

## Carboxytherapy: seeking evidence for its use in plastic surgery and dermatology

There is now a strong trend for clinical practice to reaffirm its commitment to scientific medicine. This does not mean that research and experience are decoupled. On the contrary, it recognizes that both are part of a systematic and continuous process of self-learning and self-assessment, without which, performance becomes outdated and irrational<sup>1</sup>.

Professionals must daily decide which treatments work (in aesthetics, it is worth noting that many “promising options” are reported regularly). Traditionally, such decisions have been based on pathophysiological principles, logical reasoning, personal observation, and intuition, which collectively constitute what is called “clinical experience”<sup>1</sup>. If a treatment seems to work, it will be repeated; if its results are disappointing, the treatment will be abandoned. However, this type of assessment is totally unpredictable because it is unknown which factors contribute to therapeutic success or failure<sup>2</sup>.

The search for guidelines for performing certain procedures is a movement pioneered by David L. Sackett, who has been keen to spread a new way of following and imparting medical practice since 1992. Sackett defines this idea as “the conscious, explicit and judicious use of the best available evidence for making decisions about the care of individual patients”<sup>3</sup>. More scientific and efficient decisions based on more vigorous evaluation methods aim to optimize benefits and minimize risks and costs<sup>2</sup>. These concepts are critical if a doctor wants to carefully examine whether the newest and most advanced methods are indeed optimal for a given patient<sup>4</sup>.

The medicinal use of carbon dioxide (CO<sub>2</sub>) is not new. In 1932, at the Spy de Royat Spa, France, CO<sub>2</sub> was used for patients with peripheral artery diseases in which patients were subjected to dry bathing or soaking in carbonated water<sup>5</sup>. In 1953, after 20 years of research, the cardiologist Jean Baptiste Romuef published the results of subcutaneous therapeutic use of CO<sub>2</sub><sup>5</sup>. The topic was largely forgotten for 4 decades, and was picked up again in the 1980s and 1990s with some studies targeting its use for vascular surgery.

In addition to its therapeutic action, CO<sub>2</sub> is commonly used to inflate the abdominal cavity during videolaparoscopy, hysteroscopy, contrast arteriography, and ventriculopathy. Health regulators such as the National Agency for Sanitary Surveillance and the Food and Drug Administration have registered equipment to control the flow of injected CO<sub>2</sub>, which makes its use safe.

CO<sub>2</sub> may have a novel application for aesthetic purposes. Its uses include treating cellulite (i.e., gynoid lipodystrophy), saggy skin, stretch marks, and unsightly scars as well as complementary treatment in liposuction to reduce irregularities and lessen the appearance of “wrinkled” skin by improving skin elasticity. These benefits are derived from the promotion of local arteriovenous vasodilation, increased regional blood flow<sup>6</sup>, increased blood and lymph drainage, and lipolysis<sup>7</sup>. In turn, these increase oxygen availability to the tissues, increase collagen turnover, and reduce the amount of adipose tissue.

However, the most reliable source of evidence about treatments is derived from randomized controlled trials (RCTs). In RCTs, a new treatment is experimentally compared to the standard therapy as a reference for disease management or a placebo if no such treatment exists. The randomization ensures that the groups being compared are similar in terms of demographics (e.g., gender, age, and race), illness severity, and frequency of comorbidities. This avoids selection bias<sup>4</sup>.

However, none of the almost 15 manuscripts available in the literature on the therapeutic use of CO<sub>2</sub> in plastic surgery or dermatology are RCTs with adequate methodology. The methodological adequacy of research is the basis for the credibility of conclusions<sup>8</sup>.

Critical reading of the scientific literature is becoming increasingly important because of the abundance of articles published in specialized journals. The publication of books and periodicals is currently increasing; moreover, electronic bibliographic databases have enabled even greater access to information<sup>8</sup>. However, only 10–15% of the published material proves to be of scientific value<sup>9</sup>.

The application of the best available scientific information aims to provide more accurate, ethical, and scientifically based treatments<sup>1</sup>. Although there is constant dissemination of the techniques and indications for the use of CO<sub>2</sub> for treating scars and cellulite, there is currently no literature that has the internationally recommended scientific rigor.

The credibility of carboxytherapy currently depends solely on its own promoters. Therefore, above all, this editorial aims to encourage professionals to conduct RCTs to scientifically prove (or disprove) the effectiveness of carboxytherapy.

Information from personal experience and questionable studies is insufficient. Impartial information should be universal and prioritized, and sufficient for public interest. It is only through this process that doubtful treatments can be improved on, to develop optimal ones.

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