N🜊MADe

ECOSYSTÈME D'APPRENTISSAGE, R&D ET EXPERTISE TRANSFRONTALIER
DÉDIÉ AUX TROUBLES NEURO-MUSCULO-SQUELETTIQUES

LEERECOSYSTEEM, O&O EN GRENSOVERSCHRIJDENDE EXPERTISE
GEWIJD AAN NEURO-MUSCULOSKELETALE AANDOENINGEN

Congrès NOMADe : recueil des abstracts

NOMADe congres : abstract boek

Grand Palais de Lille

16/10/21

Presentation

Le projet INTERREG FWVL NOMADe (NeurOMuskuloskeletAl Disorders – e-learning ecosystem) vise à développer et coordonner un écosystème d'apprentissage, R&D et expertise spécialisé dans le domaine des troubles neuro-musculo-squelettiques (TNMS). Ce projet, financé sur une durée de trois ans (octobre 2019-septembre 2022), est entré dans sa troisième année et compte déjà à son actif de nombreuses réalisations ; le lecteur intéressé pourra consulter le site http://nomadeproject.eu pour un aperçu détaillé de celles-ci.

Ce congrès, intitulé « *A NOMADe journey between research and clinic of Neuro-Musculoskeletal Disorders* », propose un ensemble de présentations en accord avec la philosophie défendue par le projet NOMADe : une approche multidisciplinaire des troubles neuro-musculo-squelettiques (TNMS), qui soit non seulement basée sur l'EBM mais également tournée vers les patients et les thérapeutes de terrain. Les communications s'organisent suivant 3 axes :

Het INTERREG FWVL NOMADe (NeurOMuskuloskeletAl Disorders - e-learning ecosystem) project heeft als doel het ontwikkelen en coördineren van een ecosysteem van leren, O&O en expertise gespecialiseerd op het gebied van neuromusculoskeletale aandoeningen (NMSA). Het project, dat voor drie jaar wordt gefinancierd (oktober 2019-september 2022), is nu aan zijn derde jaar bezig en heeft al een aantal verwezenlijkingen bereikt; de geïnteresseerde lezer kan voor een gedetailleerd overzicht daarvan terecht op http://nomadeproject.eu.

Dit congres, getiteld "Een NOMADe reis tussen onderzoek en kliniek van Neuro-Musculoskeletale Aandoeningen", biedt een reeks presentaties in lijn met de filosofie van het NOMADe project: een multidisciplinaire benadering van Neuro-Musculoskeletale Aandoeningen (NMSD), die niet alleen gebaseerd is op EBM, maar ook patiënt- en veldtherapeutgericht is. De documenten zijn georganiseerd langs drie assen:

Education des cliniciens et patients aux TNMS / Onderwijs voor clinici en patiënten in NMSA

1. *Pain neuroscience education: a scoping review in the management of patient with chronic low back pain* - Adenis Nicolas & Gosselin Kevin.

2. *Workplace health promotion programs to increase physical activity levels of sedentary workers* – Briffaud Korélien, Lelard Thierry & Telliez Frédéric.

3. *Effect of a pain education program on paravertebral allodynia surface: Beliefs, knowledge, physical and functional repercussions in chronic low back pain patients* – Danjoux Loïc, Hanot Quentin, Keunebroek Roxane, Potencier Pierre, Raymekers Olivier & Thévenon André.

4. *An interactive e-learning module to promote bio-psycho-social management of low back pain in healthcare professionals: a pilot study* – Fourré Antoine, Fierens Auriane, Michielsen Jef, Ris Laurence, Dierick Frédéric, Roussel Nathalie.

Perceptions et croyances des patients et thérapeutes au sujet des TNMS / De percepties en overtuigingen van patiënten en therapeuten over NMSA

5. *From vulnerability to agency: the contingent path of patients with chronic low back pain* – Pierre Amélie.

6. *Telerehabilitation of musculoskeletal diseases: Who wants it?* - Pierre Amélie, Buisseret Fabien, Profeta Loredana & Dierick Frédéric.

Inclusion de nouveaux outils (technologies et mobilisations) dans le diagnostic et le traitement des TNMS / Opneming van nieuwe instrumenten (technologieën en mobilisaties) in de diagnose en behandeling van NMSA

7. *Towards a new clinical test for assessing Low Back Pain: Design and implementation guided by movement variability and irregularity* – Thiry Paul, Nocent Olivier, Buisseret Fabien, Bertucci William, Thévenon André & Simoneau-Buessinger Emilie.

