

The Impact of Psychodynamic Psychotherapy on Signs and Symptoms of Ulcerative Colitis- a Multivariate Time-series Analysis

Janina Marèn Buettner¹ and Burkhard Brosig^{2*}

¹Center for Pediatrics and Adolescent Medicine, Department for General Pediatrics and Neonatology, Justus Liebig University, Germany

²Center for Pediatrics and Adolescent Medicine, Unit of Family Therapy and Pediatric Psychosomatics, Justus Liebig University, Germany

Abstract

Background: Ulcerative colitis is a chronic gastroenterological autoimmune disease with a psychosomatic background. The aim of this study was to collect and identify the phases triggering acute crises of disease activity over a 1-year course of psychotherapy.

Methods: Gastroenterological activity parameters (abdominal pain, stool frequency / diarrhea) as well as moods and important or disturbing events of the day were recorded in a diary study over 355 days. The resulting empirical data set was evaluated using a multivariate time-series analysis vector autoregression (VAR) model.

Results: A substantial, significant decrease in disease activity was seen over time (adj. R^2 for abdominal pain as the dependent variable: 42%, for stool frequency / diarrhea: 71%). While working through the patient's conflicts, there were phases of increased stress and negative moods. Towards the end, a psychic stabilization and a reduction of symptoms was achieved. The catamnesis showed a significant improvement in the internal medicine colonoscopy-verified status.

Conclusion: The integration of psychotherapeutic reflection and empirical single-case analysis (mixed methods) contributes to understanding what is happening over the course of the chronic disease. The psychosomatic treatment is characterized by an enhanced capacity for mentalization and desomatization.

Background

The chronic inflammatory bowel disease (IBD) is a recurring, permanent disease of the gastrointestinal tract with an unknown etiology. Ulcerative colitis and Crohn's disease are the clinical presentations of this illness. The illness is classified as an autoimmune disorder. Predisposing genetic factors are in discussion. Lifestyle and other cultural and psychological factors play a part in this disease's epidemiological data [1]. The treatment is determined by the administration of immunosuppressive drugs [2]. If it is arguable that psychosomatic processes participate in triggering the disease, an accompanying psychosomatic therapy is recognized as a supplementary basic therapeutic for illness processing (coping) with the goals of improved disease acceptance and better treatment adherence [3]. What is presented here is the psychosomatic treatment of a patient in a clinical case presentation and an accompanying single-case statistical evaluation. It is an exemplary presentation, in line with the dovetailing of qualitative and quantitative approaches, that illustrates the opportunities presented by depth-psychology based psychotherapy.

The statistical approach via time-series analysis hereby takes into account the individual character of the individual case. The analysis of *intra*-individual variation represents the modeling of dynamic processes in the therapy.

At the time of the initial interview (2009), Martin, the patient, presented with the symptoms of a moderately severe depressive episode, the conflict resolution for which can be traced back to the seemingly uncontrolled course of ulcerative colitis diagnosed in February 2007. The patient, who fell ill 8 weeks prior to his master's examination, was at first still able to come to terms with his illness and for a time it was "all somehow still bearable".

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As the physical ailments multiplied (frequent bowel movements, fears of side effects from the medications and worries about sequelae), Martin reacted with worsening depressive symptoms: the patient reported despondency, depressive withdrawal, sleep disturbances, nightmares, tension and irritability, chronic exhaustion as well as intermittent seemingly obsessive fears. In particular, they manifest themselves in a preoccupation that something could happen to his wife or the children.

In light of the acuteness of the psychological symptoms, the need to start therapy immediately became clear during the initial interview and the probatory sessions. Short-time therapy in the form of a crisis intervention was begun as an emergency measure and to review the indication of treatment (diagnosis) for long-term therapy. In working with the patient, the focus was on his anxious-depressive symptoms, the tendency to withdraw into himself and their impact on the relationship with his partner, including his lack of illness coping skills.

Materials & Method

Case history

At the start of therapy, the treating therapist diagnosed a moderately severe depressive episode (F 32.1) and psychosomatic factors (F 54) with ulcerative colitis (K 51.9).

