EMG Training and Headache Reduction: 
Some Methodological Issues

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We've been running experiments on voluntary control of tension headaches since 1971, and our results have done nothing but cause problems for us. They simply are not orthodox. More specifically, they raise questions about the relationship of head and neck muscle tension to the etiology, onset, and control of tension headaches. And what is learned by our subjects does not appear to fit either the operant learning model or the skills learning model—not, at least, in any obvious way. This is, perhaps, not quite correct. Some skills are being learned and reinforcement of operant behavior does occur. The skills being learned, however, do not appear to be the ones we think we are training, and the reinforcement we are paying attention to does not appear to be the one that is responsible for making the subject headache-free.

I'd like to briefly review that we've been doing and solicit your assistance in trying to make some sense out of our data. We have a theory, but it is a theory born out of mild desperation. Maybe you've got a better one that requires fewer epicycles.

All in all, we've run 80 medically defined tension headache subjects in six experiments. I'll briefly review the main findings of the first four experiments and present some data from the fifth; the sixth is in progress.

In our first experiment feedback was not provided during lower tension commands (that is, when the subject was told to decrease his trapezius neck muscle tension he did not receive feedback) but only during 1-minute raise tension commands. Ten sets of 1-minute raise, rest, and lower commands were given in sequence for 10 sessions over two 5-day periods. The results were little short of amazing: Nine of 11 feedback subjects reported significant decreases in headaches after the 2nd week of training and 7 of these subjects were headache-free. Six of 8 that responded to a 1-year follow-up continued to have a significantly lower headache score than their pretraining score.

We faced a dilemma in trying to explain these results. The classic assumption, based on a reasonable amount of respectable research, is that tension headaches arise from the sustained maintenance of high levels of head and neck muscle tension. This does not appear to be the case, however. The skills being learned are not the ones we think we are training, and the reinforcement we are paying attention to does not appear to be the one that is responsible for making the subject headache-free.

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muscle tension. In this experiment we trained our subjects to become more tense and yet their headaches disappeared.

We claim no brilliance for this design. Our findings resulted from serendipity. The subjects were supposed to get feedback for both the raise and lower tension conditions. A fluke in the computer, however, withheld feedback during lower commands. The subjects, of course, complained that they experienced great difficulty in responding to the lower-tension commands; but knowing that lowering tension is a difficult task, we simply encouraged them to keep trying.

After a good deal of puzzlement our results finally made sense. The Jacobsen Progressive Relaxation Technique trains muscle relaxation by having subjects increase tension and then letting go. This is similar to our increase-tension condition followed by the rest period (i.e., return-to-baseline condition). Unlike the progressive relaxation technique, however, we were showing the subjects, by feedback, how well they were doing.

The reinforcement, of course, was the relief of tension upon reaching the baseline condition following each raise command. This would appear to be a much more powerful reinforcing state of affairs than one would expect from that achieved by lowering tension from baseline and returning to baseline. It also had the advantage of training subjects to sense the difference between high and relatively lower (i.e., baseline) levels of muscle tension. Accordingly, away from the laboratory, they might have become more adept at sensing muscle tension buildup and immediately relaxing—thereby aborting an incipient headache.

This first experiment makes the point that “face validity” doesn’t necessarily make things so. Others have trained tension headache subjects with feedback to reduce muscle tension levels below baseline. This approach has a great deal of face validity and it also works. But it takes a long time to teach the average subjects to accomplish this rather difficult task; it’s much easier and requires a much shorter time to train subjects to tense and let go. What our results told us is that it seems much more important to train people to sense (by experiencing) voluntarily induced high and low levels of tension than it is to train them directly to lower tension. This point has been made before for cardiac patients by Bernie Engle; he found it beneficial to have his patients learn to increase, as well as decrease, their cardiac arrhythmias. We also had the terrible thought that you may not even have to provide external feedback to achieve this goal. We chose not to follow up on this traumatic thought and proceeded to continue our feedback experiments. Lately, however, we’ve been forced to reconsider this possibility. But before I go into that issue, let me briefly tell you what else we’ve found.

First, subjects appear to learn to raise or lower on command (as tested without feedback) fairly quickly, or they don’t learn at all. In our second experiment, additional training was without effect in learning better muscle tension control or in further reducing headache density.

Second, sitting quietly for an equivalent number of sessions has no effect on achieving better muscle tension control, or on headache density. Neither does noncontingent feedback.