Effects of Stretch-Based Progressive Relaxation Training on the Secretion of Salivary Immunoglobulin A in Orofacial Pain Patients

Jeffrey J. Sherman, MS
Graduate Student
Departments of Psychology and Behavioral Science, Orofacial Pain Center
College of Medicine

Charles R. Carlson, PhD
Associate Professor
Department of Psychology and Orofacial Pain Center

James A. McCubbin, PhD
Professor
Department of Behavioral Science
College of Medicine

John F. Wilson, PhD
Associate Professor
Department of Behavioral Science
College of Medicine

University of Kentucky
Lexington, Kentucky

Correspondence to:
Dr Charles R. Carlson
Department of Psychology
112 Kastle Hall
University of Kentucky
Lexington, Kentucky 40506–0044

There is a growing body of evidence that psychologic stressors can affect physical health and proneness to disease through depletion of the body's immune system. Relatively little research, however, has investigated the potential immunoenhancing effect of stress-relieving strategies such as progressive muscle relaxation. This study explored the relationship between immune functioning and relaxation training with persons experiencing persistent facial pain. In a single experimental session, 21 subjects either received relaxation training or rested for an equivalent time period. Salivary immunoglobulin A, mood, pain, and tension levels were measured before and after relaxation and rest periods. Results indicated that a greater proportion of those receiving relaxation training had increases in secretion of salivary immunoglobulin A. These findings suggest that immunoenhancement may be another potential benefit of progressive relaxation training for persons with chronic pain conditions.

J OROFACIAL PAIN 1997;11:115–124.

key words: facial pain, relaxation, psychoneuroimmunology, salivary immunoglobulin A

Temporomandibular disorders are characterized by pain and dysfunction of the masticatory and associated muscles.[1] In general, chronic pain syndromes are powerful stressors,[2] but facial pain is a particularly stressful experience because of the region in which the pain is localized. Pain in the facial area affects body image, subsistence, and the demonstration of pleasure in the form of smiling and laughter.[3] Disruptions in the normal functioning of the temporomandibular joint can have a significant influence on an individual's capacity to adapt to her/his environments.

Facial pain conditions can have profound psychologic effects along with important physiologic changes for the individual. For example, when compared to control subjects, facial pain patients are more depressed,[4] distressed,[5] and demoralized.[2] In the laboratory setting, facial pain patients have exaggerated heart rate and systolic blood pressure responses to stressors.[6] Patients also report more pain-related illnesses, more life threatening physical problems, more recent life events involving injury, and more nonpain-related physical illnesses.[5] Taken together, these findings suggest that facial pain may be a stressor of significant magnitude.

The immune system is sensitive to the psychosocial experience of stress.[7] Components of the cellular immune system are affected

by the death of a spouse,[8] recent separation from a spouse,[9] medical school examinations,[10] and depression.[11] A number of studies have demonstrated that secretory immunoglobulin A (IgA) is also sensitive to environmental and laboratory stressors. Secretory IgA is an important part of the body's humoral immune system. It is the predominant immunoglobulin found in body fluids, such as tears, nasal secretions, saliva, milk, and gastrointestinal secretions. Since it is most prevalent in surfaces that are exposed to the external environment, it prevents penetration of microorganisms and acts as the front line of defense against upper respiratory tract infections.[12–14]

As an important component of humoral immunity, the relationship between salivary IgA (S-IgA) and acute stressors has been investigated in several studies. Salivary IgA has been found to decrease after the stress produced by college exams[15–17] and daily hassles.[18] Salivary IgA is also influenced by levels of social support,[16] desirable and undesirable life events,[19] and positive mood states.[17,20] Furthermore, studies have shown that lower levels of S-IgA are associated with higher incidence of illness.[12,13,21,22] These results suggest that S-IgA may be a useful measure of immune system functioning that is sensitive to changes in the immediate psychologic environment.

Given the relationship between the experience of stress, life events, and the immune system, Marbach et al[2] examined the cellular immune functioning of facial pain patients. Results indicated that lymphocyte activity in response to concanavalin A (ConA) and pokeweed mitogen (PWM) was decreased in pain patients who had higher levels of distress and lower self-esteem. In addition, the level of pain intensity reported by the patients was inversely related to ConA response. Although there were no differences between pain patients and control subjects in natural killer cell activity, T-lymphocyte concentrations, and B cell counts, the authors concluded that demoralization and level of pain intensity are associated with diminished in vitro immune responses in facial pain patients.

Facial pain patients comprise a chronically stressed population with high levels of depression, anxiety, helplessness, and life events. If these conditions are associated with an immunocompromised state, then patients currently in pain may be at increased risk for further diseases. For this reason, Schleifer et al[23] suggested that chronic facial pain patients provide a useful model for the study of psychoimmunologic processes. As Marbach and colleagues[5(150)] describe patients with temporomandibular disorders, they "are usually distressed individuals who are beleaguered by recent physical illnesses and injuries as well as by pain, who tend to attribute their fate to external factors, and who have fewer of some important types of social support." This group of patients makes for an ideal population in which to study immune processes.

