



Société Française de NeuroModulation | INS French Chapter

Contrôle de la douleur par stimulation proprioceptive et extéroceptive au niveau du trijumeau.

Une forme particulière de neuromodulation qui est l'autoneuromodulation du trijumeau.

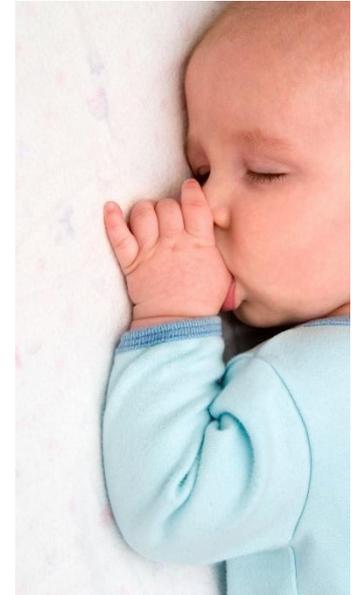
Dr. Roberta Ficacci Zampino
Médecin, dentiste and coach bien-être
Collaborateur de recherche à l'Université de Pérouse Italie

Communications libres | Samedi 14 Octobre 2023, Aix-en-Provence

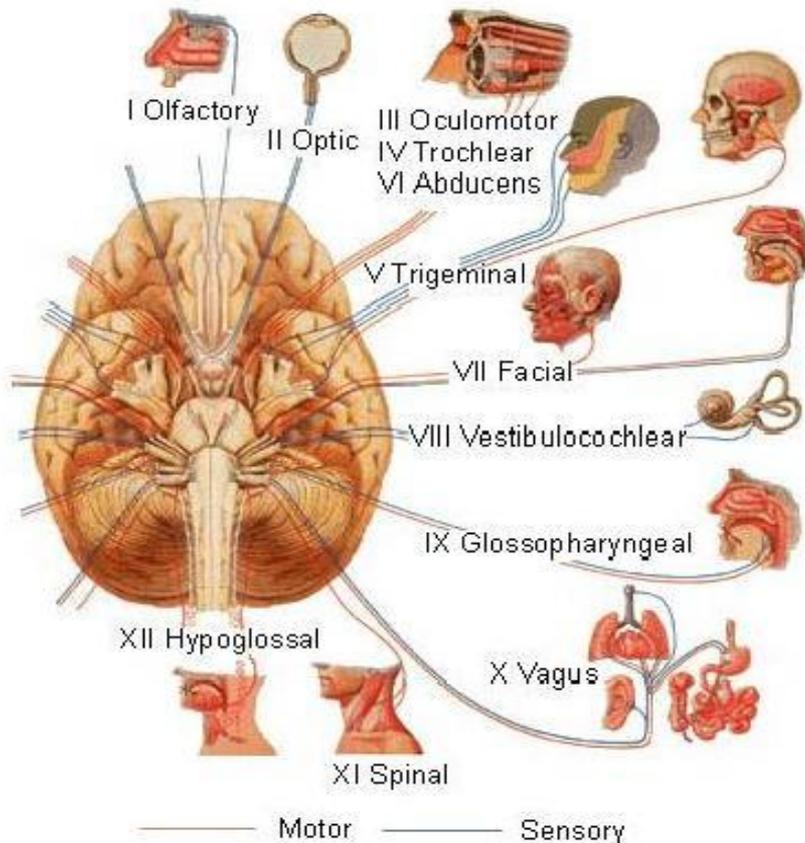
Auto neuromodulation



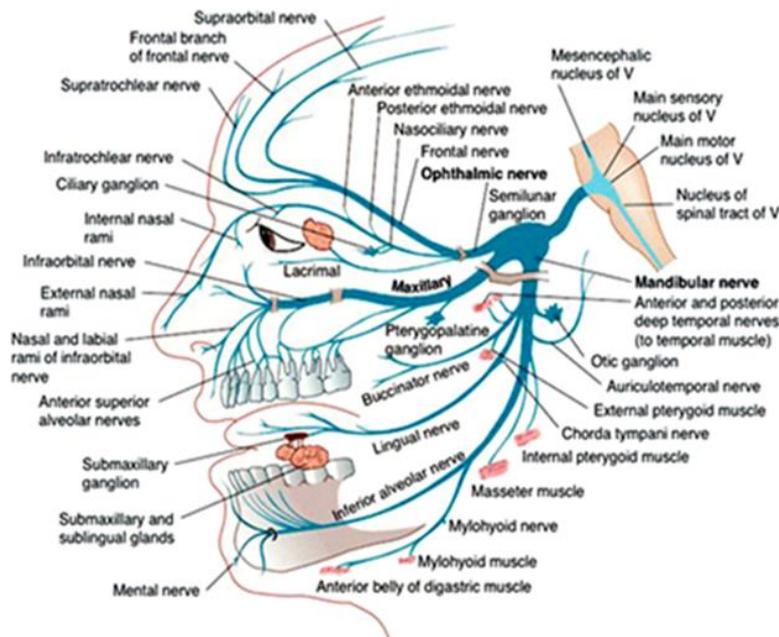
Succion - instinct naturel dans les premiers stades de la vie humaine



