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An Observation Based Intervention Study: Clinical Changes in Interaction Behaviour as Response to Guided Tactual Interaction Therapy in 5 Adults with Acquired, Severe Brain Injury

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Abstract

Purpose: To identify and explore possible clinical changes in behaviour, elicited by Guided Tactual Interaction Therapy (GTIT), in patients with very low level of function following severe brain injury.

Methods: 5 adults with acquired, severe brain injury, scoring Rancho Los Amigos Scale (RLAS) 2-4, received GTIT three times. The interventions were video recorded, analysed and interpreted. Clinical changes in behaviour were identified by 4 different investigators, through individual and more consensus analyses.

Results: 4 main types of clinical changes in behaviour elicited by GTIT were identified, represented by 34 differentiated subtypes, which all appeared in pattern formations.

Conclusion: Clinical changes in behaviour were identified during application of GTIT. The changes included positive impacts on motor hyperactivities, tone alterations, eye directions and-expressions, and they revealed several active adjustments to or participations in ADL activities in the patients scoring RLAS 3-4. The clinical changes represent each individual patient's ability to rise in response level in an individually tailored GTIT treatment situation, and they may reflect different levels of perceptual organisation. More studies on individual response behaviours elicited by GTIT in persons with acquired, severe brain injury are suggested.

Keywords: Tactual perception; Guided tactual interaction therapy; Neurorehabilitation; Severe brain injury

Introduction

Health care professionals meet a range of challenges when providing neurorehabilitation to patients with acquired brain injury. Knowledge about the effectiveness of specific interventions in the overall rehabilitation programme is needed [1]. Research about learning processes during rehabilitation of daily life activities is sparse [2]. Preconditions for learning must be identified and subsequently considered in order to assign the brain injured patient an active role as well as an opportunity to learn during the rehabilitation process [3]. Only very limited literature can be identified regarding how persons with the most severe acquired brain injuries participate in rehabilitation [4].

Assessing a severely brain injured patient's ability to adapt and to learn, demands selection of dynamic approaches which consider perceptual and other impairments. According to Affolter et al. [5] learning is situational and begins with comprehension. Information and perception form prerequisites [5]. Learning, understood as perceptual reorganisation, in persons with acquired brain injuries can only be observed indirectly through observations of a person's behaviour changing from being pathological to being more normal (ibid). Elements of such clinical reflections are mainly based on observations from daily nursing and treatment situations.

The Affolter-Modell© concept presents a treatment approach which is applied during everyday activities. The model considers all learning situational, attention and perception being necessary prerequisites for interaction and problem solving in a learning situation [5-7]. Guiding, comprehension and learning are considered closely related units and form the rational basis of the model's therapeutic work [8]. The dosage is dynamic and continually adjusted, according to each patient's individual responses. Therefore, registration of a patient's response to treatment ought to start as soon as he or she is able to show short term attention and comprehension as well as being able to acknowledge relevant information [5].

In this model's theory of development, tactual and kinaesthetic perception is fundamental for a person's opportunity to interact with the environment. Through clear physical interactions in daily living, basic experiences of touch and action are stored and used as a frame of reference when performing skills or experiencing and partaking in activities. Guided Tactual Interaction Therapy (GTIT) is applied in order to help patients with perceptual disorders regain such repertoire. In this process, tactual information sources are regarded crucial as a means to establish information to the patient about his or her physical, environmental relations for comprehension [9,10].

Few publications on the application and effect of GTIT exist. No publication addresses the most severely brain injured patients selectively.

The investigation took place at a highly specialized neurorehabilitation centre for persons with brain injuries. The multidisciplinary teams systematically collect functional scores on

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the patients, with the Rancho Los Amigos Levels of Functioning Scale (RLAS) [11] being one of the standard measuring instruments. Patients scoring RLAS 2-4 demonstrate a range of severe mental, cognitive and often sensory-motor problems and a relatively stereotype response behaviour. Low level of attention and lack of participation in basic everyday life activities seems general. Table 1 presents the differentiated characteristics of response behaviours according to RLAS scaling 2, 3 and 4 [11]. In 2009 and in 2010 approximately 100 patients per year scored RLAS 2-4 on admission to the neurorehabilitation centre.

