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Importance of cognitive coping in facilitation of hypno-relaxation in stressed students and in anxious patients:
holistic psycho-neuroendocrino-immunological analysis
(Building telepathic contact with the inner adviser)

Final report

by

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Summary

We are especially interested to study the importance of cognitive psychological factors and hypnorelaxation in the reduction of stress/anxiety and in the maintenance of psycho-neuroendocrino-immune balance. We set out to investigate psychological stress both in healthy and in chronic anxious persons; the two stress model groups included students doing academic examinations and chronic anxious patients.

The major focus of our study is to show whether there could be a difference between the impact of a hypnorelaxation associated with special cognitive coping and that of a standard imagery hypnorelaxation – on the reduction of stress/anxiety level. In both groups, two hypnosis sessions were "routine ones" (with standard Leuner field imaginations), while the third one (in between) was complemented with cognitive coping suggestions to contact and to ask one, maybe two questions from the inner adviser.

The stress/anxiety level was determined in an integrative manner which means in addition to several psychotests (for the assessment of hypnotizability, anxiety, depression and stress-coping level), EMG-scan, stress hormone assays (ACTH, cortisol), and a sympathetic system indicator (chromogranin A), also tests of special inflammatory-immunological-lectin markers (in blood plasma: LL-37, lactoferrin; sICAM-1; IL-6; galectin-3; in saliva: lactoferrin). Biosamples were collected from the student/patient groups before and after three relaxation hypnosis sessions; samples in a pre-examination period were tested in students.

In case of **students**, cortisol concentration (in blood plasma) decreased considerably and significantly after the first and third hypnorelaxation of the standard type, while there was only a tendency of decrease after the second, special hypnorelaxation. Regarding the other stress hormone: ACTH, the decreases after all the three hypnorelaxation sessions were statistically significant. Interestingly, students had similarly high cortisol and ACTH concentrations before the examination period, than during it - before the three sessions. No changes could be detected in the chromogranin A level, in the concentrations of the special inflammatory-immunological-lectin markers, in the leukocyte counts, and in neutrophil percentage. Similarly, no changes were seen in psychotest scores, in blood pressure and in pulse rate. It is to be noted, that all these parameters were in the normal range.

In contrast, muscle tension of the tested skeletal muscles raised grossly (left stide: cca. 10-fold, right side: cca. 8-fold) with the onset of the examination period, and it remained high throughout the study. Surprisingly, there was a significant increase of the left-side muscle tension after the second hypnorelaxation (special type).

Thus, in students, standard hypnorelaxation appears to be effective to reduce the activity of the neuroendocrine system secreting ACTH and cortisol in the stressed state of the examination period. The cognitive type of hypnorelaxation seemed to be less effective in downregulating cortisol secretion; surprisingly, this psychotherapy type even resulted in raised muscle tension in contrast to the standard hypnorelaxation.

Concerning the **chronic anxious patients**, significant reduction of plasma cortisol was observed after the second and third hypnorelaxation. In contrast to the student group, no alterations could be detected in the values of ACTH, and similarly to students, in chromogranin A. It is worth noting, that all the values were in the normal ranges; however, the stress hormone levels tended to be lower, than in the students. No changes could be detected in the concentrations of the special inflammatory-immunological-lectin markers, in the leukocyte counts, in neutrophil percentage, in blood pressure and pulse rate values, as in the student group.

In parallel with the findings related to the students, muscle tension increased significantly after the second (special) hypnorelaxation in the patients, especially on the left side. In addition, there was a significant reduction in muscle tension following the first (standard) session on both sides; while no change occurred after the third (standard) session.

In contrast, the Spielberger psychotest indicated a marked decrease in state (current) anxiety after each hypnorelaxation in the patients. No alterations could be shown with all the rest of the psychotests. It is to be noted, that our patients were in a severely depressed state, with very limited stress-coping capacity (in the worst range), and had a mild-medium level of anxiety.

Summing up, the special cognitive coping type of hypnorelaxation (involving contact with the inner adviser) appeared less effective in the decrease of the highly elevated muscle tension both in the stressed students in the chronic anxious patients, in comparison to the standard relaxation-imagery hypnosis (with pleasant Leuner field suggestions). On the contrary, muscle tension was further increased after the special (second) hypnorelaxation, (especially) on the left side that may be due to a subconscious, increased stress in the right hemisphere of the brain.

Since the elevated state anxiety of the chronic patients was succesfully reduced by both types of hypnorelaxations, the related psychological and psychomotor systems may be differently affected by the cognitive coping type of hypnorelaxation.

The relatively high ACTH (cortisol) levels were effectively reduced by the hypnorelaxation sessions in the stressed students, while no alterations were seen in the anxiety scores, in the chromogranin A level, and in the inflammatory markers (in normal ranges). Thus, the main neuroendocrine stress system was responsive to the hypnorelaxation sessions in the students facing academic examinations. In contrast, the moderately increased ACTH level of the patients with chronic anxiety appeared to be non-responsive to the hypnorelaxations; and significant changes could be observed only in the case of cortisol.

All in all, muscle tension scores appear to be most sensitive markers of psychological stress both in students and in the chronic anxious patients. In the transiently stressed students, also stress hormones (ACTH, cortisol) could serve as appropriate markers to assess the stress level, while in the chronically anxious patients state anxiety inventories appeared to be more sensitive indicators than ACTH. Relaxed psychosomatic state appeared to be more facilitated by standard relaxation-imagery hypnosis (with pleasant Leuner field suggestions) than by cognitive coping type of hypnorelaxation (involving contact with the inner adviser) in case of one/one subsequent sessions.

Objectives (original – from grant application)

Our research proposal has double aims in two human auto-controlled stress models (students doing academic exams and chronic anxious patients):

1/ Investigating the effectiveness of hypnorelaxation with special cognitive coping (contact and communication with the inner adviser) in comparison with standard relaxation-imagery hypnosis (pleasant Leuner field suggestions)

a) focusing on the possible enhanced impact of special cognitive coping (contact with the inner adviser and asking help to reduce stress and to regain homeostasis) on the effectivity of relaxation hypnosis to influence the psycho-neuroendocrino-immune parameters;

b) studying the possible usefulness and efficacy of relaxation-imagery hypnosis psychotechniques in the achievement of balanced psycho-neuro-immunological state.

2/ Comparison of stress markers

a) characterization of psychological stressed state in a novel psycho-immune approach, focusing on inflammatory-immune-lectin markers (IL-6, sICAM-1, lactoferrin, LL-37, galectin-3) in blood plasma

b) complementary psycho-neuroendocrine tests are planned to give a broad view (psychotests; EMG-scan of neck muscles; stress hormones: cortisol, ACTH, chromogranin A assays); salivary marker (lactoferrin/total protein) /acute inflammatory reactions are to be checked by routine lab tests/

Project Schedule (original – from grant application)

A) November 2010 - July 2011: Student Study (auto-controlled)

1. November *(relaxed state: pre-exam period)*
   1.a/ recruiting students, inclusion-exclusion
   (medical history, general medical-physical examinations)
   informations on the project, ethical points (informed consent)
   1.b/ EMG-scan (neck), routine (blood pressure /BP/, pulse rate /P/),
   sample collection (S1); routine psychotests (Spielberger, BDI, Rahe)

2. middle of December *(start of the examination term, hypnorelaxation)*
   2.a/ before hypnorelaxation: sample collection (S2)
   psychotests: hypnotizability group scaling, *BDI*
   2.b/ hypnorelaxation (with pleasant Leuner-field imaginative suggestions)
   2.c/ after hypnorelaxation: sample collection (S3)
   before and after: EMG-scan (neck muscles), routine (BP, P)
   psychotest: *Spielberger (state anxiety)*

3. first week of January (*examination term, hypnorelaxation with cognitive coping – contact with the inner adviser)*
   3.a/ before cogntive hypnorelaxation: sample collection (S4)
   psychotest: *BDI*
   3.b/ cogntive hypnorelaxation (contact with the inner adviser)
   3.c/ after cogntive hypnorelaxation: sample collection (S5)
   before and after: EMG-scan (neck muscles), routine (BP, P)
   psychotest: *Spielberger (state anxiety)*

4. second week of January (*examination term, hypnorelaxation)*
   4.a/ before hypnorelaxation: sample collection (S6)
   4.b/ hypnorelaxation (with pleasant Leuner imaginative suggestions)
   4.c/ after hypnorelaxation: sample collection (S7)
   psychotests: *BDI, Spielberger (trait anxiety), Rahe*
   before and after: EMG-scan (neck muscles), routine (BP, P)
   psychotest: *Spielberger (state anxiety)*

5. February-May
   a/ Assays (stress hormones, inflammatory-immune-lectin tests)
   b/ Evaluation of psychotests and of EMG-scan

6. June-July
   Data analysis, statistical analysis

B) October 2011 - July 2012: Patient Study (auto-controlled)

1. October-November *(getting started)*
   1.a/ recruiting anxious patients, inclusion-exclusion
   (medical history, general medical and neurological examinations)
   informations on the project, ethical points (informed consent)
   1.b/ psychotests
   hypnotizability group scaling
   routine psychotests (Spielberger, BDI, Rahe)

2. beginning of Dec/end of November *(hypnorelaxation)*
   2.a/ before hypnorelaxation: sample collection (P1)
   Rahe psychotest
   2.b/ hypnorelaxation (with pleasant Leuner imaginative suggestions)
   2.c/ after hypnorelaxation: sample collection (P2)
   before and after: EMG-scan (neck), routine (BP, P)

