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### **Breathing Biofeedback to Reduce Side Effects After a Kidney Transplant**

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**Abstract:** A 39-year-old kidney transplant female participated in six biofeedback sessions to learn relaxation and enhance control. When she inhaled pentamidine it caused coughing, gagging and increased blood pressure and heart rate. Respiration feedback was recorded with abdominal and thoracic strain gauges. Training included cognitive and physiological breathing self-regulation skill. After training, respiration changed from 27 to 8 breaths per minute with concurrent abdominal movement; heart rate decreased and RSA increased. She was able to take the pentamidine inhalation treatment without evoking discomfort and her blood pressure and heart rate remained normal.

**Keywords:** kidney transplant, breathing, anxiety, respiratory sinus arrhythmia

**Introduction:** Patients who receive successful kidney transplants often face uncertainty and ambiguity for the first six months to a year following surgery. Anxiety and fear are commonplace as they endure ongoing medication and wait to see if their body rejects the new kidney. Biofeedback training may offer kidney transplant patients tools to reduce anxiety, to master skills to breathe easier, and to reduce excessive sympathetic arousal. The following case report describes the use of biofeedback as an adjunctive procedure to enhance quality of life for a recent kidney transplant patient.

**Subject:** A 39-year-old female who underwent a second kidney transplant on April 13, 2000. She was first diagnosed with congenital retrogradient reflux at age 13. A surgical procedure to re-insert the ureters at the correct angle to the bladder resulted in restoring her kidney function to 50%. With this enhanced kidney function, she grew 6 or 7 inches within a year. However, during this time, she developed high blood pressure, which was controlled by medication. To preserve kidney function in order to avoid dialysis treatment, she also maintained a 55 mg low protein diet. Nevertheless, at age 18 dialysis treatments began. The following year she received her first kidney transplant from her mother. This transplanted kidney worked well initially and dialysis was stopped, but after 3 months it was removed due to multiple rejections. For the next 20 years, she was maintained on in-center hemodialysis, self-care home hemodialysis or continuous ambulatory peritoneal dialysis.

The subject received her second kidney transplant on April 13th, 2000, from a 12-year-old drowning victim. Besides taking medication to prevent rejection, she also receives lung inhalation therapy once monthly, which requires breathing pentamidine, a bitter substance, into her lungs for fifteen minutes to prevent pneumocystis, a rare pneumonia

commonly seen in AIDS or immuno-suppressed patients. The first time she did this she coughed, gagged, cried, couldn't catch her breath and felt light-headed. Her blood pressure and heart rate soared, requiring extra treatment time before she felt better and was able to leave the room. Upon leaving, she went home to rest and recuperate.

She chose biofeedback to learn to lower her blood pressure, reduce anxiety and learn to have peace of mind.

**Method.** The subject was seen for six individual biofeedback sessions to learn relaxation and, hopefully, experience peace of mind. During the initial session, we observed visually that there was an obvious absence of abdominal movement during breathing and a rapid thoracic breathing pattern. As part of the training, respiration and heart rate were monitored with a Flexcomp (Thought Technology Ltd). Respiration was recorded with abdominal and thoracic strain gauges and her heart rate was derived from the photoplethysmograph recorded from the left thumb. In each session, cognitive and physiological self-regulation skills were explored, monitored and trained. She received visual feedback and discussed the implications of the observed physiological patterns. The major themes included teaching slower diaphragmatic breathing, integrating breathing skills into daily life, and reducing cognitive arousal through visualization and discussions (e.g., using awareness of a worry to trigger slow diaphragmatic breathing, projecting goodwill to people or situations with whom she anticipated conflict).

After the initial observation of predominantly rapid thoracic breathing, the biofeedback training focused upon learning slower diaphragmatic breathing. This process included:

- Discussion of optimum breathing patterns (e.g., whole body involvement).
- Discussion of the role of arousal, homeostasis and immune competence.
- Exploration of possible reasons why her abdomen had no movement during breathing (e.g., multiple abdominal surgeries, fear of bumping the transplanted kidney which was placed in her lower abdomen, restrictive clothing and belt, and self-image—my stomach is big).
- Monitoring, feedback and training of diaphragmatic breathing combined with heart rate feedback to increase respiratory sinus arrhythmia (RSA) and increase abdominal movement during breathing.
- Tactile and kinesthetic coaching and imagery to encourage slower breathing (e.g., imagine exhaling down her arms and legs).
- Breathing while lying down on her back with a weight on her abdomen to encourage diaphragmatic breathing (e.g., the weight goes up during inhalation and down during exhalation).
- Practicing slow exhalation approximately twice as long as inhalation.
- Transferring the skills at home and during various daily situations.

**Results.** During the initial baseline, her respiration rate was 27 breaths per minute while sitting quietly and 22 breaths per minute during talking without abdominal movement as shown in figure 1. There was an absence of RSA, with a heart rate between 80 and 85 beats per minute (bpm) during rest and 85 to 90 bpm during talking. After training, there was a significant slowing of respiration to 8 breaths per minute with concurrent abdominal movement, the presence of RSA and a slower heart rate (between 78 to 82 bpm).

The subject significantly improved her ability to relax, fall asleep, inhale pentamidine and transfer the biofeedback skills into her daily life as described below in her self-report.