This study intended to identify and explore possible, observable, clinical changes in behaviour, elicited during application of GTIT, in patients with very low functional level as a result of acquired, severe brain injury.

Methods

Design

The study is a qualitative study based on observation of five patients with severe brain injury. The patients` responses to intervention with GTIT were video observed and analysed.

Participants

The patients were hospitalized in a highly specialised neurorehabilitation centre for persons with acquired brain injury and presented the most recently admitted patients scoring RLAS 2-4, when entering the project. Exclusion criteria were congenital brain injury, earlier acquired brain injury or other chronic neurological or psychological diseases. Each patient's gender, diagnosis, RLAS score, age and the number of days from injury to first study invention are shown in Table 2.

The five participants were 7-11 weeks post injury and showed different and varying levels of consciousness, from generalised to more localised response behaviours. They often showed signs of confusion, hallucination, agitation, and those who spoke could be confabulating. The participants showed no or very little understanding of spoken language and could not respond to verbal requests. They were paralysed in one or more extremities and trunk and showed abnormal changes in muscle tone. 4 presented stereotype motor hyperactivity. All were nourished by gastric tubes due to functional disorders in mouth and throat or comprehension disorders. None of them could carry out part activities of daily life voluntarily, neither when given verbal instructions.

RLAS Level	Behavioral responses
2 Generalized Response	The patient reacts inconsistently and non purposefully to stimuli in a nonspecific manner. Responses are limited and often the same, regardless of stimulus presented. Responses may be physiological changes, gross body movements and/or vocalization.
3 Localized Response	The patient reacts specifically, but inconsistently, to stimuli. Responses are directly related to the type of stimulus presented. May follow simple commands such as "Close your eyes" or "Squeeze my hand" in an inconsistent, delayed manner.
4 Confused-Agitated	Behavior is bizarre and non purposeful relative to immediate environment. Does not discriminate among persons or objects, is unable to co-operate directly with treatment efforts, verbalizations are frequently incoherent and/or inappropriate to the environment, confabulation may be present. Gross attention to environment is very short, and selective attention is often nonexistent. Patient lacks short term recall.

Table 1: Characteristics of behavioral responses according to RLAS levels of cognitive functioning 2, 3 and 4 [11].

Gender	Diagnosis ICD10 code	RLAS at intervention	Age	Number of days from injury to first study intervention
Female	Aneurysmus arteriae communicans anterior	3	63	57
Male	Haemorrhagia cerebri hemisphaeris subcortikalis I610	4	42	77
Female	Haemorrhagia cerebri I619	4	53	59
Male	Haemorrhagia cerebri I619	2	50	74
Male	Haemorrhagia subarachnodialis traumatica I608	2	69	48

Table 2: Patients' gender, diagnosis (ICD10 code), RLAS, age and numbers of days from injury to first invention.

Ethics

Relatives to all participants provided written informed consent to the patients' participation in the project, preceded by written and verbal information on the study. The research study was also explained fully to each individual's primary caregiver. The interventions were part of all patients' everyday treatment, and as so, agreement by the Ethics Committee was not claimed. The study was completed in accordance with the Helsinki Declaration of 1983.

Intervention

When applying GTIT the brain injured person is stimulated through the therapist's use of manual guiding techniques. The guiding techniques are applied when the patient is being helped during daily life activities like dressing and grooming. Special attention is drawn to mediate important tactual sources of information, which a person would normally seek and receive during necessary physical changes, adhered to the activity, with physical contact areas naturally occurring and changing during the interaction, interrelated to the person and the activity objects and to the person and the environment.

The therapist leads the patient through the activity by guiding his hands and body [8-15]. The aim is to let the patient clearly sense the objects directly related to the activity. This provides the patient tactual information referring to the activity. The patient's ongoing experience of a concurrent, safe body position during the activity is mediated to him by the therapist moving his main supportive part of the body, the pelvis, on the supporting surface, eventually supplementing with relations to sides, such as a wall. This provides the patient with tactual information related to his/her position of the body in the near surroundings- a prerequisite for acting.