3. middle of December *(hypnorelaxation with cognitive coping – contact with the inner adviser)*
   3.a/ before cogntive hypnorelaxation: sample collection (P3)
   3.b/ cogntive hypnorelaxation (contact with the inner adviser)
   3.c/ after cogntive hypnorelaxation: sample collection (P4)
   Rahe psychotest

4. first half of January (*hypnorelaxation)*
   4.a/ before hypnorelaxation: sample collection (P5)
   4.b/ hypnorelaxation (with pleasant Leuner imaginative suggestions)
   4.c/ after hypnorelaxation: sample collection (P6)
   routine psychotests
   before and after: EMG-scan (neck), routine (BP, P)

5. February-May
   a/ Assays (ELISA, RIA)
   b/ Evaluation of psychotests, EMG-scan

6. June-July
   a/ Data analysis, final statistical analysis
   b/ Summary for report
   c/ Future plan: preparation of manuscript for publication

Methodology (part of the original)

A/ Hypnorelaxations, psycho- and psychophysiological tests

1. Hypnorelaxation types

a) Relaxation-imagery hypnosis (standard hypnorelaxation)
a superficial group hypnosis according to clinical standards with pleasant suggestions (Leuner-field imagination), employing systematic relaxation of the participant
(duration: about 25-30 min)

b) Relaxation-imagery hypnosis with special cognitive coping: "telepathic contact with the inner adviser"
after induction of relaxation hypnosis, hypnotic suggestions are given to contact the inner adviser and to ask help from him/her to reduce stress/anxiety and to regain psychosomatic homeostasis; finally, the inner adviser is detached (duration: about 35 min)(led each case by our psychologist expert, an experienced hypnotherapeutist)

2. Psychotests

a/ hypnotizability (Harvard Group Scales),
b/ state and trait anxiety (Spielberger, STAI)
c/ *depression* (Beck, BDI)
d/ perceived stress and coping (Rahe)

3. EMG-scan (computer-assisted surface EMG)

Determination of the tension of 2 neck muscles is planned by computer-assisted surface EMG.
(Note: instead of 2 muscles, 7 muscle pairs were tested.)

B/ Biosamples and assays

1. Biosamples

a) Blood: whole blood samples are collected to standard EDTA Vacutainer tubes; blood plasma samples are separated and stored frozen (-80 C) till usage for soluble marker assays
b) Saliva: fresh samples are collected / according to standard protocol: 5 min after rinsing mouth, spitting 3 times (1/min)/ and stored frozen (-20 C) till usage for assays (after homogenization and centrifugation)

2. Assays of blood plasma parameters

a) specific inflammatory-immune-lectin parameters: *IL-6* (cytokine), *sICAM-1*, (endothel-leukocyte activation marker) *lactoferrin*, *LL-37* (neutrophil activation markers), *galectin-3* are to be measured by ELISA (commercial kits, except for lactoferrin: by home-made kit after validation);

b) stress hormones: cortisol, ACTH; chromogranin A would be tested by chemiluminescent assays and RIA, respectively.
(in the Endocrine Lab, according to routine protocols, using commercial kits)

c) control routine inflammatory markers (total leukocyte count, neutrophil %) to check possible inflammatory-immune diseases - are to be tested routinely in our clinical chemistry lab at the faculty.

3. Saliva assays

a) lactoferrin ELISA (home-made ELISA kit)
(Note: because of technical problems, partially commercial kits were used.)

b) total protein (BCA assay)

D/ Statistical analysis
SPSS software (mostly ANOVA tests are planned)

Results

A/ Students

1. Participants

Healthy college students were recruited to investigate the effect of examination stress and the impact of two types of hypnorelaxations before and during the examination period.

Table 1. presents the most important anamnestic data of our students.

/From the initial 25 students (signing the informed consent), however, only max. 20 ones participated finally in the investigations; in the middle of the examination period, even less students appeared. Still, this relatively limited number of students proved to be sufficient to show significant changes in stress hormone levels and in muscle tension scores (see below)/.

Table 1.
Anamnestic data of the students

Total number	**20**
a. pre-exam period	19/18
b. 1. hypnorelaxation	20
c. 2. hypnorelaxation	16
d. 3. hypnorelaxation	16
Age (mean±SE)	**20.5 ± 1.6** (range: 19-24)
Male (%)	10
Smoking	
Current smoker (%)	26.3
Former smoker (%)	10.5
Never-smoker (%)	**63.2**
BMI	**20.2 ± 2.6**

Results

2.Blood pressure and pulse rate

The routine clinical data: pulse rate and blood pressure values were in the normal range and no significant changes could be detected among the values measured before the examination period, and before-after hypnorelaxations.

Table 2.
Pulse rate, systolic and diastolic blood pressure (BP) of the students (mean ± SE)

	Pulse rate	Systolic BP	Diastolic BP
Pre-exam	78.2 ± 3.4	113.2 ± 2.7	68.4 ± 1.8
Before 1. hy	80.8 ± 3.3	111.6 ± 3.2	65.6 ± 1.5
After 1. hy	77.2 ± 2.7	109.9 ± 3.3	64.9 ± 1.5
Before 2. hy	85.0 ± 4.0	111.1 ± 2.8	68.4 ± 2.1
After 2. hy	74.4 ± 2.9	106.8 ± 2.0	63.3 ± 1.1
Before 3. hy	75.8 ± 2.1	106.6 ± 4.6	63.9 ± 1.8
After 3. hy	71.9 ± 2.1	110.5 ± 2.9	66.7 ± 2.5

Note: **hy** denotes hypnorelaxation

Results

3. Stress hormones: ACTH, cortisol and sympathetic marker: chromogranin-A

Significant decreases were detected in the blood plasma level of ACTH after each hypnorelaxation session (Table 3, Fig. 1.) Regarding cortisol, the second, special hypnorelaxation (involving contact with the inner adviser) appeared to be less/non-effective in downregulating its blood plasma concentration (Table 3, Fig. 2.). No significant changes were seen in case of chromogranin A.

It is to be noted, that all values were in the normal ranges. (Normal reference ranges: ACTH: 0-46 pg/ml; cortisol: 140–690 nmol/l; chromogranin A: 19-98 ng/ml.)

/Blood samples were collected before the examination period, and before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second is of a cognitive coping type).

Table 3.
Stress hormones and sympathetic marker chromogranin-A (CgA) - blood plasma concentrations of the students (mean ± SE)

	ACTH (pg/ml)	Cortisol (nmol/l)	CgA (ng/ml)
Pre-exam	40.08 ± 10.60	606.56 ± 49.25	45.18 ± 4.23
Before 1. hy	38.34 ± 8.14	551.55 ± 45.45	42.74 ± 3.45
After 1. hy	20.95 ± 3.15#	317.05 ± 47.85*	47.49 ± 4.06
Before 2. hy	41.35 ± 8.31	617.88 ± 52.76	43.37 ± 4.90
After 2. hy	18.01 ± 2.39#	413.81 ± 60.67	57.66 ± 6.93
Before 3. hy	32.09 ± 4.99	556.19 ± 36.82	57.93 ± 6.20
After 3. hy	16.17 ± 1.11#	248.27 ± 27.52*	56.79 ± 6.57

in case of ACTH, the overall alteration was proven to be significant ($p<0.05$); using pairwise comparisons, hypnorelaxations were associated by significant changes: first hypnosis: $p<0.01$ (before/after, n=20), second hypnosis: $p<0.001$ (before/after, n=16), third hypnosis: $p<0.01$ (before/after, n=16/15).

* indicates significant differences in cortisol levels before vs after the first and third hypnorelaxation: first hypnosis: $p<0.01$ (before/after, n=20), third hypnosis $p=0.001$ (before/after, n=16/15); overall change: $p<0.0001$.

Results

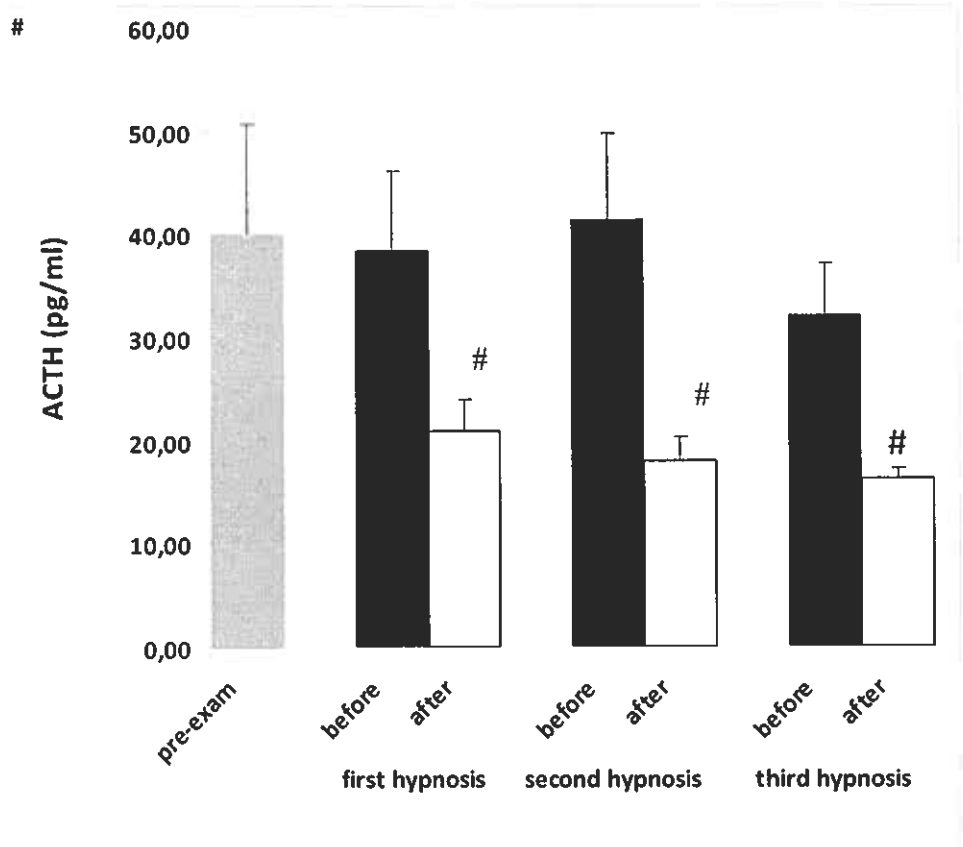

Fig. 1. ACTH blood plasma concentrations of the students (mean ± SE) before the examination period, and before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second one involves contact with the inner adviser).

