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Coping and Posttraumatic Growth: A Longitudinal Comparison of Two Alternative Views

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Abstract

Purpose: The current study aimed to examine two possible explanations for why higher levels of posttraumatic growth (PTG) were repeatedly found to be predicted by both approach- and avoidance-oriented coping, focusing on individuals recently diagnosed with a spinal cord injury (SCI). First, negative changes (posttraumatic depreciation, PTD) may moderate the association between PTG and the two types of coping indicating that PTG reflects avoidance of PTD for some individuals, but a constructive view on posttraumatic life changes for others. Second, it may be that a flexible use of different types of coping strategies (coping flexibility) enables the experience of PTG. ***Method:*** A sample consisting of 122 patients admitted to one of the four national SCI rehabilitation centers was examined in a longitudinal study. Hierarchical multiple regression analyses were conducted to test the two competing explanations. ***Results:*** Both approach- ($\beta = .30$, $p = .001$) and avoidance-oriented coping ($\beta = .23$, $p = .011$) measured three months after SCI diagnosis predicted higher PTG levels at discharge from clinical rehabilitation. PTD did not moderate the relationship between approach- ($\beta = .03$, $p = .743$) and avoidance-oriented coping ($\beta = -.04$, $p = .656$) and PTG. However, coping flexibility ($\beta = .23$, $p = .012$) predicted higher PTG levels. ***Conclusion:*** These results suggest that a flexible use of different types of coping strategies potentially according to situational demands may explain findings that PTG was predicted by both approach- and avoidance-oriented coping.

Keywords: spinal cord injuries; posttraumatic growth; coping flexibility; posttraumatic depreciation; psychological adaptation

Impact

- Findings that both approach- and avoidance-oriented coping predict higher PTG experienced after SCI and other potentially traumatic events pose a puzzle for the PTG literature, as these types of coping are assumed to serve opposing functions in the adjustment process. This study is the first to empirically compare competing theoretical explanations examining individuals with SCI.
- Moderated hierarchical regression analyses indicate no support for the so far untested assumption that perceived PTG reflects two facets which are predicted differently by the two types of coping. However, this is the first longitudinal study testing and finding support for the notion that a flexible use of both approach- and avoidance-oriented coping strategies contributes to the experience of PTG.
- A flexible way of coping may be a promising target for intervention programs aiming to foster the experience of PTG in individuals with an SCI.

Introduction

The onset of a spinal cord injury (SCI) has wide ranging and life altering consequences. Resulting either from an accident (e.g., car crash, fall) or disease (e.g., cancer), a damage to the spinal cord leads to a partial (incomplete) or complete loss of autonomic, motor, and/or sensory functions. Depending on the lesion level, commonly affected areas include trunk and legs (paraplegia) or additionally the arms (tetraplegia; World Health Organization, 2013). These physical impairments entail restrictions in everyday activities and societal participation and result in chronic disability (World Health Organization, 2013). A substantial minority of individuals with SCI are at risk for psychological morbidity (Craig, Tran, & Middleton, 2009). However, individuals with SCI also perceive posttraumatic growth (PTG), which is the experience of positive psychological changes such as having better relationships with others or a greater appreciation of life (Chun & Lee, 2008).

According to PTG theories (e.g., Joseph & Linley, 2005; Tedeschi & Calhoun, 2004), the process of positive transformation in the aftermath of potentially traumatic events such as SCI is initiated by the psychological struggle with the new reality. For example, Tedeschi and Calhoun (2004) assume in their PTG model that a traumatic event severely challenges or shatters an individual's assumptive world (i.e., deeply rooted self-perceptions, worldviews, and sense of meaning and purpose). According to their model, assumptive world challenges are accompanied by high levels of psychological distress, for example symptoms of posttraumatic stress disorder (PTSD). With time, however, they can be resolved through persistent cognitive processing. Thereby, the trauma-related information is deliberately analyzed, re-appraised, and integrated into mental structures so that positively altered or rebuilt assumptive worlds (i.e., PTG) can emerge. Thus, persistent cognitive processing is supposed to hold a central role in the development of PTG.

One way to operationalize cognitive processing in empirical studies is through approach-oriented coping strategies as they are defined as cognitive-emotional activity directed towards a stressor (Roth & Cohen, 1986). Supporting their important role in the development of PTG, approach-oriented coping strategies such as positive reappraisal or acceptance coping were found to have the largest effect sizes of all predictors considered in meta-analyses in cancer survivors (Shand, Cowlishaw, Brooker, Burney, & Ricciardelli, 2015) and other trauma populations (Helgeson, Reynolds, & Tomich, 2006; Prati & Pietrantoni, 2009).

Contradictorily, avoidance-oriented coping strategies (i.e., cognitive-emotional activity directed away from a stressor; Roth & Cohen, 1986) being indicators of a lack of cognitive processing were also found to be related to higher levels of PTG. For example, denial coping was positively associated with PTG in a meta-analysis focusing on individuals after various types of potentially traumatic events (Helgeson et al., 2006). This positive association with avoidance-oriented coping strategies (denial, behavioral disengagement) also

remained in multivariate analyses when controlling for approach-oriented coping (e.g., Gangstad, Norman, & Barton, 2009; Lelorain, Bonnaud-Antignac, & Florin, 2010; Park, Riley, & Snyder, 2012). Similarly, a longitudinal study in individuals with SCI (Pollard & Kennedy, 2007) found both mental disengagement, an avoidance-oriented coping strategy, and active coping, which involves thoughts about the action to take and thus represents a derivative of approach-oriented coping, to predict higher PTG levels measured later on.

These findings are puzzling in that PTG was cross-sectionally and longitudinally associated with both indicators of enhanced cognitive processing and indicators of diminished cognitive processing. The current study aimed to examine two possible explanations for these findings.

One explanation may be that PTG is not a uniform construct, but reflects realistic views on psychological changes for some individuals and illusory ones for others: These two facets of PTG may be differently associated with different types of coping, as hypothesized in the Janus face model of PTG (Maercker & Zoellner, 2004; Zoellner & Maercker, 2006). More precisely, the Janus face model of PTG tries to account for findings that PTG was predicted by different types of coping and that it was inconsistently associated with indicators of adjustment to trauma across different studies (see e.g., Shand et al., 2015, for a review). PTG representing realistic changes is thought to result from constructive cognitive processing (i.e., to be predicted by approach-oriented coping), as hypothesized by Tedeschi and Calhoun (2004), and to be associated with good adjustment. In contrast, illusory PTG perceptions are expected to reflect a cognitive distortion, acting as a self-defense mechanism, which may help to restore self-esteem and to manage emotional distress in the short-term, but not long-term. Instead of resulting from cognitive processing, this illusory facet of PTG is therefore assumed to be associated with avoidance-oriented coping over time, indicating that it may serve the function of denial and repression (Maercker & Zoellner, 2004; Zoellner & Maercker, 2006). In sum, illusory PTG reports are proposed to be predicted by avoidance-oriented coping

strategies, whereas realistic PTG reports are predicted by approach-oriented coping strategies.