Nerfs crâniens



Nerf trijumeau



Oral Stretching (étirement oral) comme autoneuromodulation du trijumeau



L'extension mandibulaire par **étirement musculaire (stimulation proprioceptive)** avec l'ajout d'une **pression palatine (stimulation extéroceptive)** détermine des réponses physiologiques importantes même chez les adultes. Ce comportement est inhibé par la société et est également contre-indiqué aux stades de développement osseux.



A été étudié, breveté et certifié un dispositif médical fonctionnel CE de première classe qui surmonte les contre-indications créées par la succion du doigt.





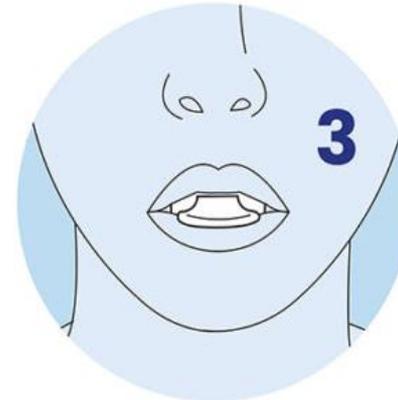
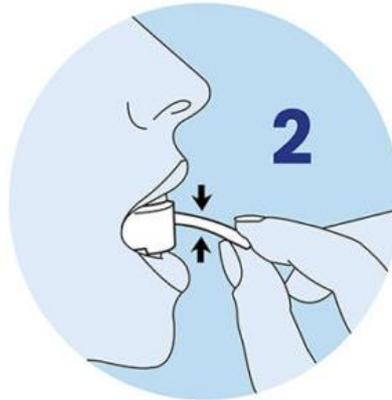
chez l'adulte, la stimulation proprioceptive et extéroceptive peut être favorisée par le dispositif médical oral stretching CE qui déclenche des réponses physiologiques importantes :

Réduction de la perception de la douleur

Action anti-stress

Modulation de la pression et de la fréquence cardiaque

Amélioration de la posture

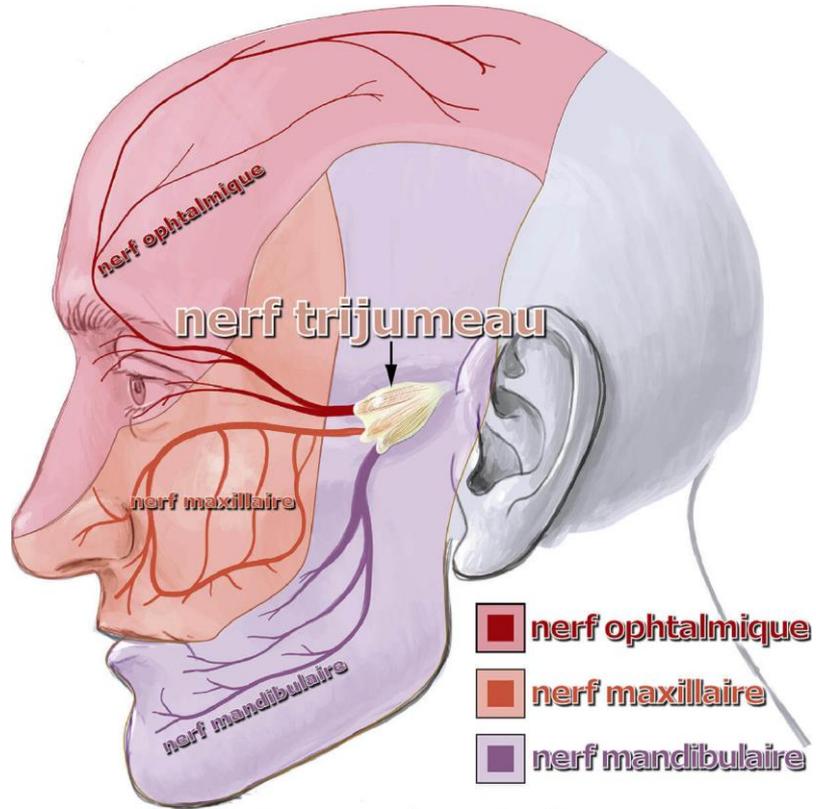


Autoneuromodulation du trijumeau: Réduction de la perception de la douleur



- Aide au contrôle des symptômes douloureux du visage et de la zone de mastication
- Diminution de la conductance des fibres nociceptives

L'activité intense du nerf trijumeau peut créer des points de sensibilité à la douleur (trigger point), ce qui nous fait comprendre l'importance de sa modulation avec l'ensemble du système.