Using pairwise comparisons, hypnorelaxations were associated by significant changes denoted by #: first hypnosis: $p<0.01$ (before/after, n=20), second hypnosis: $p<0.001$ (before/after, n=16), third hypnosis: $p<0.01$ (before/after, n=16/15); overall change: $p<0.05$.

Normal reference range: 0-46 pg/ml.

Results

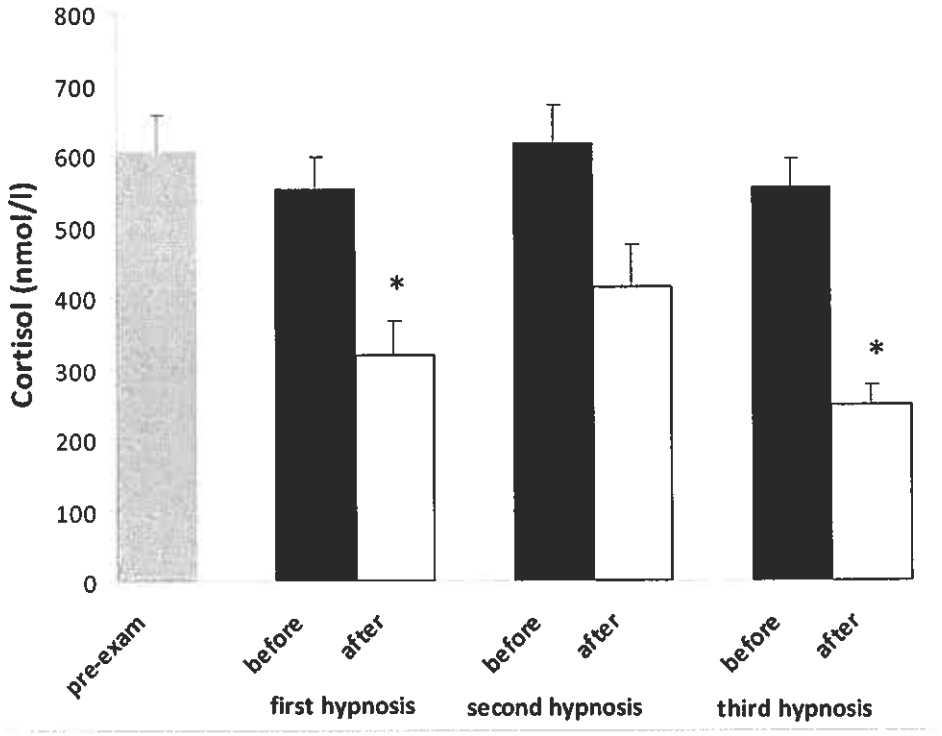

Fig. 2. Cortisol blood plasma concentrations of the students (mean ± SE) before the examination period, and before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second one involves contact with the inner adviser).

Overall change: $p<0.0001$; * indicates significant differences during first hypnosis (before-after, n=20): $p<0.01$ and third hypnosis (before-after, n=16/15): $p=0.001$.

Normal reference range: 140–690 nmol/l.

Results

4. Inflammatory-immune markers in blood and saliva

To investigate the state of the innate (non-specific) immune sytem, involved in the inflammatory reaction and in the neuroimmune regulation, several markers: IL-6 (a major cytokine), LL-37 and lactoferrin (multifunctional immune mediators liberated after degranulation of neutrophils), sICAM-1 (endothelial and granulocyte activation marker), and galectin-3 (neutrophil activator) were assayed.

No significant changes could be detected, and all the values were normal (Table 4.)

/Normal reference ranges are the following: for IL-6: 0 – 8.7 pg/ml; for LL-37: 25-250 ng/ml; for sICAM-1: 249–966 ng/ml; for lactoferrin: 40-200 ng/ml (mean: 90 ng/ml); for galectin-3: 0.62-6.25 ng/ml./

Table 4.
Special inflammatory-immune markers - blood plasma concentrations of the students (mean ± SE)

	IL-6 (pg/ml)	LL-37 (ng/ml)	sICAM-1 (ng/ml)	Lactoferrin (ng/ml)	Galectin-3 (ng/ml)
Pre-exam	0.40 ± 0.13	42.26 ± 1.50	248.8 ± 14.0	109.0 ± 11.9	6.98 ± 0.5
Before 1. hy	0.47 ± 0.13	42.63 ± 1.11	254.1 ± 12.7	112.2 ± 5.8	6.09 ± 0.45
After 1. hy	0.34 ± 0.09	42.38 ± 1.17	299.2 ± 13.0	111.4 ± 6.5	6.11 ± 0.49
Before 2. hy	0.36 ± 0.14	40.81 ± 1.02	284.1 ± 17.6	115.5 ± 7.8	6.65 ± 0.65
After 2. hy	0.25 ± 0.13	41.92 ± 1.19	284.0 ± 14,7	114.5 ± 7.8	5.93 ± 0.58
Before 3. hy	0.32 ± 0.12	42.02 ± 1.20	277.3 ± 20.5	122.4 ± 9.1	7.08 ± 0.66
After 3. hy	0.28 ± 0.12	41.85 ± 1.14	280.7 ± 22.1	132.8 ± 10.3	6.86 ± 0.64

(Blood samples were collected before the examination period, and before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second one involves contact with the inner adviser).

Results

As salivary lactoferrin is involved in the innate protective system, too, we thought it worthwhile to determine its concentration relatively to the total protein content.

Like in the case of blood plasma lactoferrin, no significant changes could be shown , although there was a clear tendency of increase in these parameters after each hypnorelaxation (Table 5).

Table 5.
Salivary markers of the students (mean ± SE)

	Total protein (mg/ml)	Lactoferrin (ng/ml)	Lactoferrin/total protein (ng/mg)
Pre-exam	0.83 ± 0.07	2879.2 ± 470.1	3527.0 ± 680.5
Before 1. hy	1.00 ± 0.15	1887.4 ± 331.2	2200.0 ± 354.3
After 1. hy	1.18 ± 0.11	3093.1 ± 431.1	2677.5 ± 298.8
Before 2. hy	0.82 ± 0.07	1572.6 ± 282.2	2030.3 ± 423.7
After 2. hy	1.13 ± 0.10	2771.0 ± 368.8	2590.6 ± 301.7
Before 3. hy	0.73 ± 0.07	1673.1 ± 313.1	2521.5 ± 464.7
After 3. hy	0.99 ± 0.08	3302.3 ± 501.1	3409.2 ± 547.8

Results

No significant differences could be shown in the routine inflammatory data: in total leukocyte count and in neutrophil ratio; in addition, all these values were normal that indicates a general non-inflammatory state (Table 6).

/Normal reference ranges: total leukocyte count: 3.9-11.1 10^9/l, neutrophil fraction: 44.0-68.0 %./

Table 6.
Routine inflammatory markers: total leukocyte count (tlc) and percentage of neutrophil granulocytes (ng%) in the students (mean ± SE)

	tlc (G/l)	ng%
Pre-exam	6.76 ± 0.35	51.91 ± 2.39
Before 1. hy	6.71 ± 0.38	54.81 ± 1.61
Before 2. hy	6.77 ± 0.45	55.47 ± 2.20
Before 3. hy	6.16 ± 0.29	51.92 ± 1.76

Blood samples were collected before the examination period, and before the hypnorelaxations.

Results

5. Psychotests

In order to investigate the psychological state of the students, several psychotests were completed by them in a given pattern. Perceived stress and coping scores were determined using Rahe test, depression was tested by the classical BDI test, hypnotizability by the Harvard group test; trait and state anxiety scores were determined by Spielberger test.

Similarly to the immunological parameters, no significant differences could be observed, and all the scores were in proper/normal range (Table 7-8.). The students had good stress coping skills, were not depressed or anxious (by trait or state), had medium susceptibility for hypnotic suggestions.

/Rahe total stress and coping score ranges: (subtracting the stress score from the coping score): (– 15) - (– 5): worrying, (– 1) - (– 4): sufficient, 0 - (+ 4): good, (+ 5) - (+ 15): very good.

BDI (depression index) ranges: score 0-9: normal, 10-18: mild depression, 19-25: medium depression, over 25: severe depressed state.

Hypnotizability (Harvard group test): score 0-3: not susceptible; score 4-8: medium susceptible; and score 9-12: highly susceptible to hypnosis.