A number of studies have demonstrated the usefulness of various forms of progressive relaxation for improving the condition of chronic pain patients.[24–26] Many of these interventions have focused on relaxation procedures that involve tensing and relaxing various muscle groups. However, tension-based relaxation procedures can sometimes increase pain and inhibit relaxation.[26] For these reasons, an alternative muscle relaxation procedure focusing on gentle muscle stretching exercises was developed. Several experimental studies have demonstrated the efficacy of a stretch-based relaxation approach with muscle pain patients.[27–29] Based on the results and efficacy of earlier controlled studies on this patient population, the stretch-based relaxation approach was chosen for use in the present study.

A number of studies have demonstrated the usefulness of relaxation training for enhancing either cellular or humoral immune functioning in the elderly,[30] in adult and pediatric cancer patients,[31,32] in asymptomatic subjects in acutely stressful situations such as medical school exams,[33] and in undergraduate students.[25,34] Thus, in addition to relieving stress and pain, progressive relaxation training may have other important benefits such as immunoenhancement. However, the authors of the present study were not able to find any published studies that examined this relationship in facial pain patients.

This study investigated the potential immunoenhancing effects of a stretch-based progressive relaxation (SBPR) intervention. Changes in S-IgA secretion rates in patients undergoing relaxation training were compared with changes in those who rested quietly. It was hypothesized that the relaxation intervention would increase S-IgA secretion rates, improve mood, and decrease pain, as compared to resting quietly in a relaxed position.

Materials and Methods

Participants

Eighteen women and three men recruited from the Orofacial Pain Center at the University of Kentucky Dental School participated in the study.

Additionally, six patients refused to participate because of time and travel constraints. Exclusion criteria were *(1)* inflammation of the mouth or body; *(2)* infections, tumors, or degenerative joint disease; *(3)* history of alcohol or other substance abuse; *(4)* recent dental surgery, invasive dental work, or open sores in the mouth; and *(5)* treatment with medications likely to have important immune or psychologic effects, such as antibiotics, corticosteroids, antidepressants, and hormonal agents. All participants had little to no experience with relaxation training. Participants gave informed consent after the procedures and voluntary nature of the experiment had been explained. This research was approved by the Institutional Review Board of the University of Kentucky for the protection of human subjects.

Dependent Measures

The secretion rates of S-IgA were measured using a single radial immunodiffusion method. The assay had a sensitivity range of 6.25 to 100.00 mg/dL. Because S-IgA concentration is influenced by the flow rate of saliva, and relaxation stimulates salivary flow rate through parasympathetic activation,[35] samples were timed and analyses were conducted on both concentration level and secretion rate. Collected samples ranged in concentration from 6.39 to 93.58 mg/dL.

Pain severity, emotion, and tension ratings were measured at two saliva collection periods. Pain severity was measured using the short form of the McGill Pain Questionnaire (MPQ-SF). The MPQ-SF is highly correlated with the original MPQ.[36] It measures sensory and affective pain components as well as intensity of pain using a present pain intensity index and visual analog scale. Mood was measured using the Emotion Assessment Scale (EAS), which measures eight dimensions of emotional responding (sadness, happiness, fear, anger, guilt, anxiety, surprise, and disgust). The measure contains 24 visual analog scale items and has a split-half reliability of .94.[37] Muscle tension was measured using the Tension Mannequin Scale (TMS). This scale measures self-reports of muscle tension in each of 19 muscle sites using a 100-mm visual analog scale.[38]

Procedures

Participants were randomly assigned to one of two groups. Those in group 1 received relaxation training, and those in group 2 rested quietly in a reclined position.

Because the effects of a variety of variables, such as exercise, use of medication and alcohol, food, and sleep, can all potentially affect S-IgA secretion rates, all participants refrained from exercise, medication, and alcohol use for 24 hours prior to participation. Participants were also told to avoid brushing their teeth and eating or drinking anything other than water for 2 hours prior to participating in the study.

All participants washed their mouths with water before beginning the experiment. Participants rested quietly in a seated position on a recliner for 5 minutes while acclimating to the experimental setting and equipment. They then completed the MPQ-SF, EAS, and TMS. After completing these instruments, they were asked to swallow any saliva they had in their mouths, and they began expectorating into a 25-mL scintillation tube for 2 minutes. This was the baseline (time 1) sample. This sample was then refrigerated before subsequent weighing, centrifuging, and freezing.

After expectorating, group 1 participants were guided through a 20- to 30-minute stretch-based relaxation procedure according to instructions by Carlson and Collins.[39] All procedures were identical for participants in group 2, except they were told to recline in the chair, find a comfortable position for themselves and rest for approximately 25 minutes.