Gate Control Theory of pain, suppose l'inhibition des informations nociceptives (douleur) entrantes produites par une stimulation non douloureuse concomitante. Pour vérifier la présence d'un tel mécanisme de contrôle de **gate** au niveau du système trijumeau humain, nous avons évalué la **réduction de la sensation de douleur dentaire en présence de stimulations proprioceptives et extéroceptives du trijumeau induites respectivement par l'extension mandibulaire et par la pression palatine.**



Craniofacial Biology and Dental Research

The world's 3rd most-cited Physiology journal

IMPACT FACTOR 3.394

2017 JCR, Clarivate Analytics 2018



Pain Control by Proprioceptive and Exteroceptive Stimulation at the Trigeminal Level.

Zampino C.1, Ficacci R.1, Checcacci M.2, Franciolini F.1, Catacuzzeno L.1. Front Physiol. 2018 Aug

1Department of Chemistry, Biology and Biotechnology, The University of Perugia, Perugia, Italy ; 2Azienda Sanitaria Locale Roma 1, Rome, Italy

Proprioceptive stimulation
PROP



Proprioceptive stimulation +
exteroceptive stimulation
PROP+EXT

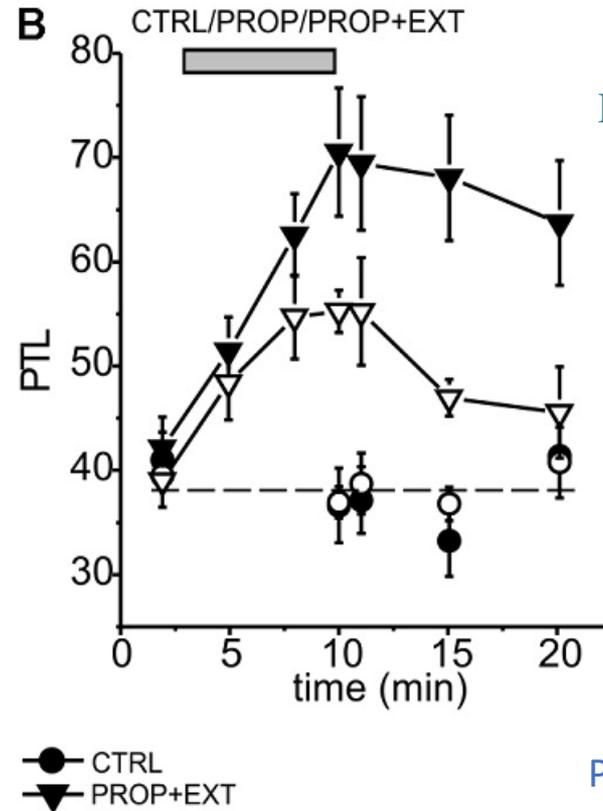
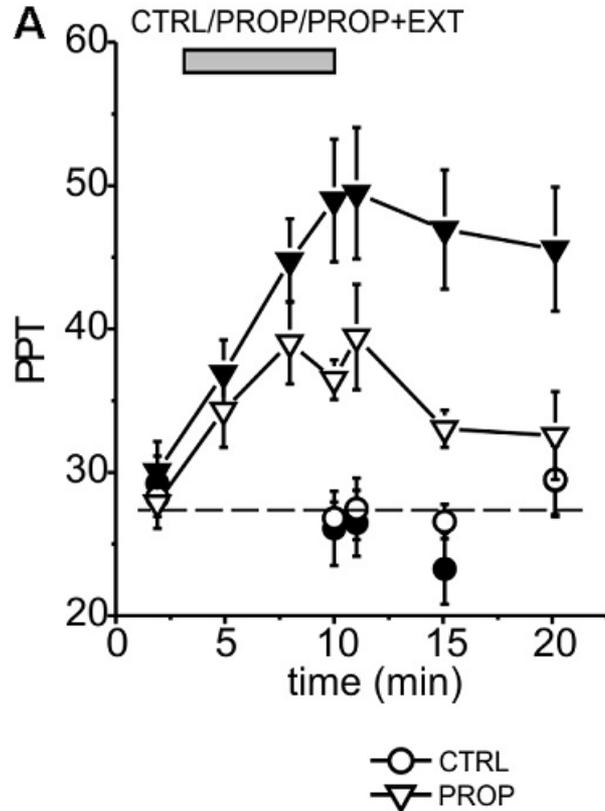