Scores for Spielberger psychotests (state-trait anxiety inventory, Hungarian version)

Ranges for both state and trait scales: <50: normal; 50-60: mild; 60-70: medium; 70-80: high level of anxiety./

Table 7.
Psychotest scores of the students (mean ± SE) – **testing stress-coping (Rahe), depression (BDI) and hypnability (Harvard)**

	Rahe			BDI	Harvard
	Stress	**Coping**	**Total**		
Pre-exam	7.61 ± 0.61	8.83 ± 0.63	1.22 ± 1.00	6.17 ± 1.14	7.94 ± 0.38
Before 1. hy				4.95 ± 0.90	
Before 2. hy				5.75 ± 1.48	
Before 3. hy				4.69 ±1.25	
After 3. hy	7.69 ± 0.65	8.94 ± 0.53	1.25 ± 0.91		

Results

The trait Spielberger psychotest (STAI-T) was completed before the examination period and after the final hypnorelaxation, while the state Spielberger test (STAI-S) was done additionally before-after each hypnorelaxation (Table 8).

Table 8.
Psychotest scores of the students (mean ± SE) **– testing trait and state anxiety (Spielberger)**

	Trait	State
Pre-exam	39.67 ± 1.26	35.67 ± 1.78
Before 1. hy		35.95 ± 1.88
After 1. hy		32.00 ± 2.32
Before 2. hy		38.19 ± 2.83
After 2. hy		34.06 ± 2.97
Before 3. hy		37.69 ± 2.89
After 3. hy	39.93 ± 1.43	35.56 ± 2.41

Scores for Spielberger psychotests (state-trait anxiety inventory, Hungarian version)
Ranges for both state and trait scales: <50: normal; 50-60: mild; 60-70: medium; 70-80: high level of anxiety.

Results

6. Surface EMG scan: muscle tensions

The tension of 7 muscle pairs were examined in sitting position (m. frontalis, m. temporalis, m. masseter, m. sternocleidomestoideus, m. cervicoparaspinalis, m. trapezoideus, m. thoracoparaspinalis T1) by computer-assisted surface EMG. (As we considered muscle tension an important indicator, 7 "stress-sensitive" muscle pairs were examined instead of the 2 neck muscles planned.)

Table 9. A-C present the mean tensions of a given muscle pair in the student group.

(The relative values are demonstrated, using the following codes: 0: normal tension, 1: mild, 2: moderate, 3: strong enhancement in muscle tension.)

Table 9./A-B
EMG-scan: muscle tension (mean ± SE) **of the students**

	M. front.		M. temp.	
	Left	**Right**	**Left**	**Right**
Pre-exam	0.00 ± 0.00	0.06 ± 0.06	0.00 ± 0,00	0.12 ± 0,08
Before 1. hy	1.05 ± 0.29	0.90 ± 0.29	1.10 ± 0.30	1.30 ± 0.27
After 1. hy	0.75 ± 0.25	1.10 ± 0.25	1.05 ± 0.30	0.55 ± 0.23
Before 2. hy	1.19 ± 0.31	1.25 ± 0.31	1.13 ± 0.31	1.38 ± 0.33
After 2. hy	2.31 ± 0.24	1.94 ± 0.32	1.81 ± 0.31	2.19 ± 0.28
Before 3. hy	2.06 ± 0.31	2.13 ± 0.31	2.31 ±0.28	2.25 ± 0.28
After 3. hy	1.69 ± 0.34	1.75 ± 0.32	2.50 ± 0.22	2.38 ± 0.30

Results

M. mass.		M. S.C.M.		M. C.P.S.	
Left	**Right**	**Left**	**Right**	**Left**	**Right**
0.18 ± 0.10	0.35 ± 0.15	0.24 ± 0.14	0.12 ± 0.08	0.35 ± 0.15	0.53 ± 0.21
2.00 ± 0.23 1.50 ± 0.30	2.55 ± 0.22 1.90 ± 0.30	1.45 ± 0.28 1.60 ± 0.29	1.45 ± 0 28 1.45 ± 0.27	2.20 ± 0 24 2.05 ± 0.28	2.65 ± 0 15 2.37 ± 0.26
2.00 ± 0.29 2.38 ± 0.30	2,31 ± 0.25 2.75 ± 0.19	2.56 ± 0.26 2.81 ± 0.14	2.06 ± 0.28 2.25 ± 0.25	2.31 ± 0.24 2.81 ± 0.19	2.44 ± 0.27 2.25 ± 0.30
2.63 ± 0.18 2.75 ± 0.11	2.75 ± 0.17 2.88 ± 0.13	2.81 ± 0.14 2.31 ± 0.27	2.50 ± 0.22 1.88 ± 0.31	2.75 ± 0.14 2.88 ± 0.09	2.50 ± 0.24 2.50 ± 0.22

Table 9./C
EMG-scan: muscle tension (mean ± SE) **of the students**

	M. trap.		M. T1 P.S.	
	Left	**Right**	**Left**	**Right**
Pre-exam	0.12 ± 0.08	0.00 ± 0.00	0.24 ± 0.11	0.35 ± 0.15
Before 1. hy **After 1. hy**	2.00 ± 0.29 1.84 ± 0.32	1.25 ± 0.29 1.37 ± 0.33	2.00 ± 0.28 1.21 ± 0.28	1.65 ± 0.31 1.84 ± 0.33
Before 2. hy **After 2. hy**	1.94 ± 0.32 2.25 ± 0.30	2.13 ± 0.29 2.31 ± 0.28	1.25 ± 0.34 2.06 ± 0.32	2.00 ± 0.34 2.69 ± 0.20
Before 3. hy **After 3. hy**	2.69 ± 0.20 2.38 ± 0.30	2.31 ± 0.31 1.44 ± 0.27	1.75 ± 0.34 1.69 ± 0.35	2.38 ± 0.26 2.31 ± 0.28

Results

When the scores of the muscle tensions were summarized on the left and on the right side (and on both), it turned out, that muscle tension was enhanced considerably at the onset of the (academic) examination term and remained at relatively high level during the study (Fig.3).

In addition, there was a significant increase in the summarized muscle tension on the left side (and in the summarized muscle tension value involving left + right sides) following the second hypnorelaxation (involving communication with the inner adviser).

Table 10.
EMG-scan - summarized muscle tension (mean ± SE) **of the students**

	Left	**Right**	**Sum**
Pre-exam	1.12 ± 0.33#	1.53 ± 0.39#	2.65 ± 0.59#
Before 1. hy	11.80 ±1.04	11.75 ± 1.00	23.55 ± 1.96
After 1. hy	9.75 ± 1.49	10.30 ±1.31	20.05 ± 2.73
Before 2. hy	12.38 ± 1.02	13.56 ± 1.17	25.94 ± 1.72
After 2. hy	16.44 ± 0.66*	16.38 ± 1.00	32.81 ± 1.42*
Before 3. hy	17.00 ± 1.11	16.81 ± 0.99	33.81 ± 1.79
After 3. hy	16.19 ± 1.07	15.13 ± 1.28	31.31 ± 2.23

marks significant differences between the muscle tension scores before the examination period and all the other values: $p<0.0001$.
* indicates significant increase after the second, special hypnorelaxation: for both cases: $p<0.05$ (before vs after, n=16);

Results

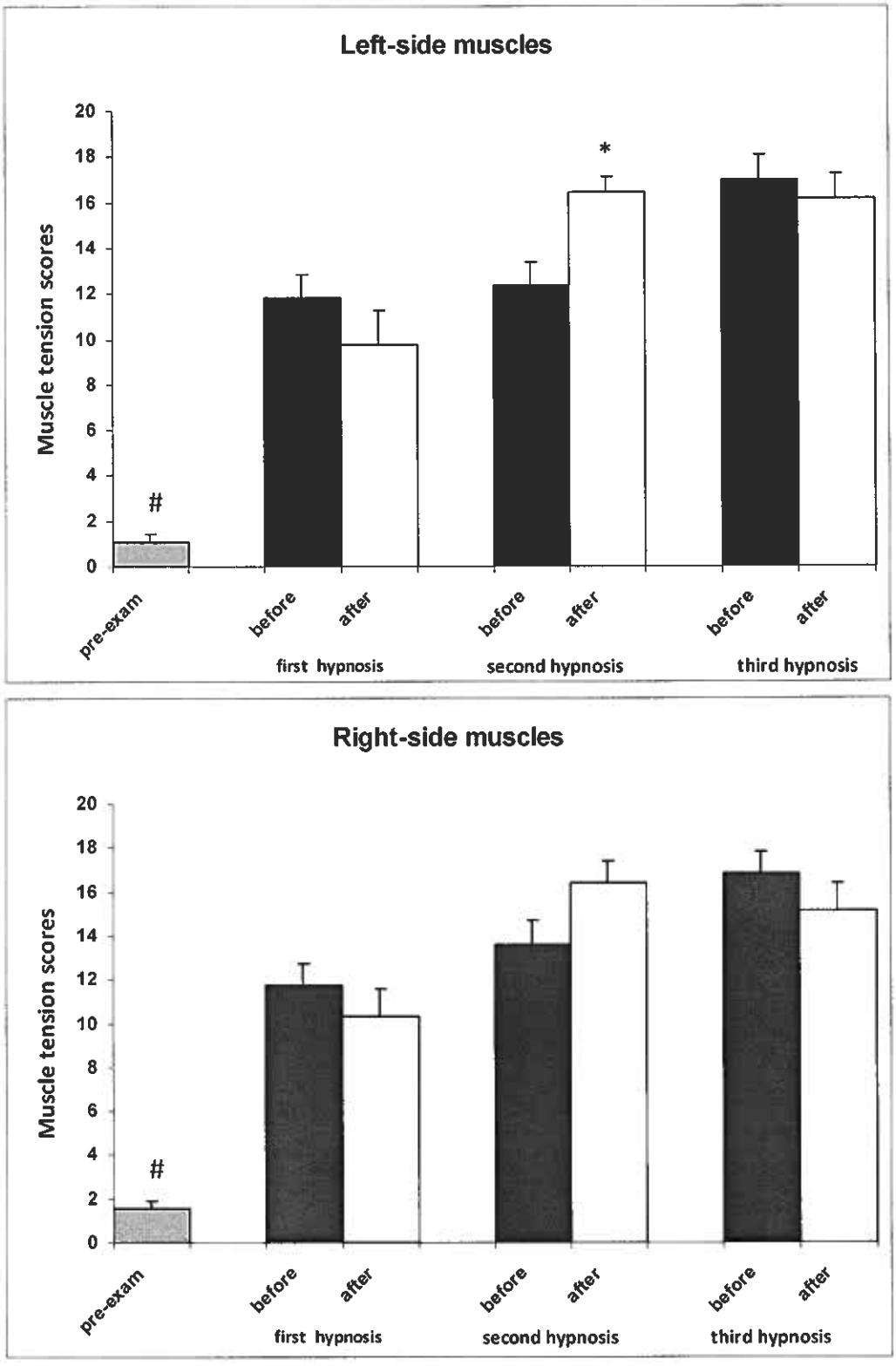

Fig. 3. Muscle tension of the students (mean ± SE) before the examination period, and before-after hypnorelaxations. # marks significant differences between the scores before the examination period and all the others: $p<0.0001$; significant increase in the summarized muscle tension on the left side was detected following the second hypnorelaxation: * indicates significant difference: $p<0.05$ (before vs after, n=16).

