CASE REPORT

The Effects of Sensory Stimulatory Treatment on an Autistic Child

Marjorie K. McClure,
Michele Holtz-Yotz

Key Words: deep pressure and tactile sensation • modalities, occupational therapy • splints • statistics

Marjorie K. McClure, OTR/L, is an Occupational Therapist, Washington Hospital, Washington, Pennsylvania 15301. At the time of this study she was employed at Allegheny Neuropsychiatric Institute, Oakdale, Pennsylvania. She is also a Private Practitioner with Becoming Independent Thru O.T., Mt. Lebanon, Pennsylvania, in which she treats children with autism.

Michele Holtz-Yotz, OTR/L, is Occupational Therapy Supervisor, Allegheny Neuropsychiatric Institute, Oakdale, Pennsylvania.

This article was accepted for publication October 1, 1990.

Occupational therapy has greatly increased the medical profession's awareness of sensory input and its effect on motor output, based on the foundation provided by Rood (McCormack, 1990; Trombly, 1989) and Ayres (1973, 1985). From her personal experience, Grandin (1986) offered a unique perspective on the importance of deep pressure and tactile input for their calming effects on persons with autism. Her ability to communicate her needs and feelings has been remarkable and insightful. Unfortunately, many autistic persons are unable to express their functional needs and motivations clearly, thus leaving us to rely on our observational skills and the desires and needs of the family members and other caregivers.

The treatment in the present case report is based on the following neurophysiological principles of Rood (as cited by Huss, 1983):

1. Motor output is dependent upon sensory input. Thus sensory stimuli are utilized to activate and/or inhibit motor responses.
2. Since there is interaction within the nervous system between somatic, psychic, and autonomic functions, stimuli can be used to influence one or more directly or indirectly. (p. 116)

This case report involved the sensorimotor effect of deep pressure and tactile input on Bob, a 13-year-old nonverbal autistic boy with severe mental retardation, who was admitted to our psychiatric inpatient facility for evaluation and treatment following severe self-injurious behavior, including pinching, biting, and rubbing of his head, neck, trunk, and upper and lower extremities.

Background

Bob's early developmental history included behavioral problems at home dating back to the age of 2 years. Tests when he was 2.8 years old revealed significant delayed development in all areas. Bob's history included five psychiatric hospitalizations for treatment of stereotypic behaviors. He had been receiving home instruction from his school district for the past 2 academic years due to aggression and self-mutilation. Before admission to our facility, Bob's self-injurious behavior jeopardized his personal safety, and staff at his former facility had expressed concern for his management. He was thus admitted to our facility for evaluation and treatment. At the time of his admission, he had coin-shaped skin excoriations that had ulcerated and become superficially infected on the left side of his neck. He had multiple wounds on his hands, arms, and shoulders and ecchymotic regions on his thighs. He exhibited almost continuous self-injurious and self-stimulatory behaviors, including rumination, trichotillomania, and vigorous masturbation.

Treatment

Because of Bob's severe self-injurious behavior, the physician ordered bilateral elbow splints to be fabricated by the occupational therapist (the first author) to inhibit the patient from reaching his head, neck, chest, and upper extremity areas. The splints were to be worn during waking hours except during bathing, feeding, and exercise. These cylindrical elbow splints (see Figure 1), which Bob began wearing on Day 1 of his hospitalization, were made from low-temperature thermoplastic material. The splints were padded with 2 in. (5.08 cm) wide foam strips at the open ends and lined with stockinette material taped to the outside of the splint to ensure that the patient would not develop pressure sores from his self-stimulatory upper body rocking movements. The end pads also helped to hold the splints in position without restricting circulation. A short-sleeved shirt was taped to the outside of the splints at the sleeve area to help hold the splints in position. The splints limited elbow flexion to 10° and provided tactile input and deep pressure to the upper arm and to the forearm above the wrist. The occupational therapist and nursing staff provided passive range of motion to the upper extremities 3 times per day to ensure continued complete joint excursion. Bob responded to the splinting regimen within 1 week of the beginning of treatment and made an intense effort to replace the splints when they were removed for passive range of motion exercises, bathing, or feeding.