***Corresponding Author:** Prof. Burkhard Brosig, Center for Pediatrics and Adolescent Medicine, Unit of Family Therapy and Pediatric Psychosomatics, Justus Liebig University, Germany; E-mail: burkhard.brosig@psycho.med.uni-giessen.de

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The anxiety symptoms escalated as early as the initial phase of the outpatient therapeutic process when the patient was diagnosed with chronic pancreatitis and cortisone-induced diabetes mellitus. In consultation with the gastroenterologist, psychosomatic rehabilitation therapy was initiated. During the 7-week stay, the adipose patient (BMI 32) was stabilized, he lost weight (5 kg, ca. 11 pounds) and his medicinal therapy was adjusted. However, when he was released from inpatient treatment, 15 mg Decortin H was still being administered. He was also taking a medication for high blood pressure.

The patient was born in 1968 in a small city. He was the youngest of three children and by his own account; he grew up in a harmonious family situation. He had always gotten along well with his sisters, who were 5 and 8 years older. As a youngster, he suffered because of his corpulence and reported that he was not particularly achievement-oriented during this time. After obtaining his secondary modern school-leaving certificate (Hauptschulabschluss), he completed his training as a gas fitter and plumber. He has been employed in this profession by a public energy utility since 1988. According to Martin, his personal life had been carefree until 2007 and he enjoyed his work.

He met his current wife (married 1995) during his military service period. A daughter was born in 1995 and a son in 1998. He lives together with his parents in separate apartments in his parents' house. At the time therapy began, his father was 69, retired, formerly a white cooper and his mother was 66, retired, formerly a sales clerk. With the founding of a family and increasing occupational expectations, Martin decided to attend a master school (*Meisterschule*) for two years. He saw this necessary absence from the family during this period as unproblematic. The outbreak of his illness (2007) occurred in the examination and graduation phase, which is when the prolonged stress, competition, lack of sleep, overloaded feeling and the separation from wife and family converged. In the ongoing demoralizing progression of the disease, the patient's defense mechanisms gradually malfunction and the conflicting situation leads to social withdrawal accompanied by a diminished quality of life.

In addition to the usual childhood illnesses (status post tonsillectomy in 1999), Martin suffered from pancreatitis in 2007 and 2008. The arterial hypertonia and the hypothyroidism are being treated medicinally. The patient states that he does not smoke or drink alcohol. He is obese. No psychological-psychiatric disorders were found in the personal or the family medical history and the patient has no prior experience with psychotherapy.

Over time, this led to somato-psychosomatic interactions between the organ illness and the anxious-depressive mood with compulsive stabilization attempts and efforts at normality. The fended-off anger, aggressivity and rage manifest themselves in internal tension, irritability and separation fantasies. In addition to ulcerative colitis, an existing arterial hypertonia was also identified as a psychosomatic correlate [4-6]. Following the prescribed rehabilitation therapy, the therapeutic relationship was strengthened. During outpatient psychotherapy, which initially began as short-time therapy, Martin became able to access the setbacks and disappointments he experienced with his illness, to accept the associated feelings and to understand the psychosomatic disease concept. However, he still exhibits much self-doubt and a lack of self-esteem as well as a continuing psychic fragility that ultimately leads to the therapeutic indication for depth-psychology based long-term therapy. Within this framework, the diary data collection method described below was utilized as a

supporting measure for the self-awareness training. Furthermore, this enables the therapist to better understand the somatic situation in the therapy parallel to what the patient communicates to the therapist.

Evaluation

The study is based on quantitative as well as qualitative elements of a diary study over 355 days.

Quantitative data: On a daily time-grid, emotions are measured using a three-dimensional pictorial questionnaire (SAM: Self-Assessment Manikin, [7]). It embodies the idea that fleeting, temporally-variable moments of emotionality can be laid out three-dimensionally into the dimensions of pleasure (positive vs. negative mood or valence), arousal (high vs. low arousal) and dominance as social variables (low vs. high dominance), whereby the respondent can mark his current mental state with a cross on a five-stage pictorial scale. As intermediate steps were possible, a total of 9 forms of the three mood dimensions were available.

This approach has already been verified in other diary studies on the processing of chronic diseases (diabetes mellitus type 1, [8-11]) with regard to practicability, variability over time as well as internal and external validity. It was demonstrated that for the respondent this approach is simple, not very tiring and its use is robust in a clinical field. It empirically displays crises and extreme situations well.

Parallel to the recording of daily moods, as activity parameters of the underlying disease, the intensity of abdominal pain (an individual item from the Giessen Subjective Complaints List (GGB) using 5 stages from 0 = none to 5 = very strong) and the number of incidents of diarrhea are collected.

As a therapeutic process model, a linear variable (Trend) was constructed with values from 1 to 355 accompanied by the time-series as a dummy variable.