Results

B/ Chronic anxious patients

1. Participants

Chronic anxious patients were enrolled, applying appropriate inclusion-exclusion criteria, to study the effect of the two types of hypnorelaxations on their psycho-neuroendocrine-immune (psychosomatic) status.

Table 11. presents the most important anamnestic data of our patients.

/From the initial 31 patients (signing the informed consent), 30 appeared on the first two occasions, and from these, 6 did not show up at the last session. However, the group of 24 patients still ensured the reliability of our results in the statistical analysis./

Table 11.
Anamnestic data of the patients

Total number	**30**
a. Initial state	30
b. 1. hypnorelaxation	30
c. 2. hypnorelaxation	28
d. 3. hypnorelaxation	24
Age (mean±SE)	**47.7 ± 1.8** (range: 28-59)
Male (%)	23
Smoking	
Current smoker (%)	40.0
Former smoker (%)	33.3
Never-smoker (%)	**26.7**
BMI	**26.3 ± 0.9**

Results

2.Blood pressure and pulse rate

Similarly to the students, pulse rate and blood pressure values were in the normal range and no significant changes were seen among the values measured before and after the hypnorelaxations in the patients (Table 12).

Table 12.
Pulse rate, systolic and diastolic blood pressure (BP) of the patients (mean ± SE)

	Pulse rate	Systolic BP	Diastolic BP
Before 1. hy	76.4 ± 2.8	124.2 ± 3.8	75.0 ± 1.9
After 1. hy	74.9 ± 2.8	129.2 ± 3.3	78.7 ± 1.8
Before 2. hy	79.6 ± 3.1	124.8 ± 3.7	76.2 ± 2.1
After 2. hy	73.3 ± 2.6	127.8 ± 2.9	79.4 ± 1.7
Before 3. hy	76.9 ± 3.5	129.0 ± 3.2	78.9 ± 2.0
After 3. hy	73.7 ± 2.9	129.5 ± 3.5	78.8 ± 1.9

Results

3. Stress hormones: ACTH, cortisol and sympathetic marker: chromogranin-A

Significant decreases in cortisol concentrations were observed following the second and third hypnorelaxations.

Similarly to the students, no significant changes were seen in case of chromogranin A; but in contrast, no alterations could be detected in the values of ACTH.

Like in the students, all the values were in the normal ranges; however, the stress hormone levels tended to be lower, than in the students.
(Normal reference ranges: ACTH: 0-46 pg/ml; cortisol: 140–690 nmol/l; chromogranin A: 19-98 ng/ml.)

/Blood samples were collected before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second is of a cognitive coping type).

Table 13.
Stress hormones and sympathetic marker chromogranin-A (CgA) - blood plasma concentrations of the patients (mean ± SE)

	ACTH (pg/ml)	Cortisol (nmol/l)	CgA (ng/ml)
Before 1. hy	23.17 ± 3.31	377.23 ± 23.69	76.44 ± 4.69
After 1. hy	25.01 ± 3.63	321.37 ± 38.07	72.06 ± 4.61
Before 2. hy	23.73 ± 3.42	360.64 ± 25.18	79.46 ± 5.41
After 2. hy	23.62 ± 3.56	271.29 ± 23.72*	74.94 ± 6.20
Before 3. hy	24.49 ± 4.42	461.67 ± 37.96	67.94 ± 3.34
After 3. hy	23.83 ± 4.23	365.83 ± 34.75*	63.28 ± 3.13

* indicates significant differences in cortisol levels before vs after the second and third hypnorelaxation: second hypnosis: $p<0.001$ (before/after, n=28), third hypnosis: $p<0.01$(before/after, n=23/24)

Results

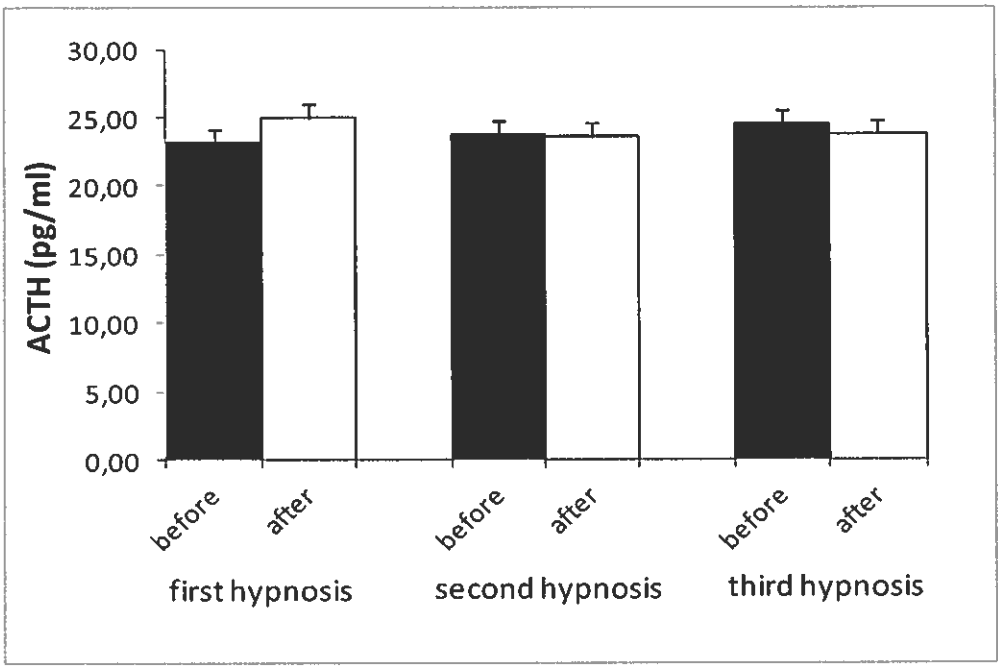

Fig. 4. ACTH blood plasma concentrations of the patients (mean ± SE) before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second one involves contact with the inner adviser). In contrast to the student group, no alterations could be seen.

Normal reference range: 0-46 pg/ml.

Results

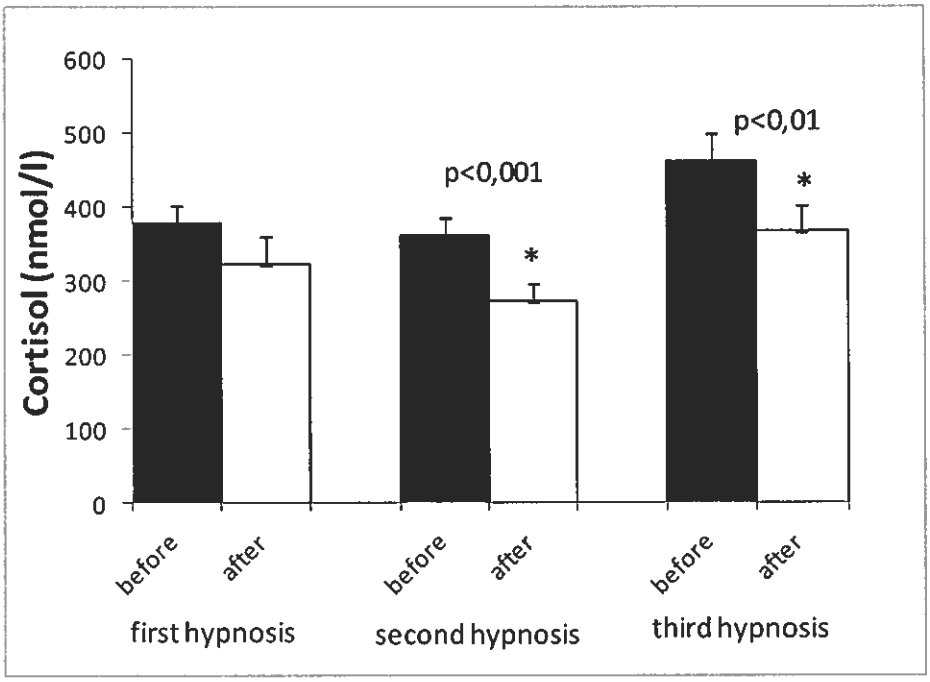

Fig. 5. ACTH blood plasma concentrations of the patients (mean ± SE) before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second one involves contact with the inner adviser). Using pairwise comparisons, the second and the third hypnorelaxations were associated with significant decreases in the level of this stress hormone.