To examine whether the potential two PTG facets are indeed predicted by these different types of coping strategies, it is necessary to differentiate between realistic and illusory reports of PTG. One way to distinguish between individuals experiencing realistic and illusory PTG may be whether they also report negative consequences of trauma (i.e., posttraumatic depreciation, PTD). PTG and PTD, even when experienced in the same dimensions (e.g., better relationships with some individuals and worse with others), were found to be unrelated (e.g., Baker, Kelly, Calhoun, Cann, & Tedeschi, 2008; Cann, Calhoun, Tedeschi, & Solomon, 2010) or even positively related (Kunz, Joseph, Geyh, & Peter, 2017; Val & Linley, 2006) demonstrating that both can co-occur. However, following Maercker and Zoellner (2004), illusory PTG may hinder individuals from acknowledging PTD as it is proposed to serve an avoidant-, denial-like function. Similarly, Park (1998) argued that acknowledging PTD paired with PTG may reflect a realistic view on posttraumatic life changes, whereas individuals only reporting PTG may be in a denial-like stage. Supporting this assumption, Cheng, Wong, and Tsang (2006) found that individuals reporting both PTG and PTD scored lower on a measure of defensiveness compared to individuals reporting PTG but no PTD.

In other studies, PTG was associated with better adjustment in individuals who concurrently experienced higher levels of PTD, but unrelated among those who experienced lower levels of PTD (Cann et al., 2010; Kunz et al., 2017). Following the Janus face model, a similar moderation effect of PTD may be expected regarding the prediction of PTG by approach- and avoidance-oriented coping. In individuals acknowledging PTD jointly with PTG, approach-oriented coping strategies may be stronger predictors of PTG indicating that their PTG perceptions reflect a result of cognitive processing and thus a realistic view. In contrast, avoidance-oriented coping strategies may be stronger PTG predictors in individuals reporting low levels of PTD indicating that PTG itself reflects an avoidant, denial-like coping

strategy, which interferes with the reporting of PTD. Such moderation effects of PTD have, however, never been empirically tested.

An alternate explanation for the finding that both approach- and avoidance-oriented coping strategies were positively related to PTG in previous research assumes a uniform PTG construct. Meaning, that it could be a flexible, situationally dependent use of both approach- and avoidance-oriented coping, rather than cognitively approaching trauma persistently that contributes to this experience. The intense and enduring challenges that result from potentially traumatic events may require extreme and competing types of coping over time (Bonanno & Burton, 2013). Joseph and Linley (2005) posited in their PTG model that managing distressing emotions in the initial phase after trauma is a prerequisite to engage in cognitive processing. In their theory, the function of avoidance-oriented coping is understood to reduce distress in such a way to actually allow the person to manage the confrontation with the trauma-related information, thus, ultimately giving way for the person to cognitively approach it (see also Horowitz, 1986; Janoff-Bulman, 2006). Therefore, individuals are required to be able to draw flexibly among both approach- and avoidance-oriented coping according to the situational demands. This ability is termed regulatory or coping flexibility (e.g., Bonanno & Burton, 2013). Indeed, PTG was found to be positively associated with coping flexibility in cross-sectional studies (Cohen & Katz, 2015; Pat-Horenczyk et al., 2016), but replicating these findings in a longitudinal study would allow for stronger causal inference.

Current Study

The objective of the current study was to examine the role of coping strategies in the development of PTG in individuals with SCI. More specifically, this study aimed to (a) replicate previous findings illustrating that higher PTG is predicted by both approach- and avoidance-oriented coping in a longitudinal design and to (b) test the two proposed and competing explanations for this finding. Explanation 1, the *Janus face of PTG hypothesis*,

assumed that PTG is predicted differently by approach- and avoidance-oriented coping strategies depending on the degree to which individuals report PTD. In individuals reporting higher levels of PTD, PTG may be predicted by approach- but not avoidance-oriented coping indicating a realistic view on posttraumatic life changes. In contrast, for individuals reporting low levels of PTD, PTG may be predicted by avoidance- but not approach-oriented coping indicating an illusory view on positive life changes and an ongoing attempt to avoid the negative impact of the injury. Explanation 2, the *coping flexibility hypothesis*, stated that the ability to draw flexibly among both approach- and avoidance-oriented coping strategies predicts higher levels of PTG.

Method

Participants and Procedure

Data in the current study were collected as part of the on-going Larger Study (LS; name and reference edited out for blind review). LS is an inception cohort study following individuals newly diagnosed with an SCI across their clinical rehabilitation and onwards. It aims to include all individuals newly diagnosed with an SCI who have a permanent residence in X [edited out for blind review], are 16 years or older, and are admitted to one of the four collaborating national SCI rehabilitation centers ([edited out for blind review]). Excluded are individuals with congenital conditions leading to SCI, including spina bifida, new SCI in the context of palliative care, and neurodegenerative disorders (e.g., multiple sclerosis). LS was formally approved by the principal ethics committee on research involving humans of X [edited out for blind review] and subsequently endorsed by all other regional ethics committees involved.

After giving written informed consent, participants in LS completed clinical assessments and questionnaires provided in German, French and Italian at four measurement time points during clinical rehabilitation: one (T1), three (T2), and six months (T3) after SCI

diagnosis and at rehabilitation discharge (T4; [reference edited out for blind review]). The T4 assessment was not at the same time after SCI diagnosis for every participant, because duration of clinical rehabilitation varied depending on the severity of the injury (see Table 1). As a result, participants with a short duration of clinical rehabilitation did not complete all the assessments before the discharge assessment and/or the discharge assessment was collapsed with other measurement occasions.