Pulp test with Vitality Scanner™ 2006

Pain perception threshold (PPT)
Pain tolerance level (PTL)



Average effects in PROP and PROP + EXT on PPT and PTL



Pain perception threshold (PPT)
Pain tolerance level (PTL)

L'autoneuromulation du
trijumeau favorise une
perception réduite de la
douleur et une
tolérance accrue

PROP = +30% on PPT and PTL

PROP+EXT = +60% on PPT and PTL

ACTA PHYSIOLOGICA

OFFICIAL JOURNAL OF THE FEDERATION OF EUROPEAN PHYSIOLOGICAL SOCIETIES



FEPS 2019 - BOLOGNA (ITALY)

Joint Meeting of the Federation of European Physiological Societies (FEPS) and the Italian Physiological Society (SIF)
Bologna (Italy), September 10th - 13th 2019

Abstracts of the Joint Meeting

A Joint International Meeting celebrating the 70th Anniversary of the Italian Physiological Society



PUBLICATION HISTORY

Acta Physiologica 2006-

Acta Physiologica Scandinavica 1940-2005

Skandinavisches Archiv für Physiologie 1889-1939

PP.66

Pain control by proprioceptive and exteroceptive stimulation at the trigeminal level

Zampino C¹, Ficacci R¹, Checcacci M², Franciolini F¹, Catacuzzeno L¹

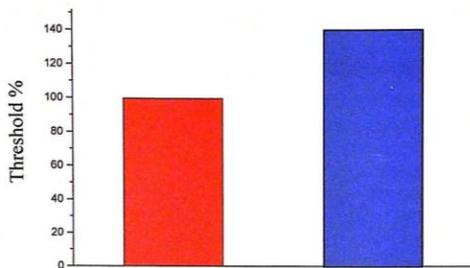
¹Department of Chemistry, Biology and Biotechnology, University of Perugia, Perugia, Italy; ²Azienda Sanitaria Locale ROMA 1, Via Marco Polo 93, 00154 Roma, Italy

The Gate Control Theory of pain, published more than half a century ago to explain nociceptive modulation of peripheral sensory input, assumes inhibition of incoming nociceptive (pain) information produced by mechanical stimulation. To verify the presence of such a gate control mechanism at the level of the human trigeminal system, we evaluated the effects on pain sensation of a proprioceptive trigeminal stimulation induced by mandibular extension. We found that such a stimulation, applied for 7 minutes, was effective in increasing the threshold and tolerance of tooth pain induced by electrical activation of dental nociceptors. Moreover the antinociceptive effect lasted for several minutes after the proprioceptive stimulus had ceased. We also tested whether an exteroceptive palatal stimulation superimposed on the proprioceptive stimulation would increase the effects on tooth pain perception of human volunteers. We observed that the exteroceptive stimulation significantly increased the antinociceptive effect induced by the sole proprioceptive stimulation. The physiological mechanisms and the possible implications of these observations are discussed.

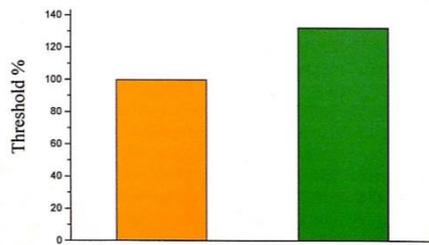
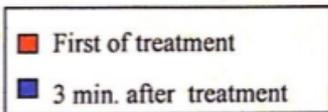


Cephalalgia

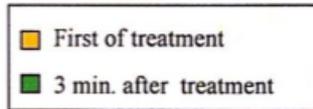
An International Journal of Headache



Sensibility



Pain



POSTER SESSION II

J: Pathophysiology

P2-J2

Modulation of cephalic pain as physiological approach to headache therapy

M. Brunelli¹, M. Zampino^{1,2}, R. Ficacci², G. Traina¹, C. Gallirelli², A. Alberti², G. Mazzotta², A. Floridi² & V. Gallai²

¹Department of Physiology and Biochemistry, University of Pisa, Pisa, Italy, ²Department of Neuroscience, University of Perugia, Perugia, Italy, ³Department of Internal Medicine-Section of Clinical Biochemistry, University of Perugia, Perugia, Italy