When carrying out GTIT the therapist continuously registers the patient's response to mediation of tactual information, visually and through sensed experiences in her hands and supporting body parts. She adjusts the guiding therapy according to the patient's responses in order to generate positive changes in behaviour, which can be related directly to a recently demonstrated pathological behaviour. Registration and assessment of the patient's responses to mediation of tactual information undergo implicit and explicit reflection in the clinical process and are based on the therapist's knowledge and experience.

In this study a GTIT approach called nursing guiding ("Pflegerisches Führen") [8] was chosen, according to the patients' low levels of awareness and functioning. The chosen daily activity for GTIT was getting dressed. The patients were in their daily environment, and

	Code		B	C	D	E	F	I alt
		Main type: Normalisation of muscle tone, as reduction or building up, making postural adjustments or other movements possible						
1	TNHR-A	Coughs and clears throat on applied tactual information related to the activity	2				3	5
2	TNHR-P	Coughs and clears throat on applied tactual information related to the position of the body		3			5	8
3	TNSUK-P	Sighs on applied tactual information related to the position of the body	3					3
4	TNA-P	Asymmetrical facial expression turns symmetrical on applied tactual information related to the position of the body		3		5		8
5	TNT-P	Separation movements between upper and lower trunk observed in not passively moveable trunk on applied tactual information related to the position of the body					2	2
6	TNH-A	Constantly clenched hand opens on applied tactual information related to the activity			2			2
7	TNHM-P	Misaligned head moves to midline on applied tactual information related to position of the body		2	4		2	8
8	TNEN-P	Continuously raised extremity is placed on surface/body on tactual information related to the position of the body			4			4
9	TNR-P	Relatively quick respiration turns deeper and slower on applied tactual information on the position of the body		4				4
10	TNM-A	Closes (constantly open) mouth on applied tactual information related to the activity					3	3
11	TNM-P	Closes (constantly open) mouth on applied tactual information related to the position of the body			2		10	12
12	TNS-A	Swallows on applied tactual information related to the activity		2				2
13	TNS-P	Swallows on applied tactual information related to position of the body		2		3	4	9
14	TNKIS-P	Erects/aligns body in sitting on applied tactual information related to the position of the body			2			2
		Main type: Decrease or cessation in hyperactivity						
15	MUSTI-A	Motor hyperactivity ceases/stops on applied tactual information related to the activity				5	6	11
16	MUSTI-P	Motor hyperactivity ceases/stops on applied tactual information related to the position of the body		5	5	16	15	41
17	TMO-P	Cease of excessive talking/mumbling/sounds/wails on applied tactual information related to position of the body		4		3		7
18	TMO-A	Cease of excessive talking/mumbling/sounds/wails on applied tactual information related to activity		3				3
		Main type: Changes in the direction or expression of the eyes						
19	LØ-P	Closes eyes on applied tactual information related to the position of the body	2	3				5
20	BL/EA-P	Glance " tins" on applied tactual information related to the position of the body	11	13			18	42
21	BL/EA-A	Glance " tins" on applied tactual information related to the activity fortinnede øjne hedder glazed eyes		2				2
22	BLO-P	Glance elevates on applied tactual information related to the position of the body	44	9	19		6	78
23	BLO-A	Glance elevates on applied tactual information related to the activity	8		6			14
24	ØIB-A	Excessive winking stops on applied tactual information related to the activity			2			2
25	OAB-A	Eyes direct to activity on applied tactual information related to the activity	9	4				13
26	OUP-P	Eyes direct to surface or body on surface on applied tactual information related to the position of the body	4					4
		Main type: Active adjustments to or participation in the specific situation						
27	SAFKA-A	Moves body part or extremity, easing the carry out of the activity on applied tactual information related to the activity	4	2				6
28	SAFDA-A	Takes over and completes activity component on applied tactual information related to the activity	2		2			4
29	SAFDA-P	Takes over and completes activity component on applied tactual information related to the position of the body	2					2
30	SADA-A	Participates actively in activity component on applied tactual information related to the activity	3	4	6			13
31	SACDA-P	Checks activity component (garment's location on body) on applied tactual information related to the position of the body	3					3
32	TOMG-P	Adjusts environment to position of the body/situation on applied tactual information related to tactual information related to the position of the body		5				5
33	OAH-A	Hand moves to activity subject on applied tactual information related to the activity	2		6	2		10
34	TKPU-P	Adjusts body part/extremity to general position on surface on applied tactual information related to the position of the body	2	9	2		3	16
In all						353		

Table 3: Coding, categorisation and totalisation of clinical changes in behaviour in patients B-F following second consensus selection. Codes reflect working code abbreviations for subtypes in Danish.

their starting point of reference was lying on a relatively firm treatment bed next to a wall in their single room on the ward.