At time 2, participants expectorated for a second time following the same guidelines as before. Following this 2-minute time period, they completed the EAS, MPQ-SF, and the TMS scale. The same male experimenter was present throughout both the relaxation and resting conditions. While the relaxation training required that the experimenter read instructions throughout the procedure, he was seated out of the patient's view and there was no two-way interaction between the experimenter and the participant during the procedure. In the resting condition, the experimenter sat quietly in the room out of the patient's view, and there was no interaction between the experimenter and the participant.

Immunoassay

After collection, saliva samples were weighed and centrifuged at 2,000 rotations per minute (656g) for at least 15 minutes. The supernatant was pipetted from the sample and stored in a manual defrost freezer for no more than 1 month. Before assaying, samples were defrosted and then inverted several times to mix the contents.

Five microliters of each sample were micropipetted into individual wells in a single radial immuno-

diffusion plate (Kent Labs, Redmond, WA) containing secretory IgA antibodies and standards. Six reference samples of known dilutions (100.00, 50.00, 25.00, 12.50, and 6.25 mg/dL) were micropipetted into six wells to serve as reference concentrations. Plates were then incubated upside down at room temperature (23°C ± 2°C) until endpoint diffusion (approximately 48 hours). Endpoint diffusion is marked by the appearance of a precipitin ring around each well. The diameter of each ring was then measured to the nearest half millimeter with a gridded magnifying plate reader. Each ring was measured by two readers to ensure reliability.

The collection technique involves centrifuging entire saliva samples, aliquoting the supernatants, discarding the sediment, then freezing the supernatant until samples could be defrosted and deposited into the wells for reading. Little is known about the effects of freezing S-IgA over extended periods of time. To clarify this question, four samples from subjects and two reliability samples of known concentrations were defrosted and assayed 1 month and 2 months after freezing. The intraclass correlation[40] for these concentrations was $R = .40$. The mean level of S-IgA for samples frozen for 1 month was 39.9 mg/dL (standard deviation [SD] 10.5). The mean level of S-IgA for samples frozen for 2 months was 34.5 mg/dL (SD 9.1). The difference between these means was not statistically significant ($t[5] = 1.36$, $P > .05$), which suggests that samples did not significantly change over the month-long freezing period.

Statistical Analysis

All statistical analyses were carried out using the Statistical Analysis System,[41] and t tests were performed on all baseline measures, such as age, emotional state, anxiety, pain levels, and baseline S-IgA levels, to confirm initial equivalence between groups. Chi square analyses were performed on the number of participants in each group who had increases versus decreases in S-IgA. A nonparametric test was chosen to reflect proportions of participants with increases in S-IgA.

Results

Reliability and Validity of the S-IgA Measure

Initial analyses were conducted to determine the reliability and validity of the assay procedures. Two observers read 74 precipitin ring diameters during the course of the study. These readings included participant samples (n = 40) and standards from colostrum (n = 34). The intraclass correlation for interrater reliability[40] of these readings was $R = .998$. This measure of interrater reliability indicated that ring diameter reading was highly consistent from one rater to the next.

To test the intraplate reliability of the measure, seven standards of known dilutions were deposited into two different wells on each of seven plates used for the study. Similarly, nine saliva samples were deposited into two wells on each plate. The intraclass correlation between the ring diameter readings is a measure of agreement of predicted S-IgA concentration for the same plate. Reliability of these readings was $R = .996$. To calculate a measure for interplate reliability, nine samples were deposited into wells on different plates. The intraclass correlation between these readings was $R = .948$. This level of intraplate and interplate agreement between values suggested minimal variability within and between plates and negligible measurement error for the technique itself.

Previous research suggests that S-IgA concentration is negatively associated with salivary flow rate. Therefore, studies using this method must correct for volume of saliva produced.[42] The relationships between concentration and weight of saliva sample at times 1 and 2, were $r(18) = -.40$, $P < .1$, and $r(18) = -.48$, $P < .05$, respectively. These findings confirm the importance of controlling for salivary flow rate by deriving S-IgA secretion rates as a function of salivary flow. Secretion rates more accurately reflect S-IgA availability in saliva because they account for the relationship between S-IgA concentration and saliva volume. The correction for secretion rates was accomplished by multiplying S-IgA concentration in milligrams per milliliter by the volume produced per minute in milliliters per minute. All subsequent analyses are performed on corrected S-IgA secretion rates reported as milligrams per minute.

