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Alfredo Hernández, Jean-Louis Pépin

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Letter to the editor of “Sleep Medicine” regarding the publication entitled “Acoustic stimulation time-locked to the beginning of sleep apnea events reduces oxygen desaturations: a pilot-study”, by Waeber et al

Dear editors, we read with a great interest the Brief Communication entitled “Acoustic stimulation time-locked to the beginning of sleep apnea events reduces oxygen desaturations: a pilot-study”, by Waeber *et al.*

We thank the authors for citing our work [1] and would like to provide “Sleep Medicine” readers with additional information regarding design and technical aspects of our original kinesthetic stimulation technique.

Our end-to-end solution is a closed-loop, real-time device that performs personalized, adaptive kinesthetic stimulation for the treatment of sleep apnea. The kinesthetic stimulation is performed on the mastoid region, using a stimulation signal that has been optimized (within the audible frequency band) in order to evoke a response, both from the activation of mechanoreceptors on the skin and through bone-conducted acoustic stimulation. A first description of our system and our preliminary results showing reduction in apneas duration and desaturations were described in [2]. In [1], we studied 24 patients from 5 centers, compared to 8 patients in a single center in the work by Waeber *et al.* Our results in a larger population extended the knowledge by demonstrating that responses to stimulation therapy are clearly patient-specific, requiring to adapt stimulation intensity over time.

Further development of our solution was based on the optimal, patient-specific and adaptive mechanical stimulation. A coupled Proportional, Integral, Derivative (PID) closed-loop method was published in [3]. 6 patent families have been filed with different criteria for therapy adaptation (see for example [4, 5]).

We do agree with the authors that real-time, adaptive mechanical stimulation, including kinesthetic and/or acoustic stimulation, may be an interesting alternative or adjunctive therapy for sleep apnea syndromes. Further collaborative clinical research is warranted in this field.

A. Hernández
J-L Pépin.

- [1] A. I. Hernandez, D. Perez, D. Feuerstein, C. Loiodice, L. Graindorge, G. Guerrero, N. Limousin, F. Gagnadoux, Y. Dauvilliers, R. Tamiésier, A. Prigent, P. Mabo, A. Amblard, L. Senhadji, and J. L. Pepin, "Kinesthetic stimulation for obstructive sleep apnea syndrome: An "on-off" proof of concept trial," *Scientific Reports*, vol. 8, p. 7, Feb 2018.
- [2] A. I. Hernandez, G. Guerrero, D. Feuerstein, L. Graindorge, D. Perez, A. Amblard, P. Mabo, J. L. Pepin, and L. Senhadji, "PASITHEA: An Integrated Monitoring and Therapeutic System for Sleep Apnea Syndromes Based on Adaptive Kinesthetic Stimulation," *Irbm*, vol. 37, pp. 81-89, Apr 2016.
- [3] D. Perez, G. Guerrero, D. Feuerstein, L. Graindorge, A. Amblard, J. L. Pepin, L. Senhadji, and A. I. Hernandez, "Closed-loop Kinesthetic Stimulation for the Treatment of Sleep

Apnea Syndromes," in 2016 Computing in Cardiology Conference. vol. 43, A. Murray, Ed., ed New York: Ieee, 2016, pp. 841-844.

- [4] L. Graindorge, A. Amblard, D. Feuerstein, A. Hernández, and J.-L. Pepin, "(EP3031492) System for treating a respiratory condition by kinesthetic stimulation, with stabilisation control of the stimulation," 2014FR-0062041, Registration Date 2014.
- [5] L. Graindorge, A. Amblard, D. Feuerstein, A. Hernández, and J.-L. Pepin, "(EP3031437) Device for optimising treatment of sleep apnoea syndrome by kinesthetic stimulation," 2014FR-0062054, Registration Date 2014.