Furthermore, social stimuli (day of therapy, dose response curve of psychotherapy as a function of appointment density over time, weekend, vacation, i.e. "exogenous variables") were collected as control parameters. To keep the model design manageable and to ensure the parameters in the multivariate model adhered to the principle of parsimony, these parameters were not evaluated for this publication.

Qualitative data collection: Parallel to the collection of quantitative data, a free text field was available to record important events of the day that could have possibly influenced the patient's moods. The patient could enter key words or entire sentences to describe the events of the day. Changes in the mental state and internal reflections could also be noted. This reporting option was used intensively and was drawn on to validate mood changes.

Evaluation: After the data was collected, it was consolidated into an Excel table and exported to EViews (Version 9).

The functions of this specialized statistical time-series analysis software program enable graphic representation of time courses via dimensions and (data collection) time-points. It includes univariate and multivariate statistical modeling that takes into account time-series relevant statistical phenomena such as autocorrelation.

In addition to observing the time courses of the variables (*optical analysis* as the evaluation basis), the descriptive statistics and the correlation of the variables among themselves, a model was then developed that summarizes moment correlations, time-lag correlations with lead and lag structures (cross correlation) and the influence of external stimuli.

Modeling: Against the background of a theoretical assumption that psychosomatic phenomena take place psychosomatically as well as somatopsychically and thus are organized in feedback loops, the final model design was formulated in the form of a *vector autoregression model* (VAR). Without going into great detail describing this form of evaluation, it should be noted that the differentiation between dependent and independent variables has been abandoned in favor of a flexible, feedback-loop oriented vectorial model. In this model, every endogenous variable functions both as a dependent and an independent variable; moreover, through the characteristic values of its own variables over a time course, it is also statistically predicted prior to a given measurement point (autocorrelation). Exogenous variables are outside of this reciprocal condition and externally influence the interactive model of endogenous variables [12].

Thus, the moods and the somatic-relevant variables are incorporated into the model as endogenous variables. The variable TREND and the smoothed dose response curve of psychotherapy THERSM function as exogenous variables. In summary, the following variables were entered into the model design:

Endogenous variables:

Somatic:

Intensity of gastric pain G_PAIN

Stool frequency (diarrhea) DIARR

Psychological:

Mood (pleasure, valence) VAL

Arousal (activation) ACT

Dominance DOM

Exogenous variables:

Dose response curve (smoothed) of psychotherapy THERSM

Linear trend TREND

Results

In the description of the empirical results, our approach is three-stage:

1. Firstly, an observation of the variables trend as a process within the clinical context of the treatment protocols and the diary entries.
2. This is followed by a description of the mean values, statistical variances and correlations.
3. In the last phase a multivariate model is developed, adapted to the particular statistical situation of the time-series, which places the individual trends of the variables in an interpretative holistic context.

Optical analysis

The collective trend over the 355 day observation period shows a significant decrease in both the subjective complaints of abdominal pain (G_PAIN) as well as the reported stool frequency (DIARR). Of the two, the decrease in stool frequency is significantly more pronounced. The following specific events are noteworthy:

When the diary entries began, there was a marital crisis to cope with: "vacation discussion" (day 4), "no joint vacation" (day 5), "wife leaves" (day 6).

Starting on day 40 of the study, the number of diary entries increase; the patient is now making use of the opportunity to describe his internal tensions more clearly. Parallel to this, the stool frequency decreases.

In the middle of treatment, from around day 150 to 200 of data recording, a renewed *crisis* occurred with increased abdominal pain, though *not* however accompanied by increased incidents of diarrhea. "problems with son" (day 154), "queasy feeling in the stomach area" (155), "serious argument with the family" (wife and children moved out); "despair" (157). Subsequently, there was a back and forth between the couple whereby the wife moved out several times, sometimes with the son, sometimes with both children. On day 188, the patient had the impression that the abdominal pains come when there is "stress and agitation". This suggests the patient is internally processing the symptoms.

Simultaneously, there is an increase in sad moods (high values for the VAL variable), a greater psychomotoric arousal (*low* values for the ACT variable) and a decrease in experiencing dominance (DOM). In the exponentially smoothed therapeutic dose (THERSM variable) trend that portrays a cumulative dose-response curve of the psychotherapy, an especially high level of therapeutic activity is also documented during this time. The TREND variable merely illustrates the linear trend's programming.

In conclusion, it can be said that over the course of the outpatient psychotherapy, the colitis-specific symptoms decreased significantly, although with an exacerbation of subjective symptoms during the therapy midpoint when the abdominal pains increased but without a return to the initial level. This crisis is accompanied by sadness, heated emotions and the patient feeling little social dominance (Figure 1).