The 'pain gating theory' (PGT) implies that, in somatoesthetic areas, pain is controlled by the activity of either peripheral proprioceptors or the central descending inhibitory pathway of troncocephalic origin. In the present report, an interdisciplinary study between basic and clinical researchers has singled out a novel therapeutic approach to relieve cephalic pain (headache) based on the concept of a 'PGT' modulating the nociception in the cephalic area. Physiological analyses have been carried out with the aim of clarifying whether jaw proprioceptors might exert an inhibition on neurons of the caudal nucleus of trigeminal spinal nuclei where all the nociceptive cephalic afferents converge. In single healthy individuals of both sexes, the threshold to painful stimulation applied to periodontal spots in the mouth has been evaluated in the absence and presence of proprioceptive activity obtained with extreme opening of the mouth for 3-5 min. Such opening, either active or passive, triggers massive proprioceptive afferents. Our results demonstrate that this natural autostimulation brings about an enhancement of threshold for pain perception in healthy subjects. In a second series of experiments the pain threshold in patients with tension headache has been calculated. Preliminary data have shown significant changes of pain threshold in these patients. Such results have allowed us to start with a therapeutic protocol in 15 young patients (aged between 10 and 18-year-old) with cephalic painful syndromes. In order to trigger the inhibitory proprioceptive pathways of jaw areas we have set up a particular 'bite plane' opportunely modified to this goal by one of us (M. Zampino). This apparatus, by inducing the extension of jaw muscles, produces a lasting and constant proprioceptive autostimulation. We have observed that this peculiar autostimulation was able to gradually reduce the number of painful episodes by decreasing both the intensity and the duration of each episode and in almost all the cases produced a complete relief of symptoms in about 20-30 days. This physiological autostimulation seems to be a very effective therapeutical treatment.

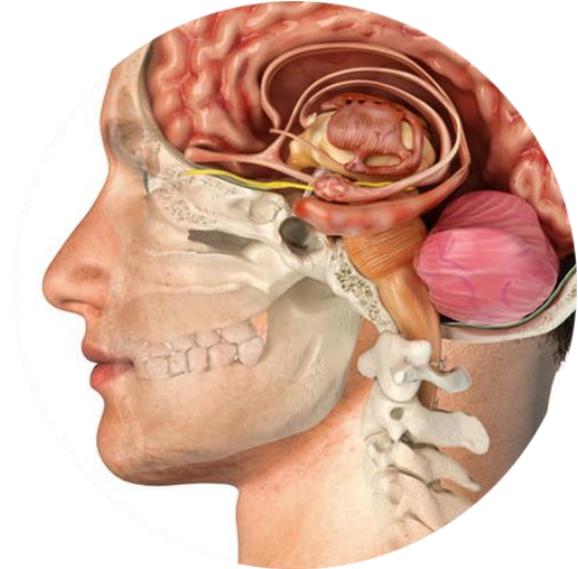


Autoneuromodulation du trijumeau: Action anti-stress



- Anti-bruxisme
- Réduction des tensions neuromusculaires
- Aide à la gestion de la tension émotionnelle
- Aide à la symétrie bilatérale de la zone orofaciale.

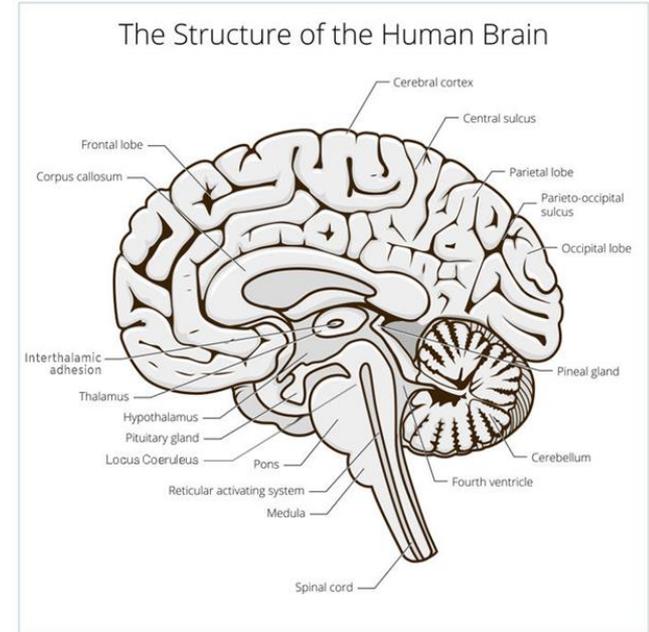
Cette autoneuromodulation a la capacité de déclencher une action de relaxation des tensions neuro-musculaires et émotionnelles, trainant une sensation de bien-être.