The current study used data on certain psychological measures collected at T1 (i.e., control variables), T2 (i.e., coping), and T4 (i.e., PTG and PTD) and based its reporting on the STROBE statement (von Elm et al., 2007). The 318 patients who participated in LS and completed their clinical rehabilitation until January 24, 2017, were considered for the current study. For the specific purpose of the study, we excluded participants for whom measurement occasions were collapsed (n = 74) and participants who entered the study after T1 (n = 79), did not complete one of the follow up assessments (n = 33), or did not answer complete scales regarding our main variables of interest (i.e., coping, PTG, PTD; n = 10) as they were considered as providing too little information to reliably impute missing values (see Figure 1). Therefore, the sample size of the current study was n =122. In this sample, the time between the T2 and the T4 assessment was on average M = 88.20 days (SD = 56.63). Further sample characteristics are shown in Table 1.

Included participants were comparatively similar to those that were excluded. They did not differ significantly regarding gender, marital status, age at injury, and cause and type of the lesion. However, excluded participants had a shorter duration of clinical rehabilitation (t (316) = 4.82, p < .001, d = .56) and differed from included participants regarding the language of the questionnaire (χ^2 (2) = 11.24, p = .004, V = .19). Participants answering to a German questionnaire (106 of 143) were more likely to be included than those answering a French (16 of 43) or Italian (0 of 10) questionnaire.

Measures

PTG and PTD (T4). PTG was measured using the short version of the Posttraumatic Growth Inventory (PTGI-SF; Cann, Calhoun, Tedeschi, Taku, et al., 2010). With 10 items, the PTGI-SF assesses positive changes in the following domains: improved relationships, recognizing new possibilities for one's life, greater appreciation of life, greater sense of personal strength, and spiritual development. Participants were instructed to rate the degree to which they experienced the respective change in each item as a result of their SCI using a six-point Likert scale from 0 (*I did not experience this change*) to 5 (*I experienced this change to a very great degree*). PTD was measured with 10 corresponding but negatively worded items selected from the Paired Format Posttraumatic Growth Inventory (PTGI-42; Baker et al., 2008). Total PTG and PTD scores were calculated separately as sum scores with higher scores indicating greater PTG or PTD (possible range of 0 to 50). The PTGI-SF and the PTGI-42 were shown to be reliable and valid instruments (Baker et al., 2008; Cann, Calhoun, Tedeschi, Taku, et al., 2010) and also the factorial structure of the reduced 20 item version of the PTGI-42 was supported (Kunz et al., 2017).

Coping and coping flexibility (T2). Items of the Brief COPE (Carver, 1997) were used to assess coping strategies individuals adopted to handle problems and distress resulting from SCI. The Brief COPE uses a Likert-scale response format ranging from 1 (*I haven't been doing this at all*) to 4 (*I've been doing this a lot*) and consists of 14 subscales. Minimally acceptable reliability was reported regarding these subscales despite they consist of only two items each (Carver, 1997). Previous research (Kapsou, Panayiotou, Kokkinos, & Demetriou, 2010) rather consistently identified higher order factors reflecting approach- (consisting of the subscales acceptance, positive reinterpretation, active, and planning coping) and avoidance-oriented coping (subscales denial, self-distraction and behavioral disengagement). To operationalize approach- and avoidance-oriented coping, we therefore tested this previously identified higher order factor structure in the current sample using confirmatory factor analysis. In doing so, we found that the subscales self-distraction and behavioral

disengagement showed nonsignificant factor loadings on the avoidance-oriented coping factor. Additionally, these two subscales and the subscale planning coping showed insufficient internal consistency ($\alpha < .50$). Based on these examinations, we excluded the subscales planning coping, self-distraction, and behavioral disengagement from further analyses. Accordingly, we had to create the approach-oriented coping factor (sumscore with a possible range of 6 to 24) consisting of the subscales acceptance, positive reinterpretation, and active coping and the avoidance-oriented coping factor (sumscore with a possible range of 2 to 8) consisting of the denial subscale only.

To create a coping flexibility score, we combined the approach- and the avoidance-oriented coping factors into an index reflecting the ability to use both types of coping equally likely. Following the procedure of Bonanno, Pat-Horenczyk, and Noll (2011), we standardized the scores for the approach- and the avoidance-oriented coping factors, then summed the two factor scores and subtracted coping polarity (absolute average of approach- minus absolute average of avoidance-oriented coping factor). Thus, a high use of both approach- and avoidance-oriented coping strategies produces a high sum score and relatively little polarity resulting in a high flexibility score. Convergent, divergent, and incremental validity for such a flexibility score, which combines two subscales broadly defined as approach- and avoidance-oriented coping, has been reported using the Perceived Ability to Cope With Trauma (PACT) scale (Bonanno et al., 2011).

Control variables (T1). We controlled for psychological distress, social support, and dispositional optimism as potential confounders, because previous research (e.g., Helgeson et al., 2006; Prati & Pietrantoni, 2009; Taylor & Stanton, 2007) showed them to be related to both PTG and to the use of specific coping strategies. To measure *posttraumatic stress reactions* as a response to SCI, the Impact of Event Scale-6 (IES-6; Thoresen et al., 2010) was used. The IES-6 is a short form of the Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1997), designed to reduce participant burden in large surveys such as LS. Two items

each cover the PTSD symptom clusters intrusion, avoidance, and hyperarousal. Symptom severity was measured using five response options ranging from 0 (*not at all*) to 4 (*extremely*). The corresponding sum score (possible range = 0-24) correlated strongly with the sum score of the IES-R across different trauma samples (pooled r = .95) and proved acceptable internal consistency (Thoresen et al., 2010). *Social support* was assessed using six survey questions of the Swiss Household Panel Wave 12 (2010-2011; Tillmann et al., 2016). Respondents indicated for three different sources (partner, family, friends) the extent to which they were provided with practical (i.e., concrete help or advice) and emotional support (i.e., being available and showing understanding), if needed. The answers were given on a scale from 0 (*not at all*) to 10 (*a great deal*). The item scores were combined into a mean score (possible range of 0 to 10). Another item of the Swiss Household Panel Wave 12 was used as a proxy for *dispositional optimism*. Respondents were asked "Are you often experiencing plenty of strength, energy, and optimism?" Response options ranged from 0 (*never*) to 10 (*always*).

Data Analysis

Data cleaning and calculating descriptive statistics was done using Stata, version 14. Between 0% and 13.9% of the participants had missing values in the study variables (Table 2). We conducted multiple imputation with chained equations (MICE) to deal with the missing data. Using the mice package in R (van Buuren & Groothuis-Oudshoorn, 2011) we created 20 imputed data sets, which was considered to be an adequate number following recommendations by Graham, Olchowski, and Gilreath (2007).