Descriptive Population Statistics

Twenty-one participants (3 men, 18 women) completed the study. One participant was unable to expectorate at time 2, so her S-IgA data were not included in the analyses. Consistent with the literature,[19] sex differences in S-IgA values were not statistically significant ($t[20] = .78$, $P > .05$). Mean S-IgA secretion rates for men and women were 0.32 mg/min and 0.24 mg/min, respectively. Initial values for S-IgA, and baseline values for age, duration

Table 1 Means and Standard Deviations of Emotional State, Pain, and Muscle Tension Levels at Baseline for Relaxation (n = 10) and Rest (n = 10) Groups

	Relaxation		Rest		
Variable	Mean	SD	Mean	SD	*F*
S-IgA (mg/min)	.210	.160	.212	.142	0.01
Age	30	8.4	36	14.4	1.46
Pain duration (months)	8	8.4	13	10.9	1.06
EAS (mm)					
Fear	5.1	4.8	5.7	4.6	0.09
Disgust	6.4	8.9	8.5	5.7	0.46
Anger	8.6	10.8	7.4	7.5	0.09
Anxiety	20.0	17.8	27.0	22.1	0.63
Sadness	10.1	9.9	10.1	5.8	0.00
Happiness	16.6	13.9	19.7	18.4	0.19
Surprise	9.3	10.2	9.4	12.4	0.00
Guilt	8.4	14.2	3.9	3.5	1.02
MPQ-SF (mm)					
Sensory	4.8	4.6	6.9	7.7	0.57
Affect	0.9	1.6	0.8	2.1	0.01
Present pain intensity index	1.4	1.1	1.3	0.6	0.10
Visual analog scale	26	19.6	35	22.6	0.91
Muscle tension (mm)	16.4	12.3	12.7	9.0	0.65

of pain, emotional state, and pain levels are shown in Table 1. No statistically significant differences were found between groups for any of the measured variables at baseline. Mean duration of pain was 11 months, with a range of 7 days to 36 months. Twelve participants had primary diagnoses of masticatory or cervical myofascial pain. Other primary diagnoses included disc displacement with reduction (four participants), chronic tension type headache (two participants), capsulitis (two participants), and osteoarthritis (one participant).

Salivary IgA Changes

Figure 1 shows the mean S-IgA values at both collection periods. To determine whether relaxation effectively increases S-IgA, individual changes in S-IgA for both groups were examined. Figures 2 and 3 show changes in S-IgA for all participants at both collection periods. Figure 2 reveals that S-IgA secretion rate increased for 9 of the 10 subjects who received relaxation training. Figure 3 reveals that 6 of the 10 participants who rested for an equivalent time period had increases in S-IgA. Pearson's chi-square statistic was used to test the hypothesis that these proportions were equal. Results indicate ($\chi^2[1,0.05] = 6.8$, $P < .05$) that these proportions are not equal, and it was unlikely that this pattern of frequencies would occur by chance.

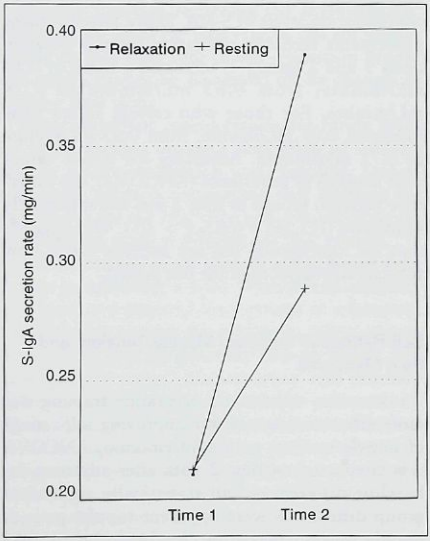

Fig 1 Salivary IgA secretion rates for relaxation (n = 10) and rest (n = 10) groups.

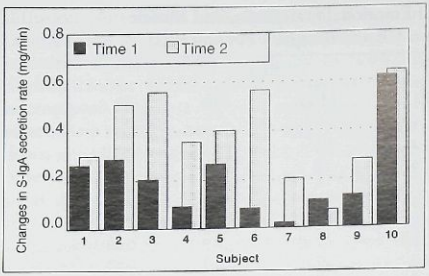

Fig 2 Individual changes in S-IgA for relaxation group (n = 10).

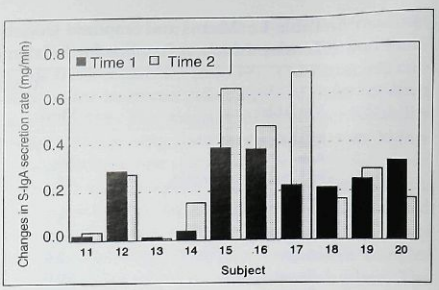

Fig 3 Individual changes in S-IgA for rest group (n = 10).

Salivary Flow Rate

Autonomic nervous system activity can change salivary flow rate because increased sympathetic nervous system activity tends to decrease saliva production. In turn, volume of saliva can affect concentration levels of S-IgA. Saliva flow for those participants receiving relaxation training between times 1 and 2 (group 1) increased a mean of 0.15 mL/minute, from 0.63 mL/minute to 0.78 mL/minute. For those who rested, saliva flow increased 0.08 mL/minute, from 0.63 mL/minute to 0.71 mL/minute. Adjusting for initial values with analysis of covariance (ANCOVA), the difference between groups at time 2 was not statistically significant ($F[1,16] = 0.63$, $P > .05$). This suggests that the intervention did not increase saliva flow substantially more than the rest period.