Data collection

Each patient was guided 3 times; four patients in three consecutive days and one patient within 4 days. Each intervention lasted approximately 20 minutes. All interventions were video recorded with two cameras; one stationary camera recorded the entire person, whereas a hand held camera focused on the person's face. Subsequently, both synchronous recordings were merged on the same display.

The interventions were carried out by four project therapists who did not know the patients beforehand. Each patient was treated by the same therapist during all three interventions.

All project therapists were specifically and equally trained in GTIT and had 8-12 years of experience in applying the treatment model

to patients with acquired, severe brain injury. Their professional statuses were one physiotherapist, two occupational therapists and one registered nurse.

A pilot data collection from interventions applied to two other patients with same inclusion criteria was analysed before the project started.

Data analysis

Video recordings of the 15 interventions were analysed in order to collect observable, clinical changes in behaviour, which could be interpreted as positive changes. These changes in behaviour included changes in muscular activity and adjustments to and active participations in activities of daily living.

The changes in behaviour

• had to be immediately related to the therapist's mediated tactual information source regarding the patient's position or activity, according to GTIT [5,8]

• should show a change towards less pathological behaviour [9,16]

• occurred at least twice within one treatment; this criteria was chosen in order to diminish occurrence by coincidence, and yet to open up for beginning signs of changes in behaviour in this very weak patient group

• could be of short term duration [7,8,10]

All 15 interventions were analysed three times; once individually by 3 different investigators and twice in groups of three investigators set in different constellations. One external investigator, a physiotherapist, took part in all three analysis sessions in all five cases. In both group analyses all three investigators had to agree fully that the selected changes in behaviour were positive, meaning that they showed a change towards less pathological behaviour. All interventions were analysed by at least four different investigators.

All clinical changes in behaviour underwent thorough descriptions of their specific individual expressions, related to each patient's pathological behaviour immediately prior to the induced tactual information. During this analysis process different subtypes and main types were identified, described and interpreted according to their manifestations and representations in each patient.

Results

Clinical changes in behaviour were identified in each of the five project persons and in all 15 individually tailored sessions. Table 3 presents an overview of the findings.

Table 3 presents a total of 353 clinical changes in behaviour which appeared during the interventions. The clinical changes in behaviour consisted of 34 identified subtypes. The subtypes were categorised into 4 main types, based on their kind of expressions. Identical subtypes of clinical changes in behaviour could appear several times in each individual patient. Most subtypes were observed in more patients.

Few subtypes which did not fit into the 4 main types were left out.

The four main types, categories, were:

• Normalisation of muscle tone- As a reduction or building up, making postural adjustments or other movements possible

• Decrease in or cessation of hyperactivity

• Changes in the direction and/or expression of the eyes

• Active adjustments to or participation in the specific situation

All five patients showed clinical changes in behaviour within the main type "Normalisation of muscle tone". Four of the five patients also showed changes within the other three main types: "Decrease in or cessation of hyperactivity", "Changes in the direction and/or expression of the eyes" and "Active adjustment to or participation in the specific situation". All patients showed clinical changes in behaviour with respect to both induced information about the position (in total 263 times) and induced information about the activity (in total 90 times).

In the following, observations and interpretations of clinical changes in behaviour are illustrated. Each description represents a subtype from one of the 4 main types.

Normalisation of muscle tone

As a reduction or building up, making postural adjustments or other movements possible: Patient C was lying on the treatment bed. His facial expression was asymmetrical, especially in the areas of mouth and cheek, due to pathologically build up muscle tone in the right side of his face. During the intervention a facial adjustment was observed: as the therapist moved the patient's pelvis on the surface of the plinth, as part of a GTIT dressing activity, the right side of patient C's face relaxed, turning his face symmetrical.