* indicates significant differences during the second hypnosis (before-after, n=28): $p<0.001$ and the third hypnosis (before-after, n=23/24): $p=0.01$.

Normal reference range: 140–690 nmol/l.

Results

4. Inflammatory-immune markers in blood and saliva

In parallel with the investigations with students, several markers of the immune-inflammatory system and of the neuroimmune regulation were assayed (IL-6: a major cytokine, LL-37 and lactoferrin: multifunctional immune mediators liberated after degranulation of neutrophils, sICAM-1: endothelial and granulocyte activation marker, and galectin-3: neutrophil activator).

As in the case of students, no significant changes could be observed, and all the values were in the normal ranges (Table 14.). However, the plasma concentrations of IL-6 and LL-37 tended to be higher in patients, than in students.

/Normal reference ranges are the following: for IL-6: 0 – 8.7 pg/ml; for LL-37: 25-250 ng/ml; for sICAM-1: 249–966 ng/ml; for lactoferrin: 40-200 ng/ml (mean: 90 ng/ml); for galectin-3: 0.62-6.25 ng/ml./

Table 14.
Special inflammatory-immune markers - blood plasma concentrations of the patients (mean ± SE)

	IL-6 (pg/ml)	LL-37 (ng/ml)	sICAM-1 (ng/ml)	Lactoferrin (ng/ml)	Galectin-3 (ng/ml)
Before 1. hy	0.74 ± 0.17	60.90 ± 3.66	327.1 ± 19.9	125.7 ± 9.2	5.69 ± 0.28
After 1. hy	0.77 ± 0.16	60.25 ± 3.18	331.9 ± 17.7	132.1 ± 10.7	5.78 ± 0.27
Before 2. hy	0.58 ± 0.11	60.01 ± 3.45	306.2 ± 16.3	118.7 ± 10.7	5.48 ± 0.29
After 2. hy	0.54 ± 0.10	61.23 ± 3.66	316.7 ± 17.7	126.3 ± 8.4	5.75 ± 0.30
Before 3. hy	0.65 ± 0.12	64.13 ± 3.94	346.9 ± 26.8	134.4 ± 14.8	5.97 ± 0.41
After 3. hy	0.70 ± 0.13	63.96 ± 3.88	355.8 ± 24.0	123.1 ± 13.8	5.75 ± 0.38

Results

Like in the student group, the salivary lactoferrin concentration did not show any changes relatively to the total protein level. However, significant changes were seen separately for total protein after the third hypnorelaxation (Fig. 6.), and for salivary lactoferrin following the second and third sessions (Fig. 7.).

Table 15.
Salivary markers of the patients (mean ± SE)

	Total protein (mg/ml)	Lactoferrin (ng/ml)	Lactoferrin/total protein (ng/mg)
Before 1. hy	1.02 ± 0.07	2669.6 ± 226.6	2600.6 ± 241.4
After 1. hy	1.09 ± 0.06	3095.1 ± 223.9	2878.5 ± 217.8
Before 2. hy	0.87 ± 0.06	2441.7 ± 191.9	3126.6 ± 304.0
After 2. hy	0.97 ± 0.06	3074.8 ± 204.0#	3285.7 ± 202.9
Before 3. hy	0.80 ± 0.07	2294.3 ± 192.1	3117.3 ± 330.7
After 3. hy	0.97 ± 0.08*	3564.9 ± 243.0#	3662.6 ± 323.5

* indicates significant increase in total protein level before vs after third hypnorelaxation: $p<0.001$ (before/after, n=24/23).
# denotes significant enhancement of salivary lactoferrin following the second hypnorelaxation: $p<0.001$ (before/after, n=28/27), and the third one: $p<0.0001$ (before/after, n=23/21).

Results

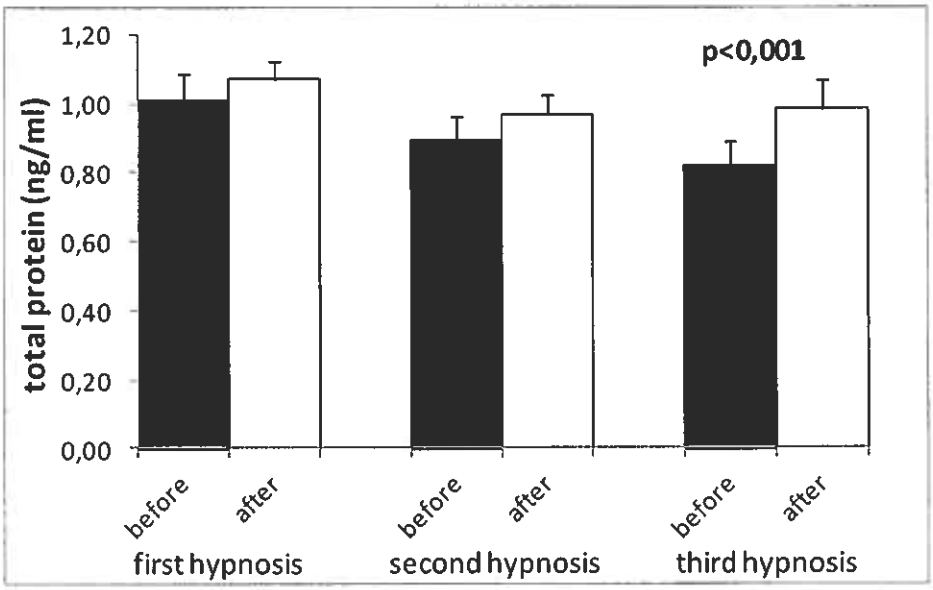

Fig. 6. Total salivary protein concentrations of the patients (mean ± SE) before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second one involves contact with the inner adviser). The third hypnorelaxation was followed by a significant increase in total protein: $p<0.001$, (before vs after, n= 24/23).

Results

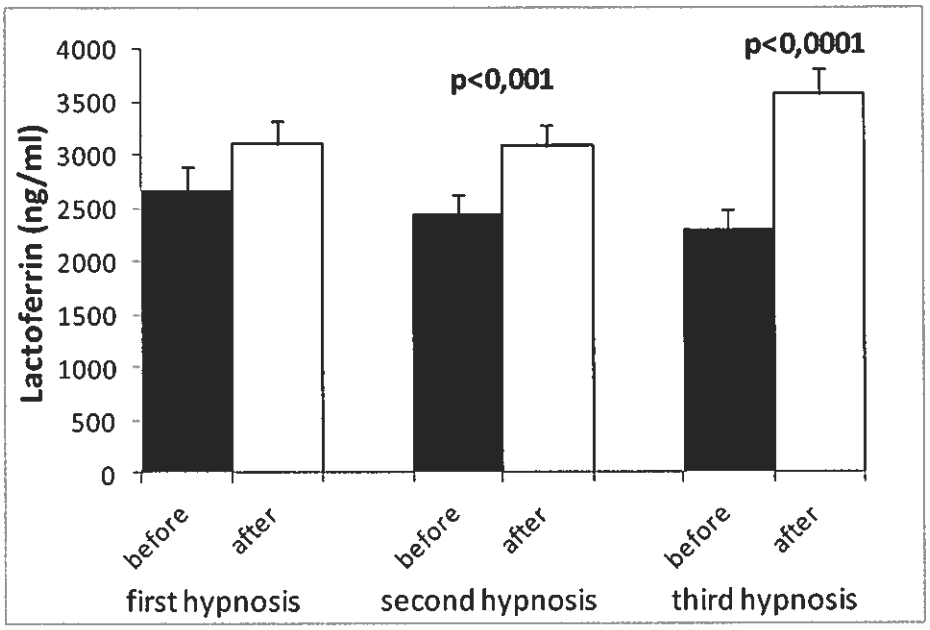

Fig. 7. Lactoferrin concentrations of the patients (mean ± SE) before-after hypnorelaxations (first and third hypnorelaxations are standard ones, the second one involves contact with the inner adviser). The second and the third hypnorelaxation were associated with significant increases in salivary lactoferrin: $p<0.001$ (before vs after, n= 28/27) and $p<0.0001$ (before vs after, n= 23/21), respectively.

Results

Concerning the routine inflammatory parameters: total leukocyte count and neutrophil percentage were tested. As in the case of students, no significant differences could be shown, and all the values were in the normal range that indicates a general non-inflammatory state (Table 16.).

(Normal/reference ranges: total leukocyte count: 3.9-11.1 10^9/l, neutrophil fraction: 44.0-68.0 %.)

Table 16.
Routine inflammatory markers: total leukocyte count (tlc) and percentage of neutrophil granulocytes (ng%) in the patients (mean ± SE)

	tlc (G/l)	ng%
Before 1. hy	6.94 ± 0.42	61.90 ± 1.30
Before 2. hy	7.09 ± 0.43	61.45 ± 1.31
Before 3. hy	7.11 ± 0.52	60.98 ± 1.56

Blood samples were collected before the hypnorelaxations.

Results

5. Psychotests

The patients completed the perceived stress and coping (Rahe), depression (BDI), hypnotizability (Harvard), trait and state anxiety inventory (Spielberger) tests in a similar pattern as the students.

Like in the case of students, no significant alterations were found in the scores of the Rahe and BDI test, and the level of hypnotizability was also of medium susceptibility (Table 17).

In contrast, however, the total stress and coping score was in the lowest, „worrying" range, and our patients were severly depressed according to the result of their BDI test.