Autoneuromodulation du trijumeau, favorisant la symétrie bilatérale, détermine les afférences dans les structures cérébrales telles que le tronc cérébral, comme la formation réticulaire et le Locus Coeruleus. Ces structures cérébrales, sont impliquées dans les processus de la sphère cognitive (comme l'attention et la mémoire), du sommeil, de la sphère émotionnelle, en corrélation avec le cortex cérébral et cérébelleux.

En effet, des études récentes ont montré que chez des sujets qui se contractent avec une activité asymétrique du plan masticatoire, il y a une diminution de l'expression de certains gènes responsables de la régulation de la plasticité neuronale de zones cérébrales importantes (tronc cérébral, hippocampe, cortex frontal) et que la correction occlusale se traduit par une amélioration des conditions cliniques.





**A further contribution
to the study of morpho-
neurophysiopathological
relations between the muscles
of the face, in particular
of the mouth, and other
apparatus and systems**

B. PANNAIN - M. ZAMPINO

*From the Department of Medical and
Legal Sciences (Head Phys.: Prof. B. Pannain)
University of Salerno, Italy*

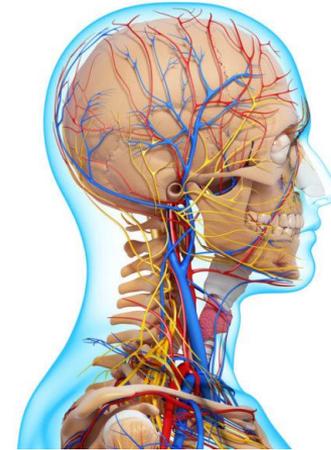
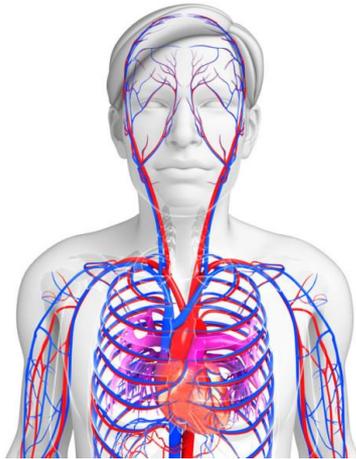
SUMMARY.—Previous personal work is recalled in a further investigation of the physiopathological morphological and neurological relations, including those of a mutual character, that the face muscle, and those of the mouth in particular, may have with other apparatus and systems, with reference to a series of cases and the literature. Several collateral hypotheses are put forward. Methods and their stages, and the intermediate and final results they give, are illustrated for the purposes of treatment. A detailed account is given of the stomatological management required to maintain such results, and to the importance of studies of this kind in both maintenance and prosthesis treatments in stomatology, as well as in orthodontics.

KEY WORDS.—Face muscles - Neurophysiopathology.

Autoneuromodulation du trijumeau: Modulation de la pression et de la fréquence cardiaque



- Amélioration de la vascularisation de la zone orofaciale
- Circulation cérébrale améliorée

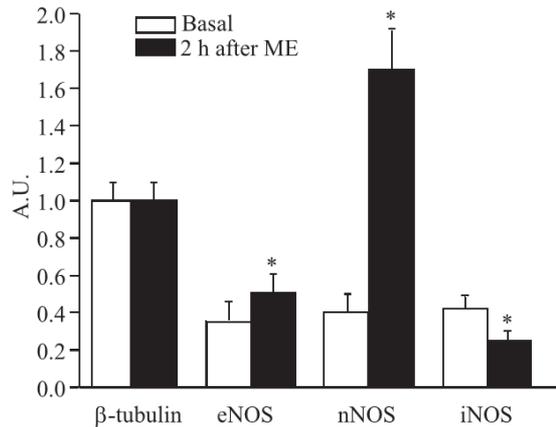




Trigemino-cardiac Reflex by Mandibular Extension on Rat Pial Microcirculation: Role of Nitric Oxide

Dominga Lapi¹, Giuseppe Federighi², M. Paola Fantozzi², Cristina del Seppia³, Sergio Ghione^{3,4}, Antonio Colantuoni¹, Rossana Scuri^{2*}

1. Department of Clinical Medicine and Surgery, "Federico II" University Medical School, Naples, Italy, 2. Department of Translational Research on New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy, 3. Institute of Clinical Physiology, National Council of Research (CNR), Pisa, Italy, 4. Fondazione Toscana Gabriele Monasterio - Medical and Public Health Research, Pisa, Italy



Des études récentes ont montré qu'un étirement statique de la mandibule de quelques minutes, de préférence répété dans le temps, entraîne une augmentation de la concentration de monoxyde d'azote dans le sang, ce qui entraîne un effet de modulation physiologique, pouvant conduire à une diminution de la pression artérielle et de la fréquence cardiaque, accompagnée d'une vascularisation cérébrale améliorée dans la région frontale et pariétale.



