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Building a fundamental understanding of what is truly known and published regarding the effects of elevating CO₂

Preamble:

We have expertise in building medical technology based on unique applications of underlying natural science (the BreatheRight ADVANCED nasal strip, The Q-Collar and now the SAGE mask)

- * CO₂ has been widely utilized in treating difficult conditions, however the prior existing delivery mechanism— large canisters — is inefficient
- * We started out with a mask-based solution to recycle a person's own CO₂, but the COVID pandemic delayed some key clinical studies
- * Based on our prior research, we knew that CO₂ could play a significant role helping to fight COVID as well
- * As a result, we pivoted to accelerate the development of our mask and the FaceShield™ products

Terminology:

ETCO₂ — end tidal CO₂, FDA-validated standard to non-invasively measure the gaseous pressure of CO₂ inside the blood stream (human norm is 35-45 mmHg). Our technology holds subjects close to the top of this range and, in some circumstances, if desired, slightly and safely, above this range

FiCO₂ — fraction of inspired CO₂, the world's atmospheric CO₂ content is roughly 400 ppm (0.04%). Our technology raises this level in one's body by rebreathing your own exhaled breath (also called “dead-space” rebreathing) and thereby raises this percentage to about 0.8% to 1.0% (notably OSHA states typically “no effects at 1%” and 1.5% merely leads to a “respiratory stimulant in some people”). Brewery standards allow Fi CO₂ as high as 5.0%.

1. TBI reduction – Our researchers discovered and patented TWO METHODS to “fill the Cranial Reserve Volume (CRV)” in order to reduce slosh energy absorption and block concussive forces from entering into the brain and spine.

- a. **Jugular Compression** — The Q-Collar has:
 - i. more than 25 publications and more than 40 patents
 - ii. FDA approval occurred in mid-2022. **83% reduction in objective TBI metrics** in precise animal studies and using non-invasive human radiological techniques, the FDA allowed a claim of 66% reduction in brain damage - partnered with US Army 2020
 - iii. Culminated in front page, lead article of *Journal of Neuroscience Research* Feb, 2021¹
- b. **CO₂ Rebreathing** — We believe ALL the above jugular compression work to be correlative/complimentary as the mechanism of protection remains to be the same, thereby filling the CRV this time, by increasing cerebral arterial blood flow, and intracranial volume



- i. FiCO_2 of 5% for 10 minutes in animal studies performed, data accumulated by University of Cincinnati and published²— **65% reduction in functional TBI metrics**
- ii. Additionally, over and beyond jugular compression CO_2 delivery *should* benefit the brain cell death cascade (called Spreading Depolarizations), and we are co-authoring, with Jed Hartings PhD, University of Cincinnati. Hartings analyzed 800-hours of neuro-ICU data that accumulated ET CO_2 concurrently with Spreading Depolarization (SD) readings (by indwelling SD probe) and found nearly a 100% concordance rate of rising CO_2 levels causing a drop in SDs and SD flatlining (a particularly grave finding). At the same time, whenever the CO_2 dropped, SDs ensued and flatlining occurred.
- iii. Further, Hartings attained a study, funded by a DoW \$4.4 million grant, to study the role of CO_2 with Ketamine to be delivered after a severe TBI. Preliminary observational studies offered to get this grant remains VERY encouraging.

2. Sleep Disorder Breathing (SDB)

- a. Central and Obstructive Sleep Apnea
 - i. By canister CO_2 delivery^{3,4,5}
 - ii. By rebreathing own CO_2 ^{6,7,8}
- b. **SIDS** – is a subheading for SDB, but in infants. We do have references on mouth breathing and nasal breathing (the latter raises ETCO_2 by 4 mmHg) and the eradication of SDB in infants by raised Fi CO_2 *ref upon request

3. Acute Mountain Sickness

- a. Eradication of Acute Mountain Sickness by
 - i. Canister delivered CO_2 ^{9,10,11}
 - ii. Rebreathing own dead space (exhale)^{12,13}

4. Dizzy Diseases (Postural Orthostatic Tachycardia Syndrome — POTS)

- a. Eradication of symptoms of POTS by
 - i. Canister delivery of CO_2 ¹⁴
 - ii. Direct study of four subjects with our SAGE Rebreather

5. COVID-19

- a. Humans are “Carboxic Breathers,” that is, we breathe when CO_2 rises and NOT when O_2 drops. Virulence factors in viral transmission include the need for precisely neutral pH and adding CO_2 should interfere with the virus’s ability to infect cell membranes.¹⁵

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TREATMENT OF SLEEP DISORDERED BREATHING / Poster Discussion Session / Monday, May 16/8:15 AM-10:45 AM /Room 403-404 (Street Level), Colorado Convention Center, Effect of Rebreathing on Obstructive Sleep Apnea
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