On Day 22 of his hospitalization, Bob was fitted with less restrictive bilateral hinged elbow splints (see Figure 2) that were to be worn throughout the day. These splints increased Bob's active range of motion to 45° without allowing him sufficient range to reach his face, neck, and trunk areas. A piece of foam padding (16 in. [40.6 cm] × 17 in. [43.2 cm] × 3/16 in. [0.476 cm]) was wrapped around each arm before the splints were placed on his arms to ensure even pressure over the entire surface area and to

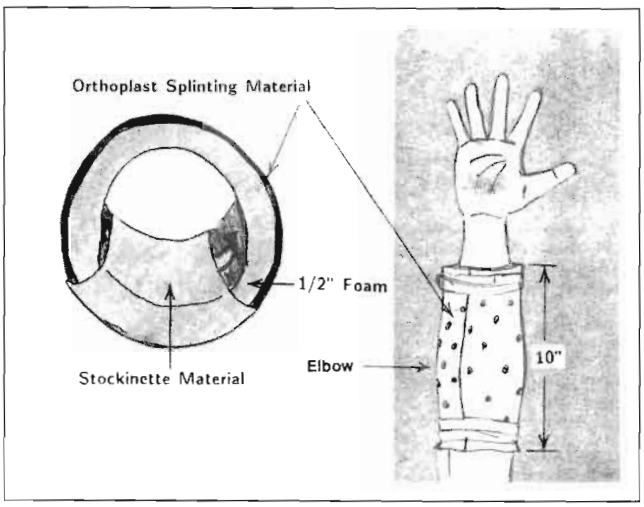

Figure 1. The cylindrical elbow splint.

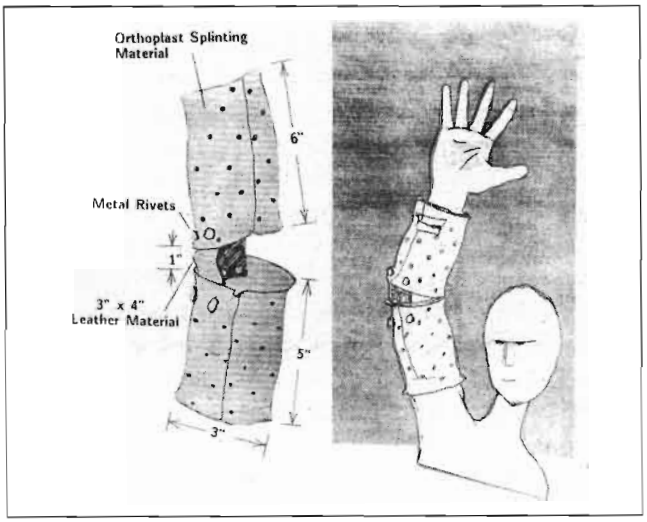

Figure 2. The cylindrical hinged elbow splint. *Note.* The patient's arm and forearm were wrapped with a cloth-covered foam pad (16 in. [40.6 cm] × 17 in. [43.2 cm] × 3/16 in. [0.476 cm]) before the splint was applied.

provide sufficient pressure to keep the splints in place without impairing circulation. The sleeves of a short-sleeved shirt were again taped to the outside of the splints for positioning purposes. These second splints were also worn throughout the day except during feeding, bathing, or exercise programs. Bob adapted well to these splints and wore them as prescribed. When the splints were removed, Bob continued to express extreme opposition to removal of the splints.

In the beginning of the hospitalization, the purpose of the splints had been to protect the patient from further self-mutilations. An unexpected finding was the improvement in his overall level of functioning. Bob was more cooperative with the nursing staff. He spent less time exhibiting self-stimulatory behaviors and more time interacting with those around him. It appeared that he had accepted the deep pressure and tactile input provided by the splints as a substitute for the self-injurious behavior and self-stimulatory input and that he was calmed by this treatment. Passive range of motion exercises were continued to ensure full joint excursion.