8. *Machine Learning can predict and identify non-specific neck pain patients assessed with the DidRen laser test* – Hage Renaud, Dierick Frédéric, Buisseret Fabien, Lecointre Julien, Houry Martin.

9. *Fine adaptive control of precision grip after median nerve mobilization* – Dierick Frédéric, Brismée Jean-Michel, White Olivier, Bouché Anne-France, Périchon Céline, Filoni Nastasia, Barvaux Vincent & Buisseret Fabien.

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Pain neuroscience education: a scoping review in the management of patient with chronic low back pain

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Abstract

Patient education is one of the recommended therapeutic strategies for the management of chronic low back pain. Pain neuroscience education (PNE) is an emerging educational trend. However, the contours of this concept are unclear. This scoping review will: 1) identify the available evidence on PNE in the management of patients with chronic low back pain; 2) clarify the concept; 3) identify the key characteristics; 4) clarify how it is integrated into clinical practice and 5) identify gaps in knowledge and determine the research needs.

Scoping review is guided by Arskey and O'Malley's methodology. A systematic search will be made from the following data base: Pubmed, ScienceDirect, Cochrane data base, and Pedro. Inclusion criteria: publication in English or French, publication on PNE and chronic low back pain, educational books (for patient and practionner) cited in white litterature. Publication type : systematic review, narrative review, controlled trial, case series, case study, qualitative study, expert opinion, study protocol. The two authors have independently select eligible studies from the eligibility criteria for final inclusion. Numerical analysis and narrative synthesis has been carried out from the extracted data. Relevant references are listed below.

References

Louw A, Zimney K, O'Hotto C, Hilton S. The clinical application of teaching people about pain. Physiother Theory Pract. 2016 Jul;32(5):385-95.

Moseley L, Butler DS. Fifteen Years of Explaining Pain: The Past, Present, and Future. J Pain. sept 2015;16(9):807-13.

Nijs J, Paul van Wilgen C, Van Oosterwijck J, van Ittersum M, Meeus M. How to explain central sensitization to patients with 'unexplained' chronic musculoskeletal pain: practice guidelines. Man Ther. 2011 Oct;16(5):413-8.

Tegner H, Frederiksen P, Esbensen BA, Juhl C. neurophysiological pain education for patients with chronic low back pain: a systematic review and meta-analysis. Clin J Pain 2018; 34: 778–86.

Wood L, Hendrick PA. A systematic review and meta-analysis of pain neuroscience education for chronic low back pain: Short-and long-term outcomes of pain and disability. Eur J Pain 2019;23:234–49.

Conflicts of interest

The authors declare no conflict of interest.

Workplace health promotion programs to increase physical activity levels and reduce sedentary behaviours of office workers

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Abstract

Sedentary behaviours and physical inactivity are more prevalent than ever in industrialised countries. In France, more than one out of two adults spend more than 3 hours per day in front of a screen outside of work (Praznoczy et al., 2017) and the mean times spent in sedentary behaviours while at work or during leave days are respectively 12 and 9 hours (Saidj et al., 2015). These amounts are consistent with what is observed in other high-income countries such as Japan or the US. In addition, people working mainly in a sitting position –such as office workers– spend more time in sedentary behaviours both at work (6.21h +/- 2.67) and outside of work (transport sitting, leisure sitting, screen time sitting, non-screen time sitting) (Saidj et al., 2015). As for physical inactivity, more than one out of three French adults report not meeting the physical activity guidelines (Praznoczy et al., 2017), 36.8% of adults are physically inactive in high income countries and 42.3% of women in high-income western countries (Guthold et al., 2018).

Far from being harmless, physical inactivity and sedentary behaviours are responsible for more than 9% (about 5.3 million) and 3% (433,000 in the 54 countries considered) of all deaths in the world each year (Lee et al., 2012; Rezende et al., 2016). Both may also be independent risk factors for many health conditions, while engaging in regular physical activity has been proven to be useful in primary, secondary and tertiary preventions. Regular MVPA reduces the risks of cardiometabolic diseases, mental disorders, obesity, musculoskeletal disorders and improves cognitive functioning, the quality of life and sleep quality (Lee et al., 2012; Haute Autorité de Santé, 2019). It also helps with hypertension, type 2

diabetes, chronic respiratory diseases, stroke, osteoarthritis, schizophrenia… (Lee et al., 2012; Haute Autorité de Santé, 2019).