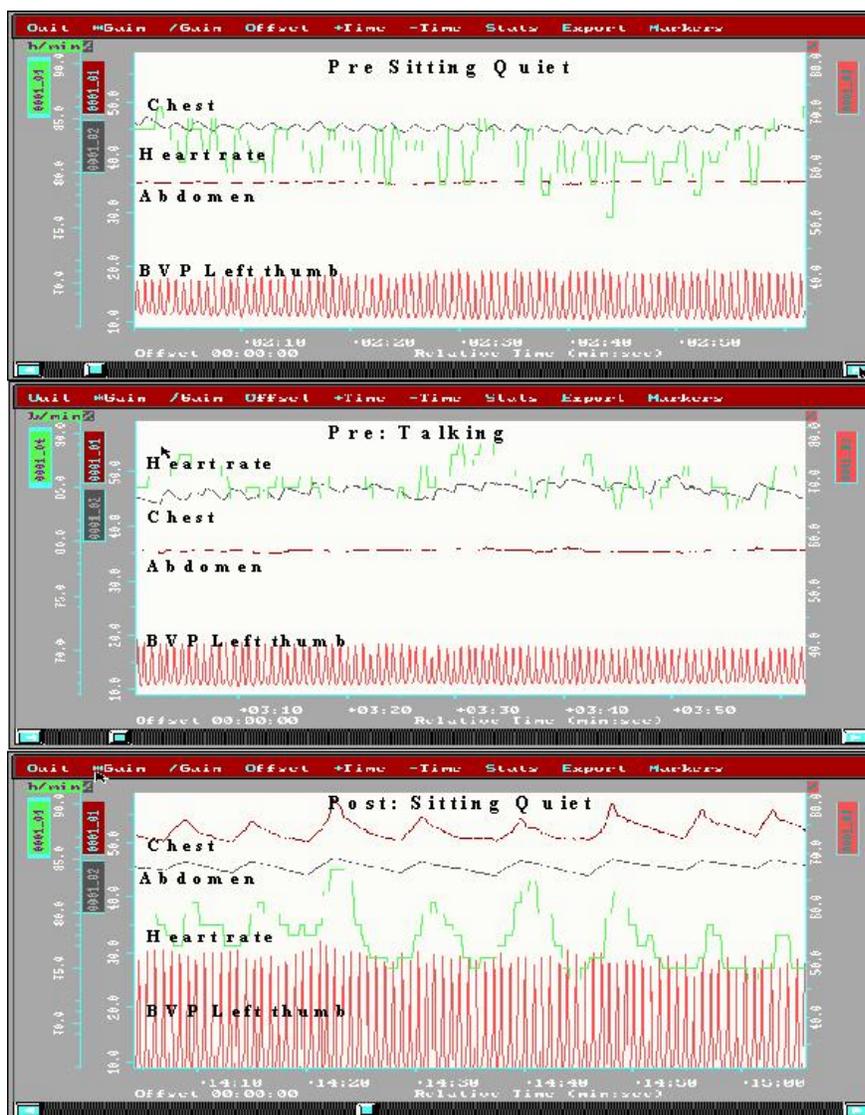


Figure 1. Representative breathing patterns and heart rates during pre-baseline while sitting and talking, and post-baseline (1 minute recordings). Note the absence of abdominal movement during the pre-baseline conditions and the presence of abdominal movement and respiratory sinus arrhythmia during the post-baseline.

### **Subject's self-report of benefits of biofeedback training**

She reported that controlling and learning how to breathe slower and more diaphragmatically showed her that this could have an immediate and positive effect on her heart and her overall feeling of well being. The following are some of the significant benefits reported from the biofeedback training sessions:

- Biofeedback helps me to focus on my breathing. When I inhale and exhale, I count to myself to slow my breathing. After a couple of minutes of steady slow breathing I find I am calm, relaxed, restful and peaceful.
- Breathing and relaxation helped me through the pentamidine inhalation sessions. During the second treatment I used the biofeedback technique and coughed only once. Upon completion of the session, my blood pressure dropped and I went about my day as usual. My husband and I were amazed at the difference between treatments. During the third treatment, I used the Biofeedback technique and did not cough at all. On the way home, I called my husband to let him know that the session went well. Even the taste of the medicine is not as noticeable. Now, my heart rate and blood pressure remain normal during the treatment.
- The transplant staff has noticed that my blood pressure was significantly lower. As a result, I do not need high blood pressure medication.
- I used biofeedback skills in many settings. For example, when waiting to be seen by the doctor, as well as while driving to the Medical Center; and before I go to bed at night to relax. I am amazed at how effective this is. Over the years, I have tried meditating and watching my breathing with minimal if any results. Biofeedback made me feel in control of my body and its reactions to unexpected events.

### **Discussion and conclusion:**

Biofeedback training of effortless breathing is a powerful adjunctive strategy to enhance quality of life and subjective control for this subject. The biofeedback monitoring demonstrated the dysfunctional breathing pattern as well as showed her that change and control was possible. Through generalization of the learned skills, the subject was able to achieve control in situations where she normally felt out of control. This approach should be investigated as a complementary technique for transplant patients as well as for anyone needing to inhale medications that evoke coughing, gagging, and panic. As the subject reported:

*“What makes biofeedback so terrific in day-to-day situations is that I can do it at any time as long as I can concentrate. When I feel I can't concentrate, I focus on counting and working with my diaphragm muscles; then my concentration returns. Because of the repetitive nature of biofeedback, my diaphragm muscles swing into action as soon as I started counting. When I first started, I had to focus on those muscles to get them to react. Getting in the car, I find myself starting these techniques almost immediately. Biofeedback training is wonderful because you learn techniques that can make challenging situations more manageable. For me, the best approach to any situation is to be calm and have peace of mind. I now have one more way to help me achieve this.”*

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