Descriptivestatistics and correlations

It can be seen in the *descriptive statistical parameters* that, on average, the patient reports little abdominal pain ($M = 0.5$, $Med = 0$). However, he reports significant incidents of diarrhea ($M = 4.47$, $Med = 4$). The maximum reported was 21 (!) incidents of diarrhea per day.

In the emotion variables, the patient portrays himself as rather relaxed, calm and dominant, whereby over time variance is also seen here with a wide range between minimum and maximum values ($SD = .66 - .79$), (Table 1).

In the correlations, it can be seen that there is a systematic correlation between the abdominal pain and the diarrhea, which in turn is correlatively accompanied by sad and agitated emotions as well as the feeling of insufficient dominance (Table 2).

When the therapeutic dose is low, the abdominal pain is especially frequent. The trend indicates a decreasing number of incidents. Diarrhea incidents are linked with insufficient dominance and a low therapeutic dose with the trend indicating a very significant decrease ($r = .72$). Sad moods are accompanied with arousal (agitation) and a lack of dominance, whereas calmness is associated with social dominance.

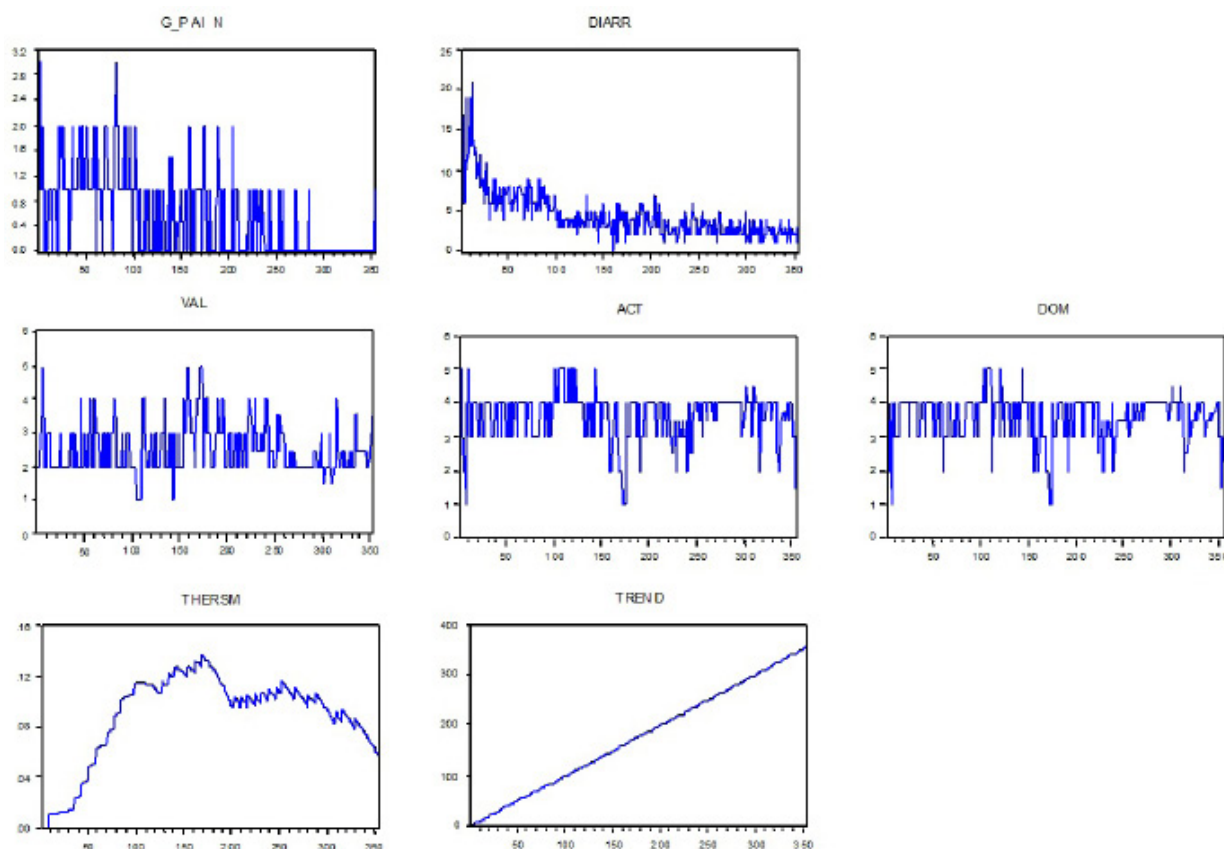


Figure 1: Variables over time.