Self-Ratings of Emotion, Muscle Tension, and Pain Measures

To determine whether the relaxation training was more effective than rest for improving self-ratings of muscle tension, pain, and emotion, ANCOVA was conducted on time 2 data after adjusting for baseline differences. No statistically significant group differences were apparent for the pain or muscle tension measures. Analyses on the EAS scores indicated that initial values for sadness significantly predicted levels at time 2 ($F[1,16] = 7.68$, $P < .05$). The effect of group membership on sadness, adjusting for initial levels, was $F(1,16) = 7.08$, $P < .05$. The interaction between the covariate and the group effect was not statistically significant ($F[1,16] = 3.09$, $P > .05$). These results indicated that the SBPR group had lower levels of self-reported sadness than those who rested. No other measured emotional differences were apparent.

To further explore these findings, the relationship between S-IgA and all related variables was examined. The S-IgA values were averaged and correlated with age; the change in S-IgA because of relaxation; and initial levels of emotion, pain, and tension. Salivary IgA was negatively correlated with age ($r[18] = -.43$, $P < .06$), initial levels of fear ($r[18] = -.43$, $P < .06$), and anger ($r[18] = -.39$, $P < .08$).

Discussion

The results supported the hypothesis that a stretch-based progressive relaxation intervention may increase salivary IgA secretion rates in facial pain patients. A greater proportion of those receiving relaxation training had increases in S-IgA when compared to those who rested quietly. In addition, those receiving the relaxation training reported lower ratings of sadness than did resting controls. These findings demonstrate two potential benefits of relaxation training for the management of chronic pain, namely the enhancement of humoral immune function and reductions in self-reports of sadness.

Because S-IgA helps to prevent pathogen implantation in mucous membranes,[43] increases in S-IgA could be associated with reduced susceptibility to upper respiratory tract infections. These findings may be of particular importance for the facial pain patient. Marbach and colleagues[5] demonstrated that facial pain patients have more pain-

and nonpain-related illnesses than do asymptomatic subjects. By enhancing the secretion rate of S-IgA, SBPR may not only reduce their risk for upper respiratory tract infections, but also for other diseases of the oral cavity. Previous findings have indicated that lowered S-IgA levels are associated with an increase in the incidence of dental caries[44] and periodontal disease.[45] The use of the SBPR approach may influence physical health on several important dimensions of health and psychosocial functioning.

The rapid effect of the relaxation was apparent by the greater proportion of increases in S-IgA secretion for the relaxation group after a brief, 25-minute intervention, but how long can this effect be maintained? McClelland et al[17] found that S-IgA concentration was higher for students immediately after a stressful examination than on more relaxed days. These authors also found an equivalent, significant drop in S-IgA within 2 hours of the stressor. Similarly, Dillon et al[20] found increases in S-IgA concentration after subjects viewed a humorous video, but increased levels declined within minutes after viewing. In agreement with our results, Green et al[34] found immediate increases in S-IgA with a 20-minute relaxation intervention in a group of students. They also found that these increases in S-IgA were maintained during a 3-week period of daily relaxation practice so that even before relaxation on the twenty-second day of practice, initial levels of S-IgA were greater than twice that of initial levels before relaxation on the first day. Longitudinal studies over extended periods of time would be necessary to clarify the maintenance of S-IgA changes resulting from relaxation among chronic facial pain patients.

It is interesting to note that the observed increase in S-IgA during relaxation occurred with a concomitant decrease in level of sadness. Although studies have found that S-IgA is related to adequacy of social support[16] and loneliness,[34] the mechanisms underlying these relationships and the effects of relaxation are poorly understood. It is possible that other emotional variables such as sadness or depression may mediate the relationship between immunologic changes and relaxation. Similarly, it is possible that other variables not adequately accounted for, other than the relaxation intervention, may have influenced S-IgA secretion. For example, the impact of sitting in a private room with a male therapist may have had differential effects on participants based on their personality characteristics and psychosocial history. While for some, the experience of interacting with an experimenter may have been pleasant, challenging, and socially supportive, others may have perceived the experience as an anxiety-provoking test. The experience of either receiving relaxation training or resting quietly, and expectorating into a tube, may have very different emotional connotations for different subjects. This highlights the need to further research the mechanisms underlying these relationships and is of particular relevance to those experiencing chronic pain who may have a higher incidence of depression and the perception of less than adequate levels of social support.[23]

Many factors affect the secretion rate and composition of saliva.[46] Stressful situations reduce salivary flow through sympathetic activation,[36] while relaxation increases flow rate.[36,47] All else being equal, increased flow of saliva would decrease S-IgA concentration.[12] As expected in both groups, S-IgA concentration was inversely related to salivary flow, which suggests the need for adjusting for salivary flow and using secretion rates rather than concentration values. However, although the intervention increased salivary flow a minimal 0.15 mL/minute, concentration rates still increased for those subjects receiving the intervention. Furthermore, since the intervention did not significantly change flow rate in the relaxation group, our results cannot be accounted for by changes in salivary flow alone.