We imputed the missing data at the scale and interaction level (i.e., centering of respective predictor variables and calculating interaction terms prior to imputation), as transforming variables after the imputation introduces bias (von Hippel, 2009). Besides all variables used in subsequent regression models, we included gender, age, type of injury, and

duration of rehabilitation as auxiliary variables in the imputation model. In order to reduce the loss of power resulting from scale level imputation, we also included items of each scale as auxiliary variables (Enders, 2010). We selected those items with the least amount of missing values and the highest correlation with the total score (see van Buuren & Groothuis-Oudshoorn, 2011).

After the imputation, we analyzed each of the 20 imputed data sets separately and pooled the results according to Rubin's rules (Barnard & Rubin, 1999; Rubin, 1987). As a measure of the uncertainty in each parameter estimate attributable to missing data, we report the fraction of missing information (FMI). The FMI is the proportion of the variability of an estimate that is due to the missing data (Enders, 2010). Values up to .2 can be considered as modest, .3 as moderate, and .5 as large (Van Buuren, 2012). To examine our research questions, we ran a series of hierarchical linear regression analyses. In the first block of each regression model, we entered the different rehabilitation centers as dummy-coded predictor variables to take into account the clustering of the data by the four clinics. Using such a fixed effect model for accommodating clustered data is recommended when the number of clusters is low (i.e., below 10) and the research interest is exclusively on the individual level (Cohen, Cohen, West, & Aiken, 2003; see also McNeish & Stapleton, 2016). We also entered symptoms of PTSD, social support, and optimism as control variables in the first block (Baseline Model). To test whether both approach- and avoidance-oriented coping independently predict PTG, we then included these variables as predictors in a second block (Model 1). To examine the Janus face of PTG hypothesis, we then included the potential moderator PTD in the third block (Model 1.1) and the interaction terms of PTD and approach- (Model 2) or avoidance-oriented coping (Model 3) in the fourth block. To test the coping flexibility hypothesis, we included the coping flexibility score instead of the independent approach- and avoidance-oriented coping scores in the second block (Model 4). The nested models were compared using a Wald test (see Meng & Rubin, 1992).

Two types of sensitivity analyses were performed. First, the regression analyses were reran in each imputed data set using nonparametric bootstrapping with 1000 repetitions with the boot package in R (Canty & Ripley, 2016; Davison & Hinkley, 1997) to account for the small sample size and potential violations of the assumptions underlying regression analyses. To check for possible bias resulting from imputation, the main analyses were reran using only complete cases.

Results

Descriptive Statistics and Bivariate Correlations

The descriptive statistics of all study variables and the bivariate correlations are presented in Table 2. PTG was significantly positively related to approach-oriented coping (r = .24, p = .010), coping flexibility (r = .20, p = .029), PTD (r = .46, p < .001), and symptoms of PTSD (r = .24, p = .004). Except the moderate correlation with PTD, all of these effects were weak (Cohen, 1992). PTG was also weakly positively related to avoidance-oriented coping (r = .18, p = .062) and weakly negatively related to dispositional optimism (r = -.18, p = .063), although these associations only approached borderline significance.

Hierarchical Regression Analyses

The pooled results of the nested multiple regression models testing our research questions in the 20 imputed data sets are summarized in Table 3. For brevity, only results regarding models directly testing our research aims are reported.

Approach- and avoidance-oriented coping as independent predictors of PTG. Compared to the Baseline Model, the additional inclusion of approach- and avoidance-oriented coping in Model 1explained another 12% of the variance in PTG and resulted in a significantly better fitting model, D_m (2, 1649.82) = 7.63, p < .001. Both, a more frequent use of approach- (β = .30, p = .001) and avoidance-oriented coping (β = .23, p = .011) within the

first three months after SCI diagnosis predicted higher levels of PTG at rehabilitation discharge.

Testing the Janus face of PTG hypothesis. The inclusion of the interaction term of PTD and approach-oriented coping (β = .03, *p* = .743) in Model 2 and the one of PTD and avoidance-oriented coping (β = -.04, *p* = .656) in Model 3 did not significantly improve the model fit compared to Model 1.1. Both interaction terms were not statistically significant. Neither approach- nor avoidance-oriented coping differently predicted PTG depending on PTD levels.

Testing the coping flexibility hypothesis. In Model 4, the inclusion of the coping flexibility score (β = .23, *p* = .012) instead of approach- and avoidance-oriented coping as independent predictors significantly increased the model fit, D_m (1, 3124.38) = 6.47, *p* < .011), compared to the Baseline Model and explained additional 5% of the variance in PTG. A higher coping flexibility score measured at three months after SCI diagnosis predicted higher PTG levels assessed at discharge from clinical rehabilitation.

Sensitivity Analyses

Bootstrapping of the 95% confidence interval of the unstandardized regression coefficients in all regression models supported the findings from above (see supplementary Table S1). Furthermore, the complete case analysis (*n* = between 89 and 91 depending on the model tested) resulted in similar findings as well. However, the effects of symptoms of PTSD (β between .20 and .29 in Models 1-4), approach-oriented coping (β between .36 and .43 in Models 1-3), and PTD (β = .44 in Models 2-3) tended to be stronger in the complete case analyses, whereas the effect of avoidance-oriented coping (β between .02 and .17 in Models 1-3) tended to be weaker (see supplementary Table S2).

Discussion

The current study examined the role of approach- (i.e., positive reinterpretation, acceptance, and active coping) and avoidance-oriented coping strategies (i.e., denial) assessed three months post-injury as predictors of PTG at rehabilitation discharge among individuals recently diagnosed with an SCI. Supporting previous research (e.g., Helgeson et al., 2006), we found that both types of coping strategies significantly predicted higher levels of PTG, even when controlling for initial symptoms of PTSD, social support, and optimism. We then tested two possible explanations for this finding. First, we did not find empirical support for the Janus face of PTG hypothesis as an explanation: PTD did neither moderate the effect of approach- nor avoidance-oriented coping on PTG. In contrast, we found support for the second explanation, the coping flexibility hypothesis: Coping flexibility significantly predicted higher levels of PTG.

Degree of PTD and Different Types of Coping Indicating Two Faces of PTG?