↑ Endothelial NO synthase (eNOS)
Neuronal NO synthase (nNOS)



↓ inducible NO synthase (iNOS) stimulation by inflammation

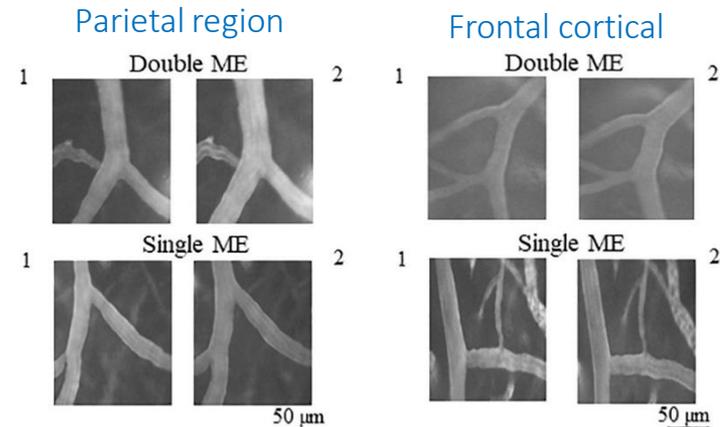


Effects of Mandibular Extension on Pial Arteriolar Diameter Changes in Glucocorticoid-Induced Hypertensive Rats

Dominga Lapi¹, Maurizio Varanini², Lucrezia Galasso³, Martina Di Maro¹, Giuseppe Federighi³, Cristina Del Seppia², Antonio Colantuoni¹ and Rossana Scuri^{2*}

¹ Department of Clinical Medicine and Surgery, University of Naples Federico II, Naples, Italy, ² Institute of Clinical Physiology, National Council of Research (CNR), Pisa, Italy, ³ Department of Translational Research on New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy

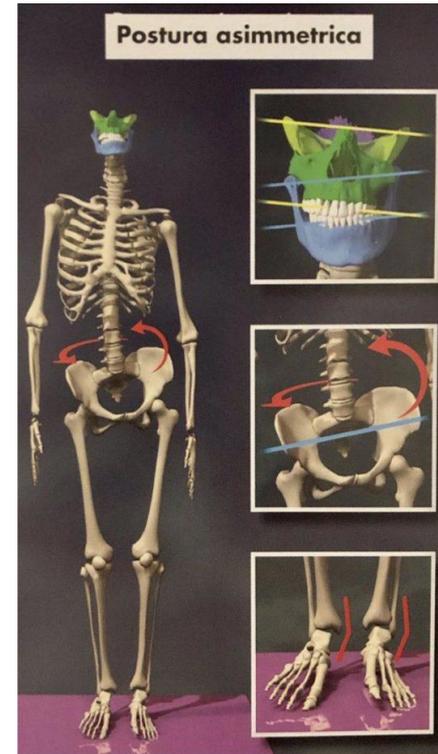
De plus, une augmentation de l'expression du système Rénine-Angiotensine-Rénal (RAS) a été notée avec une action protectrice et préventive dans l'hypertension avec des améliorations conséquentes qui persistent pendant quelques heures après l'étirement.



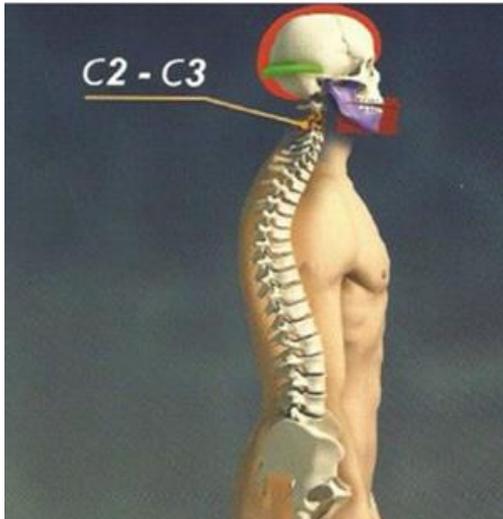
Autoneuromodulation du trijumeau: Amélioration de la posture



- Réalignement du plan de mastication
- Auto-stimulation des récepteurs du spot palatin
- Promotion de l'activité musculaire symétrique
- Réduction des tensions neuromusculaires du système cervico-facial et posturo-cervical