Some important considerations for future studies were revealed during a debriefing of subjects shortly after participation was complete. Several relaxation subjects commented that learning the procedures for the first time and concentrating on the stretches made it difficult to "feel relaxed." It is not uncommon in the clinical setting to see difficulties in achieving a truly relaxed and comfortable state in a patient's first attempt at relaxation. The stretches require the patient to follow simple instructions and are generally easy to follow, but they require some concentration and practice before patients feel proficient in their performance. Thus, future studies should emphasize additional sessions and practice training until subjects feel adept at the procedures. Regardless, even with the difficulties associated with learning a new technique, subjects receiving relaxation training for the first time still had increases in S-IgA secretion rate.

In addition, some subjects in the control group also commented about the boredom that set in during the rest period. Although it is possible that differences between groups may have resulted from the tedium of resting and not from benefits of the training, this explanation is not supported by the evidence from other relaxation studies. For

example, Green and Green[48] compared relaxation with massage, touching, visualization, and lying quietly. They found that relaxation increased secretion of S-IgA more than the alternative control procedures. Thus, the evidence would suggest that some aspect of the relaxation training influenced S-IgA. It is possible that this aspect may have been the socially supportive role of the therapist, and such hypotheses merit further exploration in future studies.

The general procedure for assay of S-IgA used in the present study (single radial immunodiffusion) has been used in much of the psychoneuroimmunology literature. The plates used in our study, however, were made specifically for secretory IgA detection (Kent Labs) and used secretory IgA antibody and standards rather than antibody and standards from serum. Previous studies[16,21,34,48] using serum IgA standards required that obtained concentration values be corrected for the differences in sedimentation coefficients between serum and salivary IgA. Using secretory-specific antibodies and standards required no conversion from serum to secretory standards. High interrater reliability demonstrates the ease and accuracy with which the precipitin rings can be measured. Moreover, high interplate and intraplate reliabilities also showed that the measure is consistent and accurate.

It is important to note these results do not suggest a relationship between relaxation and the production of serum antibodies because such a process takes days as opposed to minutes. We did not measure a change in the number of antibodies actually produced. Rather, we observed changes in antibodies released and available in saliva. Results suggest that relaxation resulted in more increases in S-IgA secretion than did sitting quietly. The magnitude of this change and the clinical significance of such change require further study.

Another important consideration when reviewing these results is the association between low power and small sample size. The low power associated with a small sample generally results in a bias toward null findings. Given the small sample size in this study, the likelihood of finding the hypothesized effects was low. Despite the low power, however, statistically significant effects and relationships did emerge in the predicted direction.

Schwartz[49(5)] stated that "measuring what is easy to measure in studying the effects of psychosocial factors [on immunity] may not be clinically relevant." In detecting an effect between S-IgA and relaxation, we must be cautious to avoid overinterpreting the results. The present findings do not allow for broad statements about improvements in health or well-being as a result of practicing relaxation. However, one can see the acute benefits of a stretch-based relaxation approach for improving mood, and increasing S-IgA secretion rate in chronic orofacial pain patients. These results demonstrate that relaxation may at least offer a brief respite from the chronic stress that likely contributes to the psychologic and physical distress that many of these pain patients report.

Acknowledgments

This study was supported by a University of Kentucky Foundation Grant awarded to Dr Charles R. Carlson.

References

1. Okeson JP. Bell's Orofacial Pains, ed 5. Chicago: Quintessence, 1995.
2. Marbach JJ, Schleifer SJ, Keller SE. Facial pain, distress, and immune functioning. Brain Behav Immunity 1990;4: 243–254.
3. Carlson CR, Bertrand PM, Okeson JP. The role of behavioral medicine in the treatment of chronic temporomandibular disorders: Neuromuscular re-education in the dental setting. In: Kall R, Shtark M, Sokhadze T (eds). The Encyclopedia of Applied Psychophysiology and Behavioral Medicine. Bensalen, PA: Future Health Press, 1997 (in press).
4. Marbach JJ, Lund P. Depression, anhedonia, and anxiety in temporomandibular joint and other facial pain syndromes. Pain 1981;11:73–84.
5. Marbach JJ, Lennon MC, Dohrenwend BP. Candidate risk factors for temporomandibular pain and dysfunction syndrome: Psychosocial, health behavior, physical illness and injury. Pain 1988;34:139–151.
6. Carlson CR, Okeson JP, Falace DA, Nitz AJ, Curran S, Anderson D. Comparison of psychologic and physiologic functioning between patients with masticatory muscle pain and matched controls. J Orofacial Pain 1993;7:15–22.
7. Ader R. Psychoneuroimmunology. New York: Academic Press, 1981.
8. Schleifer SJ, Keller SE, Camerino M, Thornton JL, Stein M. Suppression of lymphocyte stimulation following bereavement. J Am Med Assoc 1984;250:374–378.
9. Kiecolt-Glaser JK, Fisher LD, Ogrocki P, Stout JC, Speicher CE, Glaser R. Marital quality, marital disruption, and immune functioning. Psychosom Med 1987;49: 13–34.
10. Kiecolt-Glaser JK, Garner W, Speicher CE, Penn G, Glaser R. Psychosocial modifiers of immunocompetence in medical students. Psychosom Med 1984;46:7–14.
11. Schleifer SJ, Keller SE, Bond RN, Cohen J, Stein M. Major depressive disorder and immunity. Arch Gen Psychiatry 1989;46:81–87.
12. Jemmot JB, McClelland DC. Secretory IgA as a measure of resistance to infectious disease: Comments on Stone, Cox, Valdimarsdottir and Neale. Behav Med 1989;12: 63–71.