/Reference ranges:

Rahe total stress and coping score ranges: (subtracting the stress score from the coping score): (– 15) - (– 5): worrying, (– 1) - (– 4): sufficient, 0 - (+ 4): good, (+ 5) - (+ 15): very good.

BDI (depression index) ranges: score 0-9: normal, 10-18: mild depression, 19-25: medium depression, over 25: severe depressed state.

Hypnotizability (Harvard group test): score 0-3: not susceptible; score 4-8: medium susceptible; and score 9-12: highly susceptible to hypnosis./

Table 17.
Psychotest scores of the patients (mean ± SE) **– testing stress-coping (Rahe), depression (BDI) and hypnability (Harvard)**

	Rahe			BDI	Harvard
	Stress	Coping	Total		
Initial	12.86 ± 0.27	2.11 ± 0.53	-10.93 ± 0.68	28.69 ± 2.66	7.73 ± 0.39
Before 1. hy				25.64 ± 2.69	
Before 2. hy				25.96 ± 2.72	
Before 3. hy				27.91 ± 3.03	
After 3. hy	13.22 ± 0.27	1.26 ± 0.33	-11.96 ± 0.43		

Results

In addition, the patient had about medium level of trait anxiety (Spielberger test, Table 18). In an apparent contradiction to the students, the state anxiety was significantly decreased after each hypnorelaxation (Fig. 8). The scores were in the normal range after the first and second hypnorelaxation, while before these, they fell into the mild anxiety range. The change was less significant after the third session.

/Scores for Spielberger psychotests (state-trait anxiety inventory, Hungarian version)
Ranges for both state and trait scales: <50: normal; 50-60: mild; 60-70: medium; 70-80: high level of anxiety./

Table 18.
Psychotest scores of the patients (mean ± SE) **– testing trait and state anxiety (Spielberger)**

	Trait	**State**
Initial state	63.52 ± 2.17	60.94 ± 2.66
Before 1. hy		58.90 ± 2.41
After 1. hy		43.87 ± 2.14*
Before 2. hy		58.90 ± 2.86
After 2. hy		44.61 ± 2.52*
Before 3. hy		59.30 ± 3.03
After 3. hy	62.74 ± 2.16	50.21 ± 3.29*

* indicates significant differences in anxiety levels before vs after each hypnorelaxation: first hypnosis: $p<0.001$ (before/after, n=30), second hypnosis: $p<0.001$ (before/after, n=28), third hypnosis: $p<0.05$ (before/after, n=23).

Results

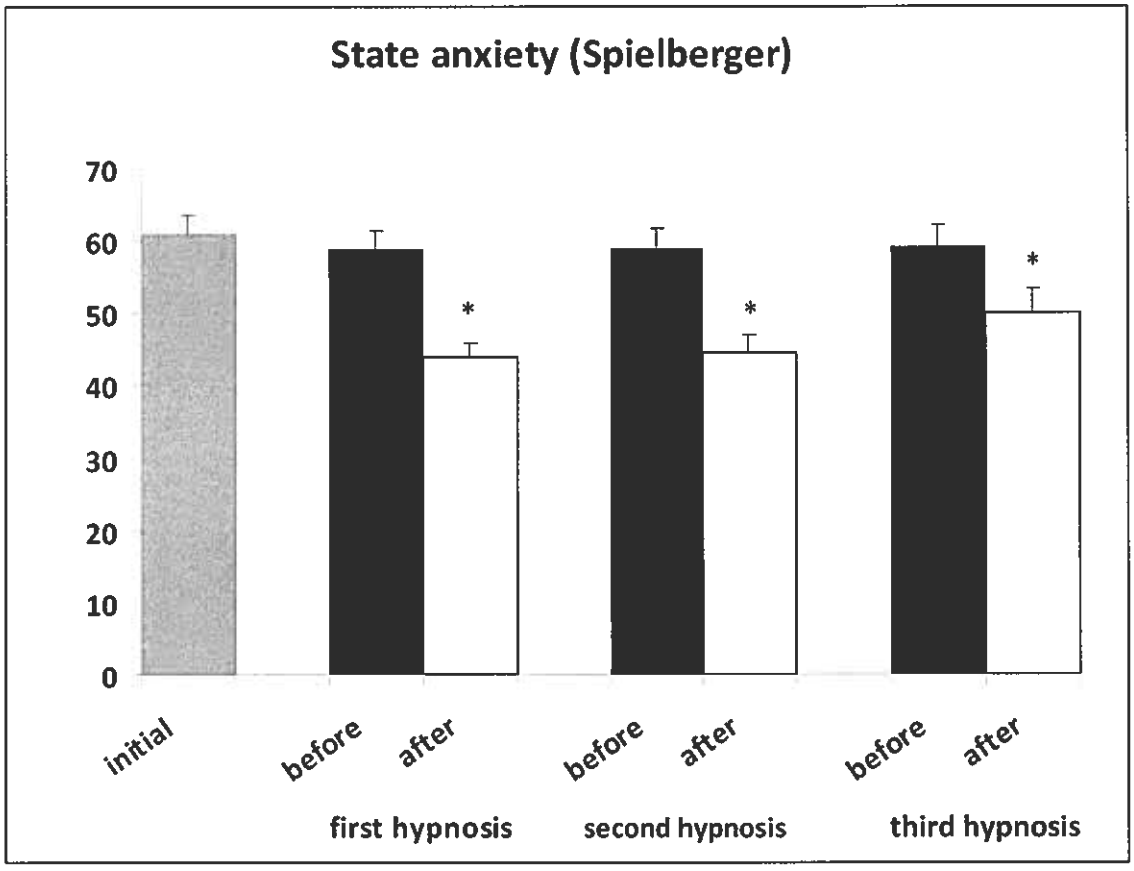

Fig. 8. State anxiety levels of the patients (Spielberger test, mean ± SE) in the initial state, and before-after hypnorelaxations. *marks significant differences between the state anxiety scores before vs after each hypnorelaxation (pairwise comparisons); first hypnosis: $p<0.001$ ($n=30$), second hypnosis: $p<0.001$ ($n=28$), third hypnosis: $p<0.05$ ($n=23$).
Ranges: <50: normal; 50-60: mild; 60-70: medium; 70-80: high level of anxiety.

Results

6.Surface EMG scan: muscle tensions

The same 7 muscle pairs were examined in the patients before and after the sessions, like in the students (Table 19/A-C).

Table 19./A-B
EMG-scan: muscle tension (mean ± SE) **of the patients**

	M. front.		M. temp.	
	Left	**Right**	**Left**	**Right**
Before 1. hy	2.20 ± 0.21	2.13 ± 0.21	2.33 ± 0.19	2.03 ± 0.22
After 1. hy	1.40 ± 0.22	1.17 ± 0.20	1.20 ± 0,21	1.30 ± 0.24
Before 2. hy	1.83 ± 0.24	2.17 ± 0.22	1.21 ± 0.22	1.69 ± 0.23
After 2. hy	2.29 ± 0.20	2.29 ± 0.19	2.07 ± 0.22	1.79 ± 0.22
Before 3. hy	1.88 ± 0.23	1.79 ± 0.26	1.58 ±0.25	1.63 ± 0.26
After 3. hy	2.30 ± 0.21	1.78 ± 0.24	1.83 ± 0.26	2.00 ± 0.26

M. mass.		M. S.C.M.		M. C.P.S.	
Left	**Right**	**Left**	**Right**	**Left**	**Right**
2.40 ± 0.18	2.63 ± 0.16	1.87 ± 0.24	2.03 ± 0 23	2.83 ± 0.08	2.20 ± 0.23
1.57 ± 0.23	1.73 ± 0.22	1.37 ± 0.23	1.27 ± 0.20	1.97 ± 0.20	2.00 ± 0.21
1.91 ± 0.24	2.34 ± 0.20	1.76 ± 0.23	1.66 ± 0.24	1.86 ± 0.21	1.86 ± 0.23
2.64 ± 0.13	2.64 ± 0.13	2.39 ± 0.19	1.96 ± 0.23	2.96 ± 0.04	2.36 ± 0.21
2.13 ± 0.24	2.38 ± 0.24	1.71 ± 0.28	1.42 ± 0.25	2.04 ± 0.26	2.04 ± 0.24
1.78 ± 0.26	2.43 ± 0.19	2.17 ± 0.24	1.74 ± 0.23	1.96 ± 0.26	1.61 ± 0.24

Results

Table 19./C
EMG-scan: muscle tension (mean ± SE) **of the patients**

	M. trap.		M. T1 P.S.	
	Left	**Right**	**Left**	**Right**
Before 1. hy	1.27 ± 0.25	1.37 ± 0.24	1.37 ± 0.24	1.53 ± 0.24
After 1. hy	0.97 ± 0.20	0.53 ± 0.14	0.67 ± 0.17	1.03 ± 0.19
Before 2. hy	0.72 ± 0.19	0.76 ± 0.21	0.97 ± 0.22	1.03 ± 0.25
After 2. hy	2.32 ± 0.19	1.89 ± 0.23	2.00 ± 0.24	1.71 ± 0.26
Before 3. hy	1.54 ± 0.25	1.42 ± 0.25	1.46 ± 0.27	1.92 ± 0.28
After 3. hy	1.48 ± 0.23	1.48 ± 0.23	1.91 ± 0.27	1.52 ± 0.23

Results

It was surprising to find, that the second session was associated with a significant increase in summarized muscle tension, particularly on the left side – like in the students (Table 20, Fig. 9). In contrast to the students, however, muscle tension was reduced significantly after the first session (on both sides).