We interpret patient C's increased facial muscle tension being a compensation for reduced or lacking sense of body position in room. As patient C's pelvis is moved on the treatment table according to GTIT, the position of his body on the surface is made clear to him, providing him a feeling of body stability in relation to the treatment table. The sensed postural safety enables him to let go of the pathological facial tension.

Another type of normalisation of muscle tension is building up of muscle tone. Patient B was being dressed, having been moved from lying on the treatment table. She sat with a lightly flexed position in her back and neck, facing the floor. The therapist put on patient B's socks according to GTIT. Having got one sock on a foot, the therapist moved patient B's pelvis on the seat of the chair, whereby patient B actively extended her trunk and neck and sat up normally.

According to our interpretation, patient B attempts to balance by lowering her body's center of gravity, pulling her body into a bent position. As patient B`s pelvis is moved on the surface, she feels her supporting surface and accordingly can let go of the hyperactive tension in her trunk flexors and successively adjusts her body's position on the chair, moving up against gravity and erecting in the sitting position.

Decrease in or cessation of hyperactivity

This type of clinical change in behaviour was observed, for example, in patient E, lying on the treatment bed. For 17 seconds his right arm had been extended and raised, pointing at the ceiling, with the fingers continuously moving restlessly, as his trousers were pulled up and over his buttocks. As the therapist moved patient E's pelvis on the supporting surface, as part of the dressing activity according to GTIT, patient E rested his right hand on his chest and stopped moving his fingers.

We interpret patient E`s stereotyped and restless movements being his way of coping under- or overstimulation, based on a lack of understanding the stimuli being at his disposal. As the therapist moves patient E´s pelvis on the treatment table, his contact to the surface grows so clear to him that he can let go off the hyperactive movements with his hand and arm. He can direct his attention to an appropriate

source belonging to the activity that is tactual inputs to his pelvis referring to the position of his body during the activity.

Changes in the direction and/or expression of the eyes

In patient B we observed a clinical change in behaviour, characterised by her glance becoming directed to the actual activity. Patient B was at this moment sitting on the treatment bed, supported from the back and to the right side. She was helped putting on a blouse according to GTIT. Initially patient B did not direct her glance to the activity, having the blouse put on. With her hands lying in her lap, the therapist brought the sleeve of the blouse directly and clearly over her one hand. In that moment patient B directed her glance to her arm and to the sleeve.

As the therapist in this chosen example clarifies the activity by entirely focusing on and inducing the stimuli being relevant to this part of the activity, it turns possible for patient B to direct the glance to the ongoing activity, according to our interpretation.

Active adjustment to or participation in the specific situation

Patient C was observed in a dressing situation, sitting on a chair with a table at his side. During applied GTIT the sleeve of the shirt touched patient C's hand clearly, upon which he started moving his fingers and actively moved his hand into the sleeve. He then stretched his arm, whereby the sleeve reached the shoulder. The starting point was the hand lying passively in the patient C's lap.

As the therapist clarifies the activity, bringing the sleeve directly onto the patient's hand, patient C is given the possibility to comprehend what is happening, and he can accordingly take brief, active part in the ongoing activity is our interpretation.

Discussion

The observed four main types, categories, of clinical changes in behaviour in the present study are in accordance with "Short term changes", "Short term effects" and "Kurzfristige Verhaltensveränderungen" referred to in previous textbooks [7,8,10,12-16]. They show close similarity to highlighted groups of clinical changes in behaviour and their presumed perceptual organisation levels in two more recent publications on the treatment model (5, 8). The participants in the present study entirely represent persons with acquired very severe brain injury, whereas the intervention groups in the studies referred to above, are broader and less specifically described.