13. Rossen RD, Butler WT, Waldman RH. The protein in nasal secretions. JAMA 1970;211:1157–1161.
14. Yodfat Y, Sylvian H. A prospective study of acute upper respiratory infections among children in a kibbutz. J Infect Dis 1977;36:26–30.
15. Jemmott JB, Borysenko JZ, Borysenko M, McClelland D, Chapman R, Meyer D, Benson M. Academic stress, power motivation, and decrease in secretion rate of salivary secretory imunnoglobulin A. Lancet 1983;25:1400–1402.
16. Jemmott JB, Magloire K. Academic stress, social support, and secretory immunoglobulin A. J Pers Soc Psychol 1988;55:803–810.
17. McClelland DC, Ross G, Patel V. The effect of an academic examination on salivary norepinephrine and immunoglobulin levels. J Human Stress 1985;11(2):52–59.
18. Martin RA, Dobbin JP. Sense of humor, hassles and immunoglobulin A: Evidence for a stress moderating effect of humor. Int J Psychiatry Med 1988;18:93–105.
19. Evans P, Bristow M, Hucklebridge F, Clow A, Walters N. The relationship between secretory immunity, mood and life events. Br J Clin Psychology 1993;32:227–236.
20. Dillon KM, Minchoff B, Baker KH. Positive emotional states and enhancement of the immune system. Int J Psychiatry Med 1985;15:13–18.
21. McClelland DC, Alexander C, Marks E. The need for power, stress, immune function and illness among male prisoners. J Abnorm Psychology 1982;91:61–70.
22. McClelland DC, Floor E, Davidson R, Saron C. Stressed power motivation, sympathetic activation, immune function and illness. J Human Stress 1980;6(2):11–19.
23. Schleifer SJ, Marbach J, Keller SE. Psychoneuroimmunology: Potential relevance to chronic facial pain. Anesth Prog 1990;34:93–98.
24. Crockett DJ, Foremen ME, Alden L, Blasberg B. A comparison of treatment modes in the management of myofascial pain dysfunction syndrome. Biofeedback Self Regul 1986;11:279–291.
25. Rider MS, Achterberg J, Lawlis F, Govern A, Toledo R, Butler JR. Effect of immune system imagery on secretory IgA. Biofeedback Self Regul 1990;15:317–333.
26. Turk CD, Meichenbaum D, Genest N. Pain and Behavioral Medicine: A Cognitive Behavioral Perspective. New York: Guilford, 1983.
27. Carlson CR, Okeson JP, Falace DA, Nitz AJ, Anderson D. Stretch-based relaxation and the reduction of EMG activity among masticatory muscle pain patients. J Craniomandib Disord Facial Oral Pain 1991;5:205–212.
28. Carlson CR, VenTrella MA, Sturgis ET. Relaxation training through muscle stretching procedures: A pilot case. J Behav Ther Exp Psychiatry 1987;18:121–126.
29. Kay JA, Carlson CR. The role of stretch based relaxation in the treatment of chronic neck tension. Behav Ther 1992;23:423–431.
30. Kiecolt-Glaser JK, Glaser R, Willinger D, Stout J, Messick G, Sheppard A, et al. Psychosocial enhancement of immunocompetence in a geriatric population. Health Psychology 1985;4:25–41.
31. Fawzy FI. Immune effects of a short term intervention for cancer patients. Advances 1990;10:32–33.
32. Olness K, Culbert T, Uden D. Self regulation of salivary immunoglobulin A by children. Pediatrics 1989;83:66–71.
33. Kiecolt-Glaser JK, Glaser R. Psychological influences on immunity. Psychosomatics 1986;27:621–624.
34. Green ML, Green RG, Santoro W. Daily relaxation modifies serum and salivary immunoglobulins and psychophysiologic symptom severity. Biofeedback Self Regul 1988; 13:187–199.
35. Morse DR, Schacterle GR, Esposite JV, Chod SD, Furst ML, DiPonziano J, Zaydenberg M. Stress, meditation and saliva: A study of separate salivary gland secretion in endodontic patients. J Oral Med 1983;38:150–159.
36. Melzack R. The short form of the McGill Pain Questionnaire. Pain 1987;30;191–197.
37. Carlson CR, Collins FL, Porzelius J, Stewart JF, Nitz AJ, Lind C. The assessment of emotional reactivity. J Psychopathol Behav Assessment 1989;11:313–325.
38. Webster JS, Ahles TA, Thompson JK, Raczynski JM. The assessment of objective tension levels among several muscle groups: The tension mannequin. J Behav Ther Exp Psychiatry 1984;15:323–328.
39. Carlson CR, Collins FL. Stretch Relaxation: A Training Manual. Wheaton, IL: 1989.
40. Fleiss JL. The Design and Analysis of Clinical Experiments. New York: Wiley & Sons, 1986.
41. SAS User's Guide: Statistics, version 5. Cary, NC: SAS Institute, 1985.
42. Stone AA, Cox DS, Valdimarsdottir H, Neale JM. Secretory-IgA as a measure of immunocompetence. J Human Stress 1987;13:136–140.
43. Tomasi TB. The Immune System of Secretions. Englewood Cliffs, NJ: Prentice Hall, 1976.
44. Lehner T, Cardwell JE, Clarry ED. Immunoglobulins in saliva and serum in dental caries. Lancet 1967;1:1294–1297.
45. Genco RJ, Evans RT, Ellison SA. Dental research in microbiology with emphasis on periodontal disease. J Am Dent Assoc 1960;78:1016–1036.
46. Mandel ID, Wotman S. The salivary secretion in health and disease. Oral Sci Rev 1976;4:25–47.
47. Feldman H. Salivary buffer capacity, pH and stress. Am Soc Psychosom Dent Med 1974;21:25–30.
48. Green ML, Green RG. Relaxation increases salivary immunoglobulin A. Psychol Rep 1987;61:623–629.
49. Schwartz CE. Introduction: Old methodological challenges and new mind body links in psychoneuroimmunology. Advances 1994;10:4–7.

