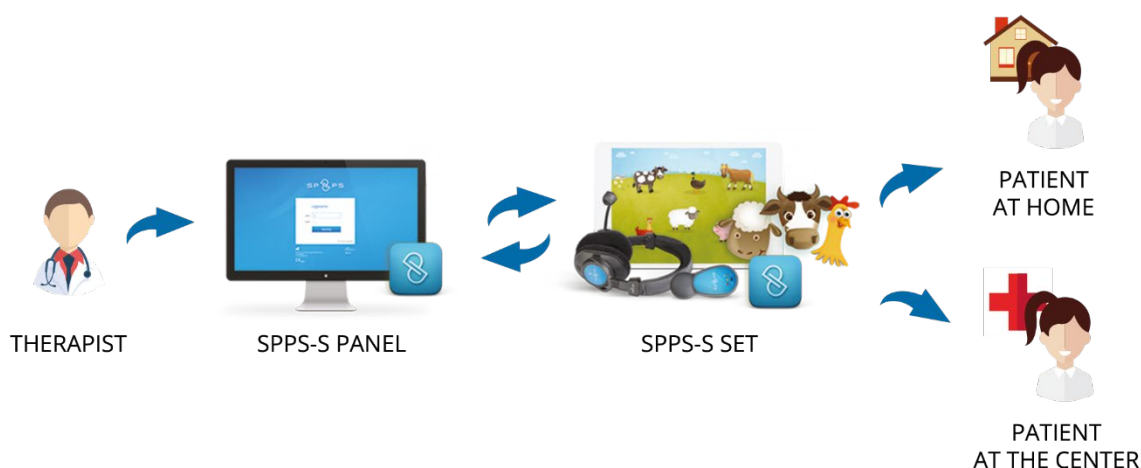


Figure 2. Scheme of work of SPPS-S.

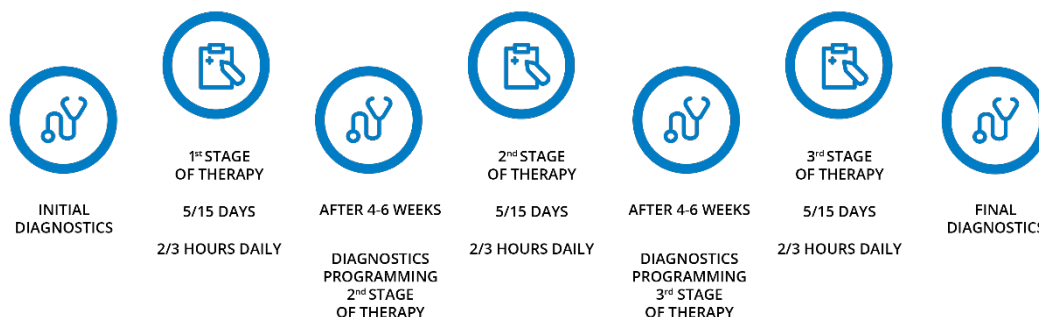


Figure 3. Stages of SPPS-S therapy.

The material used to assess the effectiveness of SPSS-S-based therapy included the results of 100 patients who received remote SPSS-S therapy compared to the results of 100 patients who performed therapy at a specialized center (Table 1.) The study was conducted retrospectively, and patients' data was completely anonymized.

Results

According to the diagnostic and rehabilitation scheme, all subjects in the study group had tests

to evaluate auditory processing within the framework of the ongoing rehabilitation. The following tests were performed to evaluate auditory processing before initiation of therapy and at the end of therapy: Frequency Pattern Test (FPT) test for differentiating tone sequences that differ in frequency [14], Duration Pattern Test (DPT) test for differentiating tone sequences that differ in duration [15], Dichotic Digit Test (DDT) a digital test of split-ear hearing with attention directed to the right and left ear and binaurally[6,16,17].

Table 1. Number of patients performed therapy.

		Stationary version (n = 100)	Remote version (n = 100)
Gender	Boys	60	65
	Girls	40	35
Age	Min–Max	5–15	5–16
	M (SD)	10.1 (2.3)	9.2 (2.2)

Table 2. Comparison of patient results from the stationary and remote version of SPSS-S therapy.

		Before therapy		After therapy				
		M	SD	M	SD	W	p	ES
Stationary version (n = 100)	FPT	37.58	23.71	57.45	26.15	8.56	<0.001	1.44
	DPT	46.90	27.49	67.58	25.48	8.46	<0.001	1.50
	DDT_RE	72.67	16.27	84.35	10.22	7.18	<0.001	0.95
	DDT_LE	52.50	18.60	68.50	15.38	8.07	<0.001	1.31
Remote version (n = 100)	FPT	30.57	21.64	55.00	23.76	8.69	<0.001	1.96
	DPT	38.63	27.56	65.35	26.05	8.56	<0.001	1.53
	DDT_RE	66.68	16.76	79.18	11.72	7.47	<0.001	0.94
	DDT_LE	51.78	17.79	68.33	12.87	8.30	<0.001	1.34

M – mean; SD-standard deviation, W-Wilcoxon test for paired samples, ES – effect size.

Statistical analysis of the results obtained, which showed that the therapy used resulted in a statistically significant improvement in all auditory functions studied. A treatment effect evaluation study (in Table 2. ES) above 0.8 shows that the effect was very high in both versions.

Conclusion

According to Katz [18] a central auditory disorder is the inability to fully use an audible acoustic signal while receiving it correctly in peripheral structures. Difficulties resulting from this condition may affect every sphere of life. Therefore, it is essential to undertake appropriate diagnostic and rehabilitation actions as soon as possible. Patients in Poland and worldwide are diagnosed and rehabilitated differently [11].

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Results confirm the high effectiveness of The Stimulation of Polymodal Sensory Perception by Skarżyński, both in stationary and remotely implemented form. The quality of telerehabilitation interventions was maintained at the same level as in therapeutic work at the therapeutic center, which was confirmed by the results of patients. Remote SPPS-S therapy as an effective telerehabilitation method has become an effective form of supporting patients in their own homes. Telemedicine, including telerehabilitation, can bring the same effects as stationary interactions, and even bring additional benefits.

Conflict of interest statement

The authors declare no conflict of interest.

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