According to Affolter et al. [5] to Affolter [6] and to Hofer [8], different levels of perceptual organisation can be observed when a person receives tactual information [5,6,8]. These levels reflect different degrees of a person's ability to upgrade and integrate sensory modalities in perceptual processing (ibid). When a person is able to draw attention to the sensory modality being the essential one in a given situation, appropriate perceptual processing is likely to occur (ibid). Applied GTIT highlights the tactual modality and its integration with other relevant sensory modalities for appropriate interaction with the environment. An example is the observed decreases in or cessations of hyperactivity reflecting the patients' ability to draw attention to the provided tactual information. Intermodal integration between the tactual and the visual sensory systems represents a higher perceptual level of information processing and is observed when the glance is turned directly to the actual, tactually perceptible activity, as registered in subtype 25 (code OAB-A) in Table 3.

However, some categorisations into main types of clinical changes in behaviour gathered in this study can be discussed. The part dealing with reduction of hyper tonicity, from the category "Normalisation of muscle tone", and the category "Decrease in or cessation of hyperactivity"- could both be gathered into a common category: "Decrease in or cessation of motor hyperactivity".

The main type "Active adjustment to or participation in the specific situation" in the current study is also based on the inference that subtypes within one category may relate to two different levels in regard to perceptual organisation; the lower level reflecting that the patient makes appropriate physical adaptations to the situation; the higher level reflecting that the patient demonstrates acting at part-performance level following mediated tactual information.

In the present study more types of changes regarding the direction of sight and/or the expression of glance were identified, compared to the ones mentioned in textbooks and in a publication on GTIT [5,6,8]. This may be due to the fact that one video camera entirely and closely focused on each patient's face, and to the fact that the investigators deliberately opened up for detecting minor behavioural changes because of the severity of the patients' impairments. Finally, it may be that eye movements and eye expressions appear in other kinds and combinations in patients with very severe brain injury, compared to reactions seen in a broader population of patients with brain injury. We will remain rather humble as to describing other kinds of observed changes in directions and expressions of gaze, until more and larger studies on GTIT are available.

All registered clinical changes in behaviour during GTIT were relative to each patient's pathological behaviour. Pathological behaviours varied between the patients, and foundations for positive reactions to GTIT varied accordingly. Another question is whether similar main categories of positive clinical changes in behaviour would be identified, applying GTIT to patients with different brain injury diagnoses and impairments than the ones presented in this study. Patient groups selected more specifically according to injuries and impairments might reveal different appearances of clinical changes in behaviour.

This study intended, through observation, to clarify appearance of clinical changes in behaviour in patients with very severe brain injury, as a result of applied GTIT. All treating therapists and investigators were specifically trained in GTIT and had 8-12 years of experience in applying the treatment model to patients with acquired brain injury, strengthening the validity of the study. At the same time the investigators´ pre-understanding might bias the result and arrangements to increase the validity were chosen. During video analyses all project persons were aware of their professional stance, and interpretations of the patients' behavioural responses were deliberately conducted as open minded as possible. In addition, quite rigorous criteria were set up for a patient response to be accepted as a possible, positive change in behaviour, and finally all 15 interventions were analysed in 3 rounds: 1) in individual analyses by three different persons, 2) in consensus analyses dealing with the findings from the three individual analyses and conducted by two project therapists and one investigator, and finally 3) in a second consensus analysis conducted by three investigators. The question still remains whether other investigators would find the same clinical changes in behaviour, elicited during application of GTIT. We expect persons possessing equal knowledge to reach approximately the same result.

The data collection was gathered within three following days in four project patients and within four following days in one project patient. This close timing sought to eliminate other disturbing or intrusive elements in relation to the patients' conditions.

The study is based on treatment of 5 patients and should be regarded as a pilot study. Due to variations in more the patients' symptoms and brain injuries each case was analysed and interpreted individually, as single case studies. When observing several identities between main types and subtypes in the five cases, it was decided to gather and compare the results of the five single case studies.

To conclude, individual changes towards less pathological behaviour were seen in five patients with severe brain injury receiving GTIT, manifested by many individually grouped subtypes of changes. The subtypes could be categorised according to the expressions of the behavioural changes and may also be related to different levels of perceptual organisation. There seems to be a basis for larger studies on individual interaction behaviours as responses elicited by GTIT targeting selected patient groups with acquired, severe brain injury.

The study provides a basis for larger scale studies. To our knowledge it is the first study specifically examining possible positive, behavioural changes elicited during GTIT in patients with acquired brain injury scoring RLAS 2-4.

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