Resumen

La Relación Entre el Relajamiento y los Niveles de Saliva-Immunoglobulina A en Personas con Dolores Faciales Persistentes

Existe una creciente evidencia que indica que el estres sicológico puede affectar la salud y la tendencia a la enfermedad a través del desgaste del sistema inmune. Relativamente pocos estudios han investigado la capacidad de alivio y fortalecimiento del sistema inmune de las estrategias para aliviar el estres, como la técnica del relajamiento progresivo muscular. Este estudio explora la relación entre el funcionamiento del sistema inmune y el relajamiento en personas con dolores faciales persistentes. En una sola sesión experimental, 21 pacientes recibieron entrenamiento de relajación, o por el mismo periodo de tiempo solo descansaron. Se midieron los niveles de Saliva-Inmunoglobulina A (S-IgA), disposición, dolor, y tension, antes y después del relajamiento o de los periodos de solo descanso. Los resultados indicaron que una gran proporción de aquellos que recibieron el entrenamiento para relajamiento tuvieron incrementos en la secreción de S-IgA. Estos resultados sugieren que el fortalecimiento del sistema inmune puede ser otro beneficio de la técnica de relajamiento progresivo para las personas que padecen de dolor crónico.

Zusammenfassung

Auswirkungen des auf Dehnung beruhenden progressiven Entspannungstrainings auf die Sekretion des Speichel-Immunoglobulin A bei Patienten mit orofazialen Schmerzen

Es existieren immer mehr Beweise dafür, dass psychologische Stressoren die körperliche Gesundheit und die Erkrankungsneigung durch eine Schwächung des Körperimmunsystems beeinflussen können. Dagegen ist relativ wenig erforscht über die mögliche immunoerhöhende Wirkung von stressabbauenden Strategien wie die zunehmende Muskelentspannung. Diese Studie untersucht die Beziehung zwischen der Immunarbeit und Entspannungstraining bei Personen, welche unter andauerndem Gesichtsschmerz leiden. In einer einzigen Versuchssitzung erhielten 21 Leute entweder Entspannungstraining oder verblieben für die entsprechende Zeitperiode. Speichel-Immunoglobulin A, Stimmung, Schmerzen und Spannungszustand wurden vor und nach der Entpannung und Ruheperiode gemessen. Die Resultate weisen darauf hin, dass ein grösserer Anteil der Personen, welche Entspannungstraining erhielten, eine Erhöhung der Sekretion von Speichel-Immunoglobulin A aufweisen. Diese Befunde legen nahe, dass die Immunoerhöhung ein weiterer möglicher Vorteil des progressiven Entspannungstrainings bei Personen mit chronischen Schmerzzuständen sein kann.