Table 20.
EMG-scan - summarized muscle tension (mean ± SE) **of the patients**

	Left	**Right**	**Sum**
Before 1. hy	14.77±0.83	13.93±0.94	28.70±1.62
After 1. hy	9.13±0.90*	9.03±0.87*	18.17±1.53*
Before 2. hy	10.24±0.66	11.52±0.94	21.76±1.36
After 2. hy	16.68±0.61*	14.64±0.87*	31.32±1.27*
Before 3. hy	12.33±0.96	12.58±0.85	24.92±1.66
After 3. hy	13.43±0.79	12.57±0.82	26.00±1.41

* indicates significant differences, after the first hypnorelaxation, for both sides (and for the sum): $p<0.001$ (before vs after, n=30); after the second hypnorelaxation, for left side and for the sum): $p<0.001$ (before vs after, n=28), for right side: $p<0.01$ (before vs after, n=28).

Results

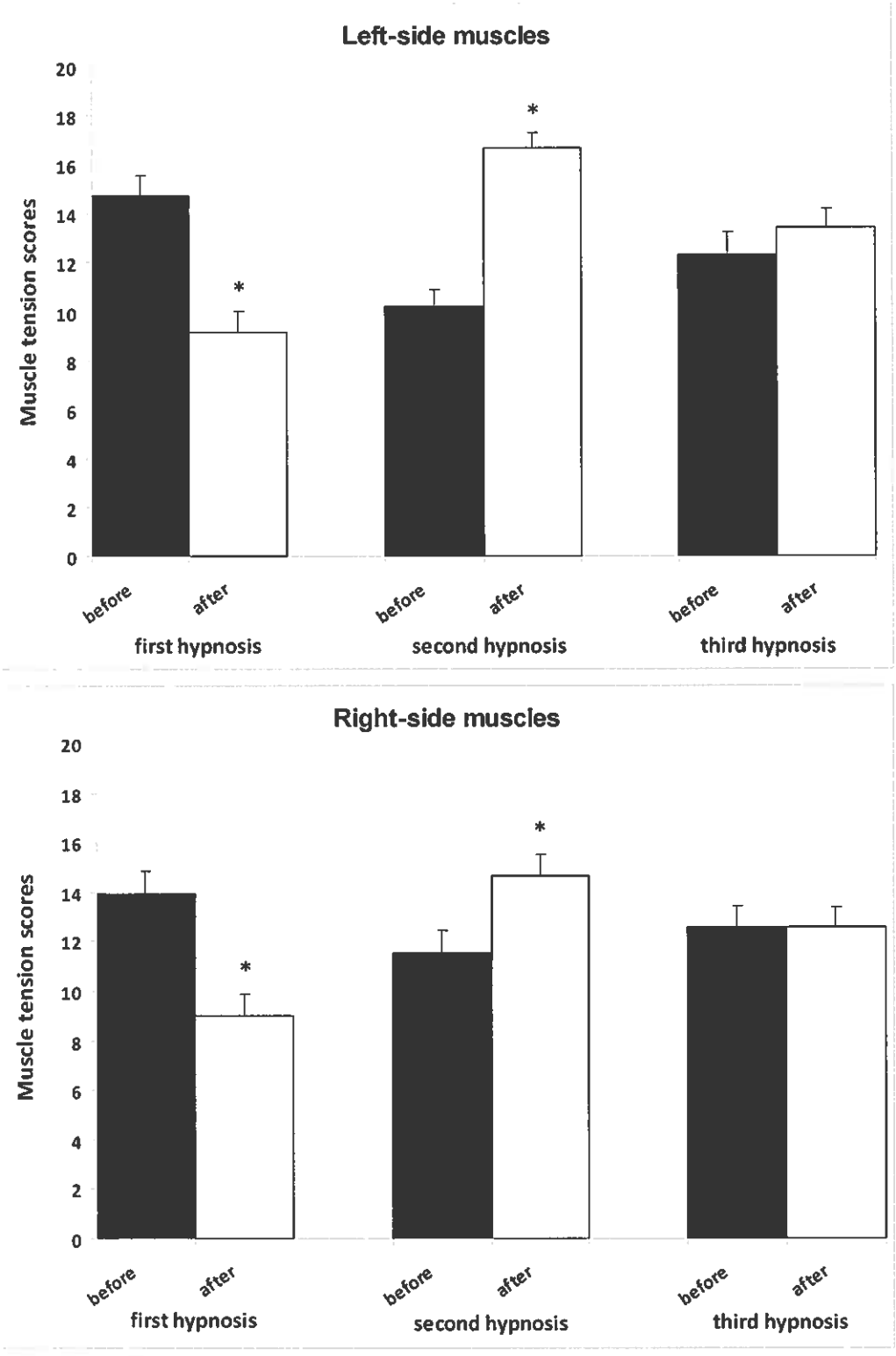

Fig. 9. Muscle tension scores of the patients (mean ± SE) before-after hypno-relaxations. * denotes significant differences, after the first hypnorelaxation, for both sides: $p<0.001$ (n=30); after the second hypnorelaxation, for left side: $p<0.001$ (n=28), for right side: $p<0.01$ (n=28).

Conclusion-Summary

Tor our surprise, both in the stressed students in the chronic anxious patients, the cognitive coping type of hypnorelaxation (involving contact with the inner adviser) appeared less effective in the decrease of the highly elevated muscle tension, in comparison to the standard relaxation-imagery hypnosis (with pleasant Leuner field suggestions).

Even more, there was a further increase in the muscle tension after the special (second) hypnorelaxation, especially on the left side, that may be related to a subconscious, increased stress in the right brain hemisphere.

As the elevated state anxiety of the chronic patients was successfully reduced by both types of hypnorelaxations, the related psychological and the psychomotor systems may be differently affected by the cognitive coping type of hypnorelaxation in highly stressed state.

The main neuroendocrine stress system (hypothalamus – pituitary - adrenal cortex, HPA axis) seemed to be responsive to both types of hypnorelaxation sessions in healthy students, as the increased ACTH levels were effectively reduced by these. (Decrease of cortisol was detected only after the standard hypnorelaxazion sessions.) Similarly to the state anxiety change in patients, the HPA axis and the psychomotor system are presumably differently influenced by cognitive coping hypnorelaxation /contact with inner adviser/.

In contrast to the transiently stressed students with relatively high ACTH and cortisol plasma levels, ACTH excretion was suppressed by cortisol (by negative feed-back) in theo chronic anxious patients, and could not be further decreased by hypnorelaxation in them, while cortisol excretion appeared to be still responsive (2-3. sessions).

Neither the examination stress, nor the chronic anxiety were sufficient to lead to significant changes in the chromogranin A level, and in the inflammatory markers in the students or in the patients with these parameters in the normal ranges.

All in all, (elevated) muscle tension scores appear to be most sensitive indicators of psychological stress in addition to either stress hormone concentrations (plasma ACTH, cortisol) in transitory stress (in healthy students), or to state anxiety psychotests (in chronic anxious patients). Relaxed psychosomatic state was more facilitated by standard relaxation-imagery hypnosis (with pleasant Leuner field suggestions) than by cognitive coping type of hypnorelaxation (involving contact with the inner adviser) in case of one/one subsequent sessions. The right brain hemisphere becomes relatively more active in hypnosis, relaxation, and suggestions to meet and ask the inner adviser appeared to result in subconscious stress affecting the tension regulation of the „stress-responsive" skeletal muscles; interestingly, the conscious anxiety feeling and/or the hypothalamus – pituitary - adrenal cortex axis was not or musc less affected.

Our investigations may contribute a/ to the development of novel, more effective schemes of hypnorelaxation for the treatment of chronic and/or intensive stress/anxiety, and b/ to more accurate assessment of the stressed state.

Presentation

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Effect of cognitive coping in hypnorelaxation in stressed students and in anxious patients

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Objective: Our aim was to compare the effect of standard and cognitive hypnorelaxations on the psycho-neuro-immunological status of healthy stressed students (before-during examination term) and in chronic anxious patients.
Methods: The patients (n=30, mean age: 47.5) and the students (n=20, mean age: 20.5) completed perceived stress and coping (Rahe), depression (BDI), hypnotizability (Harvard), trait and state anxiety (Spielberger) tests. The tensions of 7 muscles were measured by computer-assisted surface EMG. Special immunological markers (LL-37, lactoferrin, sICAM-1, IL-6, galectin-3) were assayed in blood plasma by ELISA. ACTH and cortisol levels were determined by chemiluminescence. Biosamples were collected before and after one cognitive and two standard hypnorelaxations.
Results: In students, significant decrease of ACTH level was detected after each hypnorelaxation session ($p<0.05$). Cognitive hypnorelaxation appeared to be less effective in downregulating cortisol concentration, but there were significant changes during the standard sessions ($p<0.01$). Contrary to students, state anxiety score was significantly decreased after each hypnorelaxation in patients ($p<0.05$). Onset of the examination term enhanced muscle tension dramatically in students ($p<0.0001$). Interestingly, cognitive hypnorelaxation resulted in an increase of muscle tension (especially on the left side) both in students and in patients. However, standard hypnorelaxation could reduce muscle tension only in patients ($p<0.01$). No significant changes were seen in the immunological markers in students.
Conclusions: Muscle tension scores appeared to be sensitive indicators of psychological stress in addition to stress hormones (ACTH, cortisol). Relaxed psychosomatic state was more facilitated by standard hypnorelaxation than by a cognitive coping one.
Keywords: stress, anxiety, hypnorelaxation, cognitive coping, muscle tension

(There was no possibility to add acknowledgement /like BIAL/ in the printed abstract.)

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Oral presentation: ***Session: Stress and coping***
30. June (10.30- 12.00 am)

(first and last slides)