We did not find indications that PTG might have reflected different facets in the current sample which could explain its positive association with both approach- and avoidance-oriented coping strategies. However, the results of the respective moderation analyses should be interpreted carefully as the relatively small sample size limited power to detect small effects (see strengths and limitations section). If replicated in studies with larger sample sizes, the finding that PTD does not moderate the prediction of PTG by approach- and avoidance-oriented coping would contradict the reasoning that self-perceived PTG may have two faces; one that reflects realistic changes resulting from cognitive processing, the other (ongoing) denial or avoidance of negative changes, as hypothesized in the Janus face model of PTG (Maercker & Zoellner, 2004; Zoellner & Maercker, 2006) and by Park (1998). In short, we did not find evidence for another face of PTG besides the one resulting from constructive cognitive processing, which is indicative of a realistic view on posttraumatic life changes following the Janus face model.

Coping Flexibility as a Predictor of PTG?

The results supported the coping flexibility hypothesis as an explanation that PTG was positively related to the use of both approach- and avoidance-oriented coping within the first three months post-injury. Importantly, our results confirm and expand previous cross-sectional research finding that flexible coping is positively associated with PTG (e.g., Cohen & Katz, 2015). A flexible use of approach- and avoidance-oriented coping strategies may thus enable individuals to process trauma at times, but also to avoid thoughts and activities when such a confrontation is too overwhelming, which together, may enable the experience of PTG (see also Janoff-Bulman, 2006). This finding is compatible with Joseph and Linley's (2005) PTG model which integrates such a function of avoidance-oriented coping as a means for distress reduction preceding engagement in cognitive processing.

Considering the solid theoretical background but very limited empirical research regarding both the Janus face of PTG and the coping flexibility hypotheses, the current study is as one of the first steps to close those important research gaps. In this respect, this is the first longitudinal study examining and finding a flexible use of approach- and avoidance-oriented coping strategies to predict higher PTG levels after potentially traumatic events such as SCI. Moreover, as we found limited support for the Janus face of PTG hypothesis, we increased confidence that the potential two facets of PTG being predicted differently by these types of coping may not serve as an alternative explanation for those findings.

Limitations and future research

This study is subject to several limitations which need to be considered when interpreting the results. First, we used a limited and unbalanced set of different approach- (positive reinterpretation, acceptance, active coping) and avoidance-oriented coping strategies (denial). We operationalized avoidance-oriented coping only with the Brief COPE's denial subscale, because other avoidance-oriented coping subscales were low in reliability. Different

theories about adaptation to the onset of a chronic disability highlight that denial can have both adaptive (e.g., stress reduction) and maladaptive (e.g., interference with psychosocial reorganization) functions, depending on the context and the duration of its use (see Livneh, 2009a, for a review). In support of these ideas, denial has been found to be inconsistently associated with different indicators of psychosocial adaptation (Livneh, 2009b; van Leeuwen, Kraaijeveld, Lindeman, & Post, 2012). Nevertheless, these findings suggest that denial can act as a means to reduce distress in this context. However, individuals with SCI also use other avoidance-oriented coping strategies such as mental disengagement or self-distraction in order to reduce distress resulting from SCI (e.g., Pollard & Kennedy, 2007). Thus, assessing avoidance-oriented coping more broadly may reveal stronger effects on PTG, also regarding the flexibility score. This could be tested in future studies.

Second, our measure of coping flexibility was limited in that higher levels only indicate that individuals were more likely to have used both approach- and avoidance-oriented coping strategies since the onset of SCI. However, this does not allow inferences to be made about when and in which order individuals used the different types of coping. Therefore, an important avenue for future research is to assess the use of approach- and avoidance-oriented coping at multiple time points after potentially traumatic events as predictors of subsequent PTG. This would allow for a better understanding of their interplay in the development of PTG. Furthermore, future studies could also examine whether the use of different types of coping in PTG development actually corresponds to situational demands. This would integrate the concept of coping flexibility, as outlined by Bonanno and Burton (2013), more fully into PTG research.

Third, operationalizing coping flexibility by using measures which were not specifically developed to assess coping flexibility is a common practice, but generally reveals weaker effect sizes than by using instruments specifically designed to measure this construct (see Cheng, Lau, & Chan, 2014, for a review). Thus, future longitudinal studies replicating

the current findings by using specific measures of coping flexibility, such as the PACT scale (Bonanno et al., 2011), are needed to be able to judge the importance of flexible coping in PTG development more precisely.

Fourth, the statistical power to detect interaction effects may have been low, favoring the coping flexibility hypothesis, which tested only main effects, over the Janus face of PTG hypothesis. Assuming ideal conditions (e.g., perfect reliability), the minimally required sample size to detect interaction effects is N = 26, 55, and 392 for large, moderate, and small effect sizes respectively (Cohen, 1988). In practice, however, determining the minimally required sample size regarding regression models including interaction terms can hardly be done (Dawson, 2014). Therefore, we relied on the sample size of another study (N = 102) finding significant interaction terms when examining the Janus face model of PTG (Zoellner, Rabe, Karl, & Maercker, 2008) and used bootstrapping to increase confidence in the results. Nevertheless, as measurement error can result in a loss of power (Dawson, 2014), we may have missed small effects given the limited reliability of our measures of approach- and avoidance-oriented coping.

Conclusion and Clinical Implications

The results of the current study contribute to a better understanding of the processes leading to the experience of PTG. We found PTG to be predicted by the prior use of both approach- and avoidance-oriented coping and the coping flexibility concept to be a suitable explanation for this finding. Therefore, clinical interventions aiming to foster the experience of PTG in individuals with SCI or potentially also after other potentially traumatic events could focus on a coping training, particularly on imparting information about the appropriate use of both approach- and avoidance-oriented coping strategies. Findings regarding the relationship between avoidance-oriented coping strategies such as denial and adjustment outcomes in general are mixed (van Leeuwen et al., 2012), but indicate that the effects are

more beneficial when such coping strategies are used sparingly and early in the adaptation process to SCI and other chronic disabilities (Livneh, 2009b). Though negative consequences may be expected when used constantly, a restricted use of denial and potentially other avoidance-oriented coping strategies may allow for a temporary reprieve from distress and to gradually accept the onset of the disability as well as to mobilize other approach-oriented coping strategies such as positive reappraisal (Livneh, 2009a). Regarding PTG development, however, more fine-grained research about the temporal and situational dependency of the adequacy of approach- and avoidance-oriented coping strategies is needed.