Legend: x-axis: The variables trend during the entire therapy process, y-axis: Variation of variables in their respective units. Endogenous variables: Abdominal pain intensity: G_PAIN, stool frequency: DIARR, mood VAL, arousal: ACT, dominance: DOM, Exogeneous variables: Dose response curve of psychotherapy: THERSM, linear trend: TREND.

	G_PAIN	DIARR	VAL	ACT	DOM
<i>M</i>	0.55	4.47	2.56	3.63	3.60
<i>Med</i>	0.00	4.00	2.50	4.00	4.00
Maximum	3.00	21.00	5.00	5.00	5.00
Minimum	0.00	0.00	1.00	1.00	1.00
<i>SD</i>	0.69	3.03	0.75	0.71	0.66
Skewness	1.03	2.07	0.94	-1.22	-1.19
Kurtosis	3.35	9.10	3.98	5.32	5.20
Jarque-Bera	64.98	803.14	66.83	168.66	155.56
<i>p</i> <	0.0001	0.0001	0.0001	0.0001	0.0001
<i>N</i>	355	355	355	355	355

Table 1: Descriptive statistics.

Note: G_PAIN = intensity of abdominal pain; DIARR = number of diarrhea incidents per day; VAL = valence, mood (happy = 1 vs. sad = 6); ACT = activation, arousal (agitated = 1 vs. calm = 6); DOM = dominance (small = 1 vs. large = 6).

	G_PAIN	DIARR	VAL	ACT	DOM	THERSM	TREND
G_PAIN							
DIARR	0.56						
VAL	0.21***	0.05					
ACT	-0.26***	-0.068	-0.78***				
DOM	-0.23***	-0.13*	-0.84***	0.83***			
THERSM	-0.30***	-0.65	0.13*	-0.06	-0.02		
TREND	-0.61***	-0.72***	-0.00	-0.06	0.01	0.45	

Table 2: Correlations.

Legend: G_PAIN = intensity of abdominal pain; DIARR = number of diarrhea incidents per day; VAL = valence, mood (happy = 1 vs. sad = 6); ACT = activation, arousal (agitated = 1 vs. calm = 6); DOM = dominance (small = 1 vs. large = 6), **p*<.05, ***p*<.01, ****p*<.001.

	G_PAIN	DIARR	VAL	ACT	DOM
G_PAIN (-1)	0.16	-0.21	-0.02	-0.02	0.06
G_PAIN (-2)	0.042	-0.51	-0.11	0.07	0.06
DIARR (-1)	-0.03	0.20	-0.03	0.06	0.04
DIARR (-2)	-0.03	0.31	0.01	-0.03	-0.02
VAL(-1)	-0.09	0.10	0.31	-0.04	-0.04
VAL(-2)	0.03	-0.11	0.06	-0.14	-0.11
ACT(-1)	-0.15	0.23	-0.03	0.30	0.11
ACT(-2)	0.10	-0.04	-0.21	0.20	0.16
DOM(-1)	-0.05	-0.31	-0.23	0.25	0.39
DOM(-2)	-0.16	-0.19	0.16	-0.23	-0.16
C	2.64	6.97	2.99	1.78	1.70
TREND	-0.004	-0.010	-0.001	>0.001	0.001
THERSM	-2.14	-16.67	0.94	1.73	1.28
Adj. R ²	0.418	0.706	0.301	0.356	0.319
F-statistic	22.030	71.472	13.616	17.241	14.770
Log likelihood	-257.645	-657.030	-331.040	-298.603	-282.372
Akaike AIC	1.533	3.796	1.949	1.765	1.673
Schwarz SC	1.676	3.939	2.092	1.908	1.816
M dependent var.	0.539	4.407	2.566	3.632	3.596
SD dependent var.	0.670	2.925	0.753	0.716	0.665
Determinant resid covariance (dof adj.)	0.003				
Determinant resid covariance	0.003				
Log likelihood	-1450.004				
Akaike Information Criteria	8.584				
Schwarz Criteria	9.296				

Table 3: Vector autoregressive model.

Legend: G_PAIN = intensity of abdominal pain; DIARR = number of diarrhea incidents per day; VAL = valence, mood (happy = 1 vs. sad= 6); ACT= activation, arousal (agitated = 1 vs. calm = 6); DOM = dominance (small = 1 vs. large = 6). Additional model design parameters can be found in textbooks on multivariate time-series statistics. Bold: T>2.0; p<.05.