Bob's psychotropic medications were haloperidol (Day 1 to Day 95), fluoxetine hydrochloride (Day 40 to Day 95), lithium citrate (Day 1 to Day 50), and lithium carbonate (Day 50 to Day 95). He also received transcutaneous electrical nerve stimulation (TENS), which was applied by the neuropsychologist, physical therapist, and nursing staff during this hospitalization. The TENS was set in the acupuncture mode and applied with the positive electrodes next to the C-7 vertebra and the negative electrodes above that. This treatment is thought to stimulate the afferent A nerve fibers in the high-frequency mode and to release enkephalins in the low-frequency mode (Kasch, 1990).

On Day 25, Bob began treatment in the occupational therapy clinic, which included vestibular input and warm bath playtime options. A rocker board, used in the prone or sitting position, provided vestibular input. The warm bath provided tactile input as Bob or the therapist poured warm water from a cup to Bob's extremities and trunk. Self-injurious behavior in these bathing and vestibular input sessions remained absent to minimal throughout Bob's hospitalization. After these treatments, Bob appeared calmed, as evidenced by his facial expression, compliance with and attention to following directions, slowed body movements, absent to minimal self-injurious behavior, and decreased body rocking movements while dressing. These calming treatments appeared more helpful on days when Bob's overall self-injurious and self-stimulatory behaviors in his living unit had been more frequent. His behavior indicated that he had accepted the deep pressure, vestibular, and tactile inputs to replace the self-injurious behavior and self-stimulation inputs and that he was calmed by the treatments.

On Day 39 of Bob's hospitalization, the occupational therapist discontinued the splints due to their restrictive nature and because Bob's overall level of functioning continued to improve. As an alternative to wearing the restrictive splints, Bob was fitted with 2 in. (5.08 cm) thick foam pads (see Figure 3) to be worn over his forearms and arms to allow for functional active range of motion while protecting his arms and forearms from potential self-injury. These thick pads were worn on the same daily schedule as the splints, but, under supervision, Bob was allowed to don and doff them as he wished as long as he did not engage in self-mutilation. These pads were beneficial in that during waking hours, the patient received continual deep pressure and tactile input from 3 in. (7.62 cm) above the wrist to 3 in. (7.62 cm) below the shoulder and had functional use of his upper extremities. The pads were not worn in the daytime during feeding, dressing, or bathing. Bob readily accepted these pads as a substitute for the splints, donned and doffed them independently, and demonstrated a further decrease in self-injurious and self-stimulatory behaviors. He continued to increase the number of social interactions with others, including nonverbal communication to the staff that he wanted deep pressure and tickling to his upper extremity, trunk, and lower thigh areas. On Day 47 of his hospitalization, he was able to work creatively with plastic interlocking building blocks with an attention span of approximately 2 to 3 min, as compared with an attention span of approximately 30 sec in Week 2 of his hospitalization.

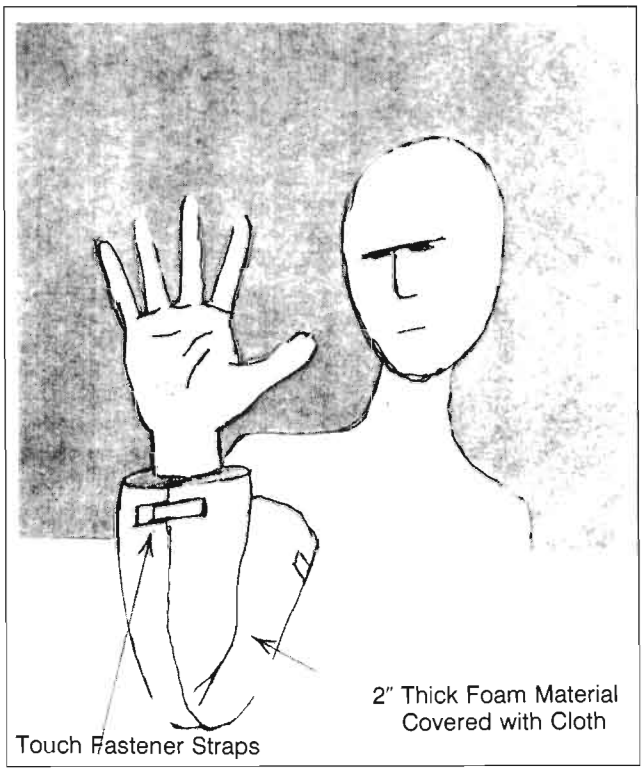

Figure 3. Foam pad to replace splint.