References

Baker, J. M., Kelly, C., Calhoun, L. G., Cann, A., & Tedeschi, R. G. (2008). An examination of posttraumatic growth and posttraumatic depreciation: Two exploratory studies. *Journal of Loss and Trauma, 13*, 450-465. doi: 10.1080/15325020802171367

Barnard, J., & Rubin, D. B. (1999). Small-sample degrees of freedom with multiple imputation. *Biometrika, 86*, 948-955. doi: 10.1093/biomet/86.4.948

Bonanno, G. A., & Burton, C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on Psychological Science, 8*, 591-612. doi: 10.1177/1745691613504116

Bonanno, G. A., Pat-Horenczyk, R., & Noll, J. (2011). Coping flexibility and trauma: The Perceived Ability to Cope With Trauma (PACT) scale. *Psychological Trauma: Theory, Research, Practice, and Policy, 3*, 117-129. doi: 10.1037/a0020921

Cann, A., Calhoun, L. G., Tedeschi, R. G., & Solomon, D. T. (2010). Posttraumatic growth and depreciation as independent experiences and predictors of well-being. *Journal of Loss and Trauma, 15*, 151-166. doi: 10.1080/15325020903375826

Canty, A., & Ripley, B. (2016). boot: Bootstrap R (S-Plus) functions (Version 1.3.18).

Retrieved from http://CRAN.R-project.org/package=boot

Carver, C. S. (1997). You want to measure coping but your protocol's too long: Consider the Brief COPE. *International Journal of Behavioral Medicine, 4*, 92-100. doi: 10.1207/s15327558ijbm0401_6

Cheng, C., Lau, H.-P. B., & Chan, M.-P. S. (2014). Coping flexibility and psychological adjustment to stressful life changes: A meta-analytic review. *Psychological Bulletin, 140*, 1582-1607. doi: 10.1037/a0037913

Cheng, C., Wong, W.-M., & Tsang, K. W. (2006). Perception of benefits and costs during SARS outbreak: An 18-month prospective study. *Journal of Consulting and Clinical Psychology, 74*, 870-879. doi: 10.1037/0022-006x.74.5.870

Chun, S., & Lee, Y. (2008). The experience of posttraumatic growth for people with spinal cord injury. *Qualitative Health Research, 18*, 877-890. doi: 10.1177/1049732308318028

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Mahwah: NJ: Lawrence Erlbaum Associates.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155-159. doi: 10.1037/0033-2909.112.1.155

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Cohen, O., & Katz, M. (2015). Grief and growth of bereaved siblings as related to attachment style and flexibility. *Death Studies, 39*, 158-164. doi: 10.1080/07481187.2014.923069

Craig, A., Tran, Y., & Middleton, J. (2009). Psychological morbidity and spinal cord injury: A systematic review. *Spinal Cord, 47*, 108-114. doi: 10.1038/sc.2008.115

Davison, A. C., & Hinkley, D. V. (1997). *Bootstrap methods and their applications*. Cambrigde, UK: Cambridge University Press.

Dawson, J. F. (2014). Moderation in management research: What, why, when, and how. *Journal of Business and Psychology, 29*, 1-19. doi: 10.1007/s10869-013-9308-7

Enders, C. K. (2010). *Applied missing data analysis*. New York, NY: Guilford Press.

Gangstad, B., Norman, P., & Barton, J. (2009). Cognitive processing and posttraumatic growth after stroke. *Rehabilitation Psychology, 54*, 69-75. doi: 10.1037/a0014639

Graham, J. W., Olchowski, A. E., & Gilreath, T. D. (2007). How many imputations are really needed? Some practical clarifications of multiple imputation theory. *Prevention Science, 8*, 206-213. doi: 10.1007/s11121-007-0070-9

Helgeson, V. S., Reynolds, K. A., & Tomich, P. L. (2006). A meta-analytic review of benefit finding and growth. *Journal of Consulting and Clinical Psychology, 74*, 797-816. doi: 10.1037/0022-006x.74.5.797

Horowitz, M. J. (1986). *Stress response syndromes* (2nd ed.). New York, NY: Free Press.

Janoff-Bulman, R. (2006). Schema-change perspectives on posttraumatic growth. In L. G. Calhoun & R. G. Tedeschi (Eds.), *Handbook of posttraumatic growth - Research and practice* (pp. 81-99). Mahwah, NJ: Lawrence Earlbaum Associates.

Joseph, S., & Linley, P. A. (2005). Positive adjustment to threatening events: An organismic valuing theory of growth through adversity. *Review of General Psychology, 9*, 262-280. doi: 10.1037/1089-2680.9.3.262

Kapsou, M., Panayiotou, G., Kokkinos, C. M., & Demetriou, A. G. (2010). Dimensionality of coping: An empirical contribution to the construct validation of the Brief-COPE with a Greek-speaking sample. *Journal of Health Psychology, 15*, 215-229. doi: 10.1177/1359105309346516

Kunz, S., Joseph, S., Geyh, S., & Peter, C. (2017). Posttraumatic growth and adjustment to spinal cord injury: Moderated by posttraumatic depreciation? *Psychological Trauma: Theory, Research, Practice, and Policy, 9*, 434-444. doi: 10.1037/tra0000164

Lelorain, S., Bonnaud-Antignac, A., & Florin, A. (2010). Long term posttraumatic growth

after breast cancer: Prevalence, predictors and relationships with psychological health. *Journal of Clinical Psychology in Medical Settings, 17,* 14-22. doi: 10.1007/s10880-009-9183-6

Livneh, H. (2009a). Denial of chronic illness and disability: Part 1. Theoretical, functional, and dynamic perspectives. *Rehabilitation Counseling Bulletin, 52,* 225-236. doi: 10.1177/0034355209333689

Livneh, H. (2009b). Denial of chronic illness and disability: Part II. Research findings, measurement considerations, and clinical aspects. *Rehabilitation Counseling Bulletin, 53,* 44-55. doi: 10.1177/0034355209346013

Maercker, A., & Zoellner, T. (2004). The Janus face of self-perceived growth: Toward a two-component model of posttraumatic growth. *Psychological Inquiry, 15*, 41-48.

McNeish, D., & Stapleton, L. M. (2016). Modeling clustered data with very few clusters. *Multivariate Behavioral Research, 51*, 495-518. doi: 10.1080/00273171.2016.1167008

Meng, X.-L., & Rubin, D. B. (1992). Performing likelihood ratio tests with multiply-imputed data sets. *Biometrika, 79*, 103-111. doi: 10.1093/biomet/79.1.103

Park, C. L. (1998). Implications of posttraumatic growth for individuals. In R. G. Tedeschi, C. L. Park & L. G. Calhoun (Eds.), *Posttraumatic growth: Positive changes in the aftermath of crisis* (pp. 149-172). Mahwah, NJ: Lawrence Erlbaum Associates.