Overall, a pattern of decreasing ailments is seen over the course of therapy, whereby outside of this linear trend, a high level of symptomatology is associated with feelings of sadness and psychomotoric activation when dominance is lacking.

Multivariate model design

The *vector autoregressive model* describes correlations between endogenous variables between each other and the influence of exogenous variables in one overall model. In the area of endogenous variables, the reciprocal influence of somatic and psychic factors is presented in a complex feedback model. It is viewable both somatopsychically as well as psychosomatically and is calculated over a time course of 6 days (that is, with two lags).

As is customary in the presentation of multivariate relationships, the first row displays the list of variables to be explained by the multivariate model.

In subsequent rows, in each case the regressors (predictors) are displayed, whereby and typical for time-series analysis, the variable itself appears as an autocorrelation.

The regressors are the same for each column so that a matrix of the statistical predictions can be developed. At the bottom of the table is a summary of the statistical parameters including the declared variance (adj. R²), which depicts the quality of the respective model for the variables in the columns and the quality of the overall model.

The results showed that the subjective complaints of abdominal pain are determined by the intensity of the previous day's complaints as well as the stool frequency from two days prior. Moreover, the results showed that the abdominal pains are determined by psychomotoric activation on the prior day and by a lack of dominance from two days prior. The abdominal pain trend is declining and when there is a lack of therapeutic intensity, abdominal pains are markedly intensified. In this model, 42% of the variance (adj. R²) is explained with the strongest regressor (predictor) being the therapeutic intensity in the exogenous variables area and the psychomotoric activation in the endogenous variables area.

Stool frequencies in particular are autocorrelatively (1 day ago and 2 days ago) predicted and here too, in turn, the trend is negative and diarrhea incidents are statistically predictable by a lack of therapeutic intensity. The level of explained variance is nearly 71% (adj. R²).

The abdominal pains by themselves do not trigger any mood dimension changes, however it can be seen that increased stool frequencies on the following day are associated with greater psychomotoric calm (equivalent to a lack of arousal) and higher social dominance. In each case, valence (mood, VAL), arousal (activation, ACT) and dominance (DOM) are also autocorrelatively determined (Table 3).

In explaining the emotion variances, an adjusted R² of about 30% was reached. The remaining statistical parameters are located in Table 3 and are sufficiently good.

Discussion

The single-case presentation portrays the intensive process of therapeutic accompaniment for chronic inflammatory intestinal disease using depth-psychology based psychotherapy. In the clinical case, two phases of significant family and matrimonial crises are described, intercepted and dealt with in the therapy. This made possible an interpretive processing of the psychosomatic reactions that were later confirmed by the patient's own diary entries. The studies conducted by Ikeda [13] and Luyten and Fonagy [14] show supporting results that are also supportive of reducing patients' physical symptoms by increasing the capacity for retrospection, i.e. reflection. (within the theoretical framework of *mentalization*).

The clinical and qualitative data-based *desomatization* [15] (for the current status of psychosomatic theory formation) process finds a parallel in *vector autoregressive* model data modeling. It leads to a statistically significant reduction of physical symptoms in the longitudinal data. Abdominal pains are triggered by preceding activation. The intensity of the therapeutic relationship (operationalized via session frequency) is the strongest statistical predictor of somatic calming.

Conclusion

The diary-supported single-case statistical approach not only has an observational effect, it also has a therapeutically supportive effect as it inspires patients to greater self-reflection.

For further research, an aggregation of multiple cases would be beneficial, whereby the strategy of individualized data collection should be retained. A pooled time-series model would make a statistically elegant agglutination of individual cases possible.

The diary study conducted here with only three variables in 9-stage scaling offers a compromise between the pragmatic manageability of collecting data and the range of reactions needed. Differentiated diaries with a larger number of grading options would be useful, but also more cumbersome. That is where the study presented here has its obvious limitations.

Nonetheless, for a chronic illness, the study presented here shows that in addition to expert medical care, a therapeutic accompaniment has proven effects and on the whole promotes internal processing and an acceptance of the adapted lifestyle. In particular, patients' improved emotion processing ability, increased conflict resolution capabilities and more nuanced introspection are hereby to be highlighted (see also: from a clinical-psychoanalytical-psychosomatic perspective, [16]).

Acknowledgments

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Competing Interests

The authors declare that they have no competing interests.

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