Emotional proprioception: Treatment of depression with afferent facial feedback

Eric Finzi, Norman E. Rosenthal

*George Washington School of Medicine & Health Sciences, Washington, DC 20037, USA
bGeorgetown Medical School, Washington, DC 20057, USA

**Article Info**

Article history:
Received 9 May 2016
Accepted 10 June 2016

Keywords:
Emotional proprioception
Treatment
Depression
Facial feedback

**Abstract**

We develop the concept of emotional proprioception, whereby the muscles of facial expression play a central role in encoding and transmitting information to the brain’s emotional circuitry, and describe its underlying neuroanatomy. We explore the role of facial expression in both reflecting and influencing depressed mood. The circuitry involved in this latter effect is a logical target for treatment with botulinum toxin, and we review the evidence in support of this strategy. Clinical trial data suggest that botulinum toxin is effective in treating depression. We discuss the clinical and theoretical implications of these data. This novel treatment approach is just one example of the potential importance of the cranial nerves in the treatment of depression.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

We and others have recently found that botulinum toxin A (BT) injected into the brow muscles has significant antidepressant effects as compared to placebo in randomized controlled studies (Wollmer et al., 2012; Finzi and Rosenthal, 2014; Magid et al., 2014). Although these findings may seem surprising at first glance, they might have been predicted by a line of thought going back over a century. While it is evident that our emotions influence our facial expressions, the reverse is less obvious. Yet Charles Darwin (Darwin, 1998) proposed this to be so over a century ago, and William James agreed (James, 1890).

Both of these scientists made special reference to this facial feedback effect, which we are calling emotional proprioception, in relation to depression. Darwin, for example, first observed the omega sign between the eyebrows, shaped like the last letter of the Greek alphabet (Ω) - a result of the corrugator muscles contracting and producing two vertical slits between the eyebrows, joined at the top by a horizontal crease. He recognized the omega sign as an indicator of melancholy and noted its disappearance when patients recovered. James famously stated that he did not cry because he was sad; rather, he was sad because he cried. In both instances the hypothesis was that the external representations of sorrow or grief were actually signaling back to the emotional centers of the brain, causing or exacerbating feelings of distress.

Over the ensuing decades experimental psychologists pursued what became known as the facial feedback hypothesis, and produced numerous results suggesting that Darwin and James were correct. Signaling between the emotional centers of the brain and the facial muscles is bidirectional (Adelmann and Zajonc, 1989; Niedenthal, 2007). The goals of this article are: 1. To develop the concept of emotional proprioception (EP) and describe its underlying neuroanatomy; 2. To show how modulating EP can be beneficial in treating depression and perhaps other distress states; and 3. To suggest that such interventions may be regarded as just one of several ways in which influencing cranial nerve function may have antidepressant effects.

2. Facial feedback hypothesis

It took about a century after Darwin’s seminal observations for researchers to systematically investigate what happens to emotional states in the brain when, either consciously, or unconsciously, the musculature of facial expression is activated.

Early research revealed that people rated cartoons as funnier when smiling than when frowning (Cupchik and Leventhal, 1974). Likewise, people also rated negative imagery as more aggressive when frowning, than when smiling (Laird, 1974). Critics of these early experiments observed that participants were aware that their facial expressions were happy or sad which might have biased the