Park, C. L., Riley, K. E., & Snyder, L. B. (2012). Meaning making coping, making sense, and post-traumatic growth following the 9/11 terrorist attacks. *The Journal of Positive Psychology, 7,* 198-207. doi: 10.1080/17439760.2012.671347

Pat-Horenczyk, R., Saltzman, L. Y., Hamama-Raz, Y., Perry, S., Ziv, Y., Ginat-Frolich, R., & Stemmer, S. M. (2016). Stability and transitions in posttraumatic growth trajectories among cancer patients: LCA and LTA analyses. *Psychological Trauma: Theory, Research, Practice, and Policy, 8*, 541-549. doi: 10.1037/tra0000094

Pollard, C., & Kennedy, P. (2007). A longitudinal analysis of emotional impact, coping strategies and post-traumatic psychological growth following spinal cord injury: A 10-year review. *British Journal of Health Psychology, 12*, 347-362. doi: 10.1348/135910707x197046

Prati, G., & Pietrantoni, L. (2009). Optimism, social support, and coping strategies as factors contributing to posttraumatic growth: A meta-analysis. *Journal of Loss and Trauma, 14*, 364-388. doi: 10.1080/15325020902724271

Roth, S., & Cohen, L. J. (1986). Approach, avoidance, and coping with stress. *American Psychologist, 41*, 813-819. doi: 10.1037/0003-066x.41.7.813

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York, NY: Wiley.

Shand, L. K., Cowlishaw, S., Brooker, J. E., Burney, S., & Ricciardelli, L. A. (2015). Correlates of post-traumatic stress symptoms and growth in cancer patients: A systematic review and meta-analysis. *Psycho-Oncology, 24*, 624-634. doi: 10.1002/pon.3719

Taylor, S. E., & Stanton, A. L. (2007). Coping resources, coping processes, and mental health. *Annual Review of Clinical Psychology, 3*, 377-401. doi: 10.1146/annurev.clinpsy.3.022806.091520

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15*, 1-18. doi: 10.1207/s15327965pli1501_01

Thoresen, S., Tambs, K., Hussain, A., Heir, T., Johansen, V. A., & Bisson, J. I. (2010). Brief measure of posttraumatic stress reactions: Impact of Event Scale-6. *Social Psychiatry and Psychiatric Epidemiology, 45*, 405-412. doi: 10.1007/s00127-009-0073-x

Tillmann, R., Voorpostel, M., Kuhn, U., Lebert, F., Ryser, V.-A., Lipps, O., . . . Antal, E. (2016). The Swiss Household Panel Study: Observing social change since 1999. *Longitudinal and Life Course Studies: International Journal, 7*, 64-78. doi:

10.14301/llcs.v7i1.360

Val, E. B., & Linley, P. A. (2006). Posttraumatic growth, positive changes, and negative changes in Madrid residents following the march 11, 2004, Madrid train bombings. *Journal of Loss and Trauma, 11*, 409-424. doi: 10.1080/15325020600685519

Van Buuren, S. (2012). *Flexible imputation of missing data*. Boca Raton, FL: Chapman & Hall/CRC Press.

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software, 45*, 1-67. doi: 10.18637/jss.v045.i03

van Leeuwen, C. M., Kraaijeveld, S., Lindeman, E., & Post, M. W. (2012). Associations between psychological factors and quality of life ratings in persons with spinal cord injury: A systematic review. *Spinal Cord, 50*, 174-187. doi: 10.1038/sc.2011.120

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gotzsche, P. C., & Vandenbroucke, J. P. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. *The Lancet, 370*, 1453-1457. doi: 10.1016/s0140-6736(07)61602-x

von Hippel, P. T. (2009). How to impute interactions, squares, and other transformed variables. *Sociological Methodology, 39*, 265-291. doi: 10.1111/j.1467-9531.2009.01215.x

Weiss, D., & Marmar, C. (1997). The Impact of Event Scale-Revised. In J. P. Wilson & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD: A practitioner's handbook* (pp. 399-411). New York, NY: Guilford Press.

World Health Organization. (2013). *International perspectives on spinal cord injury*. Geneva, Switzerland: WHO Press.

Zoellner, T., & Maercker, A. (2006). Posttraumatic growth in clinical psychology: A critical review and introduction of a two component model. *Clinical Psychology Review, 26*, 626-653. doi: 10.1016/j.cpr.2006.01.008

Zoellner, T., Rabe, S., Karl, A., & Maercker, A. (2008). Posttraumatic growth in accident survivors: Openness and optimism as predictors of its constructive or illusory sides. *Journal of Clinical Psychology, 64,* 245-263. doi: 10.1002/jclp.20441

Tables

Table 1

Demographic and Injury-related Characteristics of the Sample (N = 122)

Characteristic	*n* (%)	*M*	*SD*	*n* (%) missing
Age at injury in years		54.30	16.48	0
Gender				0
Male	87 (71.3)			
Female	35 (28.7)			
Marital status				0
Single (never married)	34 (27.9)			
Married	70 (57.4)			
Widowed	6 (4.9)			
Divorced	12 (9.8)			
Duration of clinical rehabilitation in days		160.85	57.24	0
Type of injury				8 (6.6)
Incomplete paraplegia	50 (41.0)			
Complete paraplegia	24 (19.7)			
Incomplete tetraplegia	33 (27.1)			
Complete tetraplegia	6 (4.9)			
Intact	1 (0.8)			

Table 2

Distributional Properties and Pooled Correlation Coefficients of the Study Variables (N = 122)

Construct	*n* (%) missing[a]	α	*M*	*SD*	Range	1.	2.	3.	4.	5.	6.	7.	8.
1. PTG	15 (12.3)	.88	20.02	11.71	2-47	-	.24**	.18	.20*	.46***	.28**	-.03	-.18
2. Approach coping	4 (3.3)	.76	17.68	3.98	6-24		-	-.27**	.69***	-.22*	-.14	.15	.43***
3. Avoidance coping[b]	0	.75	9.39	4.85	6-24			-	.16	.41***	.27**	-.13	-.27**
4. Coping flexibility	4 (3.3)	-	-	-	-				-	.05	.04	-.06	.14
5. PTD	17 (13.9)	.89	10.33	10.04	0-50					-	.37***	-.20*	-.41***
6. Symptoms of PTSD	9 (7.4)	.72	7.30	4.53	0-24						-	-.17	-.39***
7. Social support	5 (4.1)	.77	7.21	2.18	0-10							-	.32***
8. Optimism	3 (2.5)	-	8.37	1.86	0-10								-

Note. α, *M*, *SD*, and range rely on unimputed data and correlations on imputed data. PTG = posttraumatic growth. PTD = posttraumatic depreciation. PTSD = posttraumatic stress disorder.