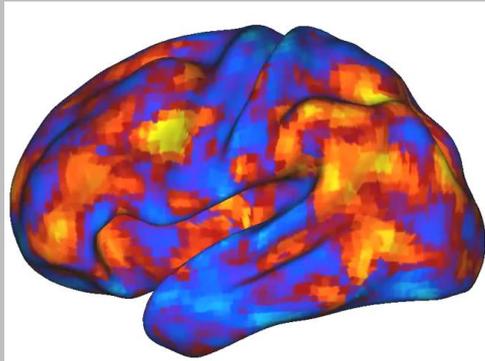
Ortoposturodonzia 2, 2008 Demi S.R.L. per gentile concessio



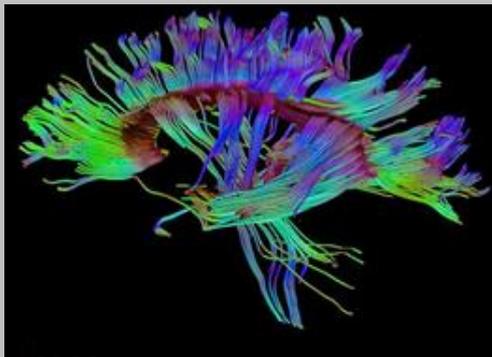
Une fermeture correcte de la bouche, qui préserve la relation mâchoire-mâchoire et la symétrie bilatérale, détermine une meilleure posture, qui peut être trouvée avec une réduction de la zone et de la vitesse d'oscillation du corps. De plus, la stimulation de la tache palatine a la capacité d'influencer le fonctionnement des récepteurs posturaux primaires de l'œil à l'appareil vestibulaire, la mâchoire et le pied.



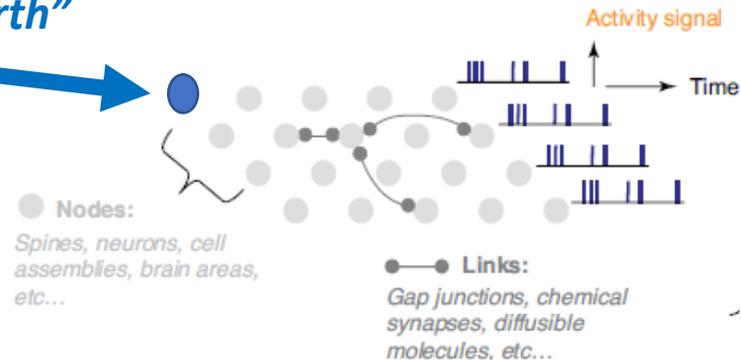
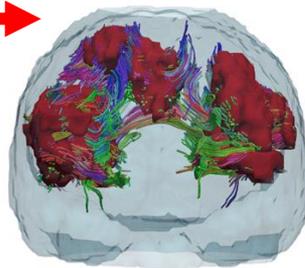
Resting state fMRI
Functional networks



Tractography – dMRI
Structural networks



Nodes' "time of birth"



Linking hubness, embryonic neurogenesis, transcriptomics and diseases in human brain networks

Diez I, Garcia-Moreno F, Carral-Sainz N, Stramaglia S, Nieto-Reyes A, D'Amato M, Cortes, J & Bonifazi P. - [biorxiv.org/content/10.1101/2022.04.01.486541v5](https://www.biorxiv.org/content/10.1101/2022.04.01.486541v5); under revision

The centrality (hubness) of different brain circuits in the human connectome is a product of their embryonic age, such that the nodes born earlier become more connected (hubs) than those born later. We call this rule as **"older gets richer"**. This means that **old ancient developmental circuits, i.e. the first ones generated during embryogenesis, become richer than other circuits in terms of connectivity.** In this study, Locus Coeruleus and brainstem nuclei are brain hubs.

Prof. Altman and Bayer (Altman and Bayer, THE JOURNAL OF COMPARATIVE NEUROLOGY 194:905-929 (1980)) in their seminal articles 40 years ago, stated that **"the trigeminal complex includes the first generated neurons that we have encountered so far in the brain."** Therefore, according to the above experimental and computational evidences, **the trigeminal nerves is a key point and the main gateway for brain functionality and regulation.**



Merci pour votre attention

Je remercie beaucoup la Société française de neuromodulation reconnaissante de avoir permis de présenter cette communication dans ce contexte.

Ces études pionnières ont été commencées dans les années 70 de doctor Michele Zampino, qui était neurologue et dentiste et s'est intéressé à la bouche, à le système oro-facial comme à une Voie afferente neurostomatologique, de **autoneuromodulation** qui pourrait donner réponses importantes physiologiques dans ce relations avec le système nerveux.