On Day 53 of Bob's hospitalization, the attending physician, who was attempting to evaluate discharge recommendations, ordered Bob's bilateral foam pads to be discontinued when Bob was not under the supervision of the occupational therapist. Bob responded by wrapping towels, bedding, and cloth around his arms, placing his arms between couch cushions and under his bed mattress, stuffing cloth inside the trunk and neck area of his shirt, and diving onto the couch from a standing position. Self-stimulatory behavior, self-injurious behavior, and aggression toward others increased, while appropriate interactions with others decreased. In an effort to decrease Bob's self-injurious behavior, nursing staff taped washcloths over his hands. The number of warm baths was increased during the day, and these continued to have a calming effect on Bob.

At this time, the occupational therapist initiated four observational sessions to evaluate the effect of deep pressure and tactile input on the patient's self-stimulation, self-injurious behavior, and ability to interact with others in his living unit. Each session was divided into three equal, consecutive time periods. The length of time of the three periods within a given session varied (see Table 1), due, in part, to the patient's self-injurious behavior, which limited the length of time that his hands were unwrapped. Subsequent wrapped and unwrapped periods were each the same length of time as the initial unwrapped period in each session. In Period 1, Bob wore no wrappings. In Period 2, his lower extremities or upper and lower extremities were wrapped with woven elastic bandages to provide deep pressure and tactile input. In Period 3, the wrappings were removed for evaluation of carryover effects. In each evaluation session, the occupational therapist observed the patient within the social milieu on his living unit. The number of times that Bob initiated self-stimulation, self-injurious behavior, and so-

Table 1
The Effect of Deep Pressure Wrapping on Number of Self-Stimulations (SS), Self-Injurious Behaviors (SIB), and Interactions with Others (INT)

Session	Day of Hospitalization	Time per period (in min)	Period 1 (No Wraps)			Period 2 (With Wraps)[a]			Period 3 (No Wraps)		
			SS	SIB	INT	SS	SIB	INT	SS	SIB	INT
1	68	25	89	2	3	24	0	7	31	0	15
2	74	20	39	0	0	21	0	4	17	0	7
3	75	10	16	9	0	8	0	5	13	0	3
4	82	15	28	0	9	26	0	8	20	0	6

[a]For Sessions 1 and 3, the patient's upper and lower extremities were wrapped with ace bandages. For Sessions 2 and 4, the patient's lower extremities were wrapped with ace bandages.

cial interactions with others were counted. Self-stimulatory behaviors included his attempts to receive vestibular, olfactory, gustatory, or tactile input. Self-injurious behavior included those self-stimulatory behaviors that resulted in bodily harm, including pinching, rubbing, or biting himself. Interaction with others was recorded as any time that Bob approached and interacted with others. The results are shown in Table 1.

Because the length of time of the observational periods varied among sessions, we found it useful to compare the percentage of self-stimulations that occurred in each period with the total number of self-stimulations observed for the entire session (see Table 2). The percentages from all four sessions for each time period were averaged. The percentage of self-stimulations in the first period before the wrapping ($M = 49\% \pm 10\%$) was approximately twice the percentage of self-stimulations in the second period ($M = 25\% \pm 8\%$) with the wraps on. This suggested that the wrappings reduced the number of self-stimulations. There appeared to be a carryover effect, because the percentage of self-stimulations in the third period ($M = 26\% \pm 6$) was also less than that observed in the first period and nearly the same as that in the second period. The trend shown by the percentages in each of the four sessions was the same as indicated by the mean of the percentage value for the four sessions.

Bob showed self-injurious behavior in only two of the four observational sessions, and in those cases the only self-injurious behavior was in Period 1, the initial period in which his extremities were unwrapped. Thus, in those two periods, the wrappings appeared to effectively lower the occurrence of self-injurious behavior. The self-injurious behavior data were not analyzed statistically because of the small number of data points.