[a] *n* (%) participants with missing values in one or more items composing the scale. [b] Because coping flexibility is calculated as the proportion of approach (six items on a scale from 1-4) and avoidance coping (two items on a scale from 1-4), we multiplied the avoidance coping sum score by 3 to make the distributional characteristics comparable to the ones of approach coping.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table 3

Pooled Results of Hierarchical Multiple Regression Analyses Testing Incremental Prediction of PTG

	Model 1		Model 2		Model 3		Model 4	
Predictor	β	FMI	β	FMI	β	FMI	β	FMI
Symptoms of PTSD	.14	.27	.09	.26	.10	.23	.17	.25

Social support	.04	.13	.08	.15	.08	.16	.07	.12
Optimism	-.16	.24	-.09	.28	-.08	.22	-.12	.23
Approach coping	.30**	.17	.32***	.20	.32***	.22	-	-
Avoidance coping	.23*	.13	.11	.24	.12	.27	-	-
PTD			.30**	.39	.30**	.40	-	-
Approach coping x PTD			.03	.18	-	-	-	-
Avoidance coping x PTD					-.04	.55	-	-
Coping flexibility							.23*	.08
ΔR^2	.12		.00		.01		.05	
R^2	.28		.38		.39		.21	
(*df*1, *df*2) D_m	(2, 1649.82) 7.63***		(1, 501.22) 0.11		(1, 54.05) 0.20		(1, 3124.38) 6.47*	
Comparison	Model 1 vs Baseline[a]		Model 2 vs Model 1.1[b]		Model 3 vs Model 1.1[b]		Model 6 vs Baseline[a]	

Note. All models were adjusted for between clinic variance (results not exposed). PTSD = posttraumatic stress disorder. PTD = posttraumatic depreciation. β = standardized regression coefficient. FMI = fraction of missing information. ΔR^2 = increase in explained variance. R^2 = proportion of explained variance. *df* = degrees of freedom. D_m = Wald test statistic.

[a] Baseline Model = including the dummy-coded rehabilitation centers, symptoms of PTSD, social support and optimism as predictors. [b] Model 1.1 = including the dummy-coded rehabilitation centers, symptoms of PTSD, social support, optimism, approach- and avoidance-oriented coping, and PTD as predictors.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Figure

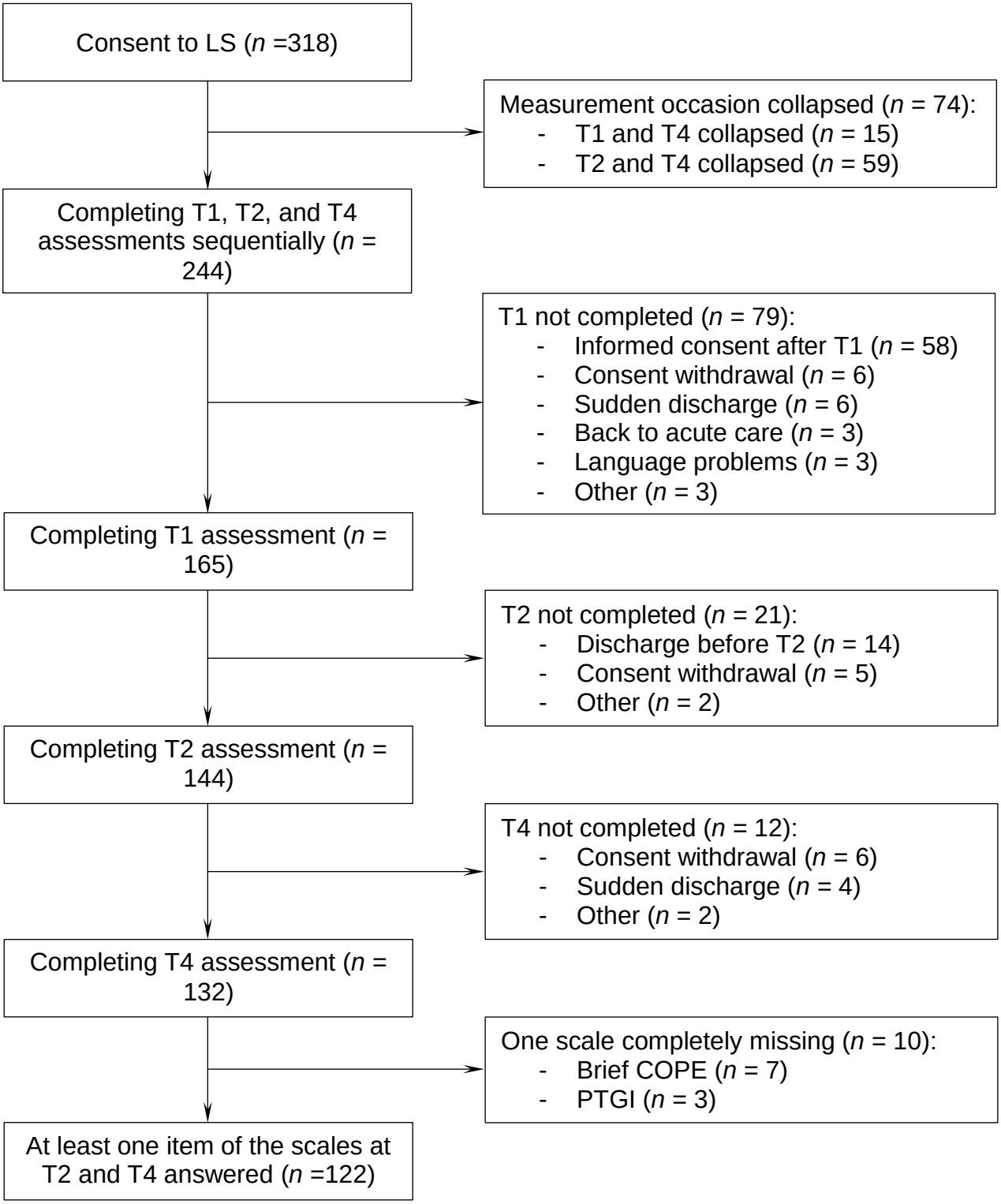

Figure 1. Flow diagram depicting participation in the current study.