In three of the four sessions, the number of interactions with others increased during Period 2, in which the wraps were worn; however, these interactions were difficult to quantify since the duration of each interaction was variable, ranging from 10 sec to 5 min. In general, the number of social interactions was observed to increase with wrapping and also remained higher in the time period following the removal of the wraps (see Table 1). The therapist observed that the quality and duration of the interactions improved from Period 1 to Periods 2 and 3.

Table 2
Percentage of Self-Stimulations[a] With and Without Deep Pressure Wrappings

Session	Period 1 (No Wraps)	Period 2 (With Wraps)	Period 3 (No Wraps)
1	62	17	21
2	51	27	22
3	43	22	35
4	38	35	27
Mean $\pm \sigma_{n-1}$	49 ± 10	25 ± 8	26 ± 6

[a]Percentage of self-stimulations for each time period was calculated from the total number of self-stimulations for that session.

Conclusion

Although the patient was unable to verbalize the effects of the splinting and wrapping, he responded to the splinting and padding regimens with decreased self-stimulation and self-injurious behavior, increased ability to interact with others, and an apparent strong desire to wear the splints. This autistic patient responded to sensory stimulatory treatment in a therapeutic way, as evidenced by (a) his ability to substitute therapeutic sensory input for self-injurious and self-stimulatory behaviors and (b) his attempt to organize his environment in order to receive further sensory input. After wearing the splints and padding during this hospitalization, the patient actively sought alternative deep pressure input to his arms, forearms, and trunk when the splints or padding were unavailable to him (i.e., at the end of his hospitalization) by attempting to wrap his arms and forearms in towels, blankets, or any available cloth and by stuffing cloth inside his shirt.

During the observation periods when the patient received deep pressure and tactile input from the woven elastic bandage wraps on his extremities, he exhibited less self-stimulatory behavior, no self-injurious behavior, and, in general, an increase in the number of interactions

with others. These observations were made in the patient's milieu under the sequence of no wraps, wraps, and no wraps for consecutive, equal time periods in each of the four sessions.

Deep pressure, tactile, and vestibular stimulation appeared to have a more marked effect in calming the patient on days when his self-stimulation and self-injurious behavior were highest. Bathing and vestibular stimulation were consistently calming for this patient, with little or no self-injurious behavior observed during these activities. He was able to participate actively and was more attentive in the dressing activity after partaking in the calming bathing and vestibular activities.

The patient underwent other milieu treatment during his hospitalization, including the addition of fluoxetine hydrochloride on Day 40 and the use of TENS. The effect of other milieu treatment may have influenced his improved behavior. ▲

Acknowledgment

We thank Brian McClure for drawing Figures 1, 2, and 3.

References

Ayres, A. J (1973). *Sensory integration and learning disorders.* Los Angeles: Western Psychological Services.

Ayres, A. J. (1985). *Sensory integration and the child.* Los Angeles: Western Psychological Services.

Grandin, T (1986). *Emergence: Labeled autistic.* Novato, CA: Arena Press.

Huss, A. J. (1983). Overview of sensorimotor approaches. In H. L. Hopkins & H. D. Smith (Eds.), *Willard and Spackman's occupational therapy* (6th ed., pp. 114–123). Philadelphia: Lippincott.

Kasch, M. C. (1990). Acute hand injuries. In L. W. Pedretti & B. Zoltan (Eds.), *Occupational therapy practice skills for physical dysfunction* (3rd ed., pp. 477–506). St. Louis: Mosby.

McCormack, G. L. (1990). The Rood approach to the treatment of neuromuscular dysfunction. In L. W. Pedretti & B. Zoltan (Eds.), *Occupational therapy practice skills for physical dysfunction* (3rd ed., pp. 311–333). St. Louis: Mosby.

Trombly, C. A. (1989). Rood approach. In C. A. Trombly (Ed.), *Occupational therapy for physical dysfunction* (3rd ed., pp. 97–107). Baltimore: Williams & Wilkins.

Editor's Note. To continue the Case Report department, we need and welcome reports that document the practice of occupational therapy for specific clinical situations. Guidelines for writing case reports are available from the Editor.