To tackle this double pandemic, recommendations have been issued, government policies have passed, and plans have been implemented for about 20 years to promote the reach of the 30-minute moderate intensity physical activity threshold and reduce the time spent in sedentary behaviours. Although being evidence-based, they have been unsuccessful in helping people change their behaviours. Indeed, physical inactivity and sedentary behaviours have been on the rise for many years along with the increase in sedentary jobs and the advent of new technologies (Guthold et al., 2018).

Given that workers spend about a third of their working days at work and that physical inactivity and sedentary behaviours are closely linked to their working conditions, one may suggest that companies should bear –at least partially– the responsibility to correct this negative externality. Physical (in)activity and sedentary behaviours depend on interventions performed at the individual, societal, environmental, organizational and political levels. Thus, there is a need to highlight the most effective interventions able to promote physical activity and to reduce sedentary behaviours. Thereby, it will become possible to provide people with the opportunity to actively improve their healths.

Based on a systematic literature review, this conference will highlight the most promising interventions to increase physical activity and to reduce the time spent in sedentary behaviours for office workers. A particular emphasis will be put on health promotion programs implemented in the workplace.

References

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016 : A pooled analysis of 358 population-based surveys with 1·9 million participants. *The Lancet. Global Health*, *6*(10), e1077-e1086. https://doi.org/10.1016/S2214-109X(18)30357-7

Haute Autorité de Santé. (2019). *Guide de promotion, consultation et prescription médicale d'activité physique et sportive pour la santé*. https://www.has-sante.fr/jcms/c_2876862/fr/promotion-consultation-et-prescription-medicale-d-activite-physique-et-sportive-pour-la-sante

Lee, I.-M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., & Katzmarzyk, P. T. (2012). Impact of Physical Inactivity on the World's Major Non-Communicable Diseases. *Lancet*, *380*(9838), 219-229. https://doi.org/10.1016/S0140-6736(12)61031-9

Praznoczy, C., Lambert, C., & Pascal, C. (2017). État des lieux de l'activité physique et de la sédentarité en France—Édition 2017. *Observatoire national de l'activité physique et de la sédentarité*, Rapport 130 pages.

Rezende, L. F. M., Sá, T. H., Mielke, G. I., Viscondi, J. Y. K., Rey-López, J. P., & Garcia, L. M. T. (2016). All-Cause Mortality Attributable to Sitting Time. *American*

Journal of Preventive Medicine, *51*(2), 253-263. https://doi.org/10.1016/j.amepre.2016.01.022

Saidj, M., Menai, M., Charreire, H., Weber, C., Enaux, C., Aadahl, M., Kesse-Guyot, E., Hercberg, S., Simon, C., & Oppert, J.-M. (2015). Descriptive study of sedentary behaviours in 35,444 French working adults : Cross-sectional findings from the ACTI-Cités study. *BMC Public Health*, *15*(1), 379. https://doi.org/10.1186/s12889-015-1711-8

Conflicts of interest

The authors declare no conflict of interest.

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Effect of a pain education program on paravertebral allodynia surface.

Beliefs, knowledge, physical and functional repercussions in chronic low back pain patients.

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Abstract

Education in the neurophysiology of pain is a therapeutic approach increasingly used in the management of chronic pain patients. It helps to reduce central sensitization and to modify the negative beliefs and behaviors of these patients. The aim is to break the vicious circle of pain and to increase the patient's adherence to its management.

The objective of our work is to study the effect of such an educational program on the lumbar paravertebral allodynia surface and the knowledge concerning pain as well as the physical and functional repercussions by means of specific tests and questionnaires.

Method: Our controlled, non-randomized study involved 30 patients, divided into two groups: the experimental group (EG, 14 patients) and the control group (CG, 16 patients). Both groups are composed of chronic low back pain patients who have followed a multidisciplinary exercise training program (physical therapy, occupational therapy, adapted physical activity and balneotherapy) for 4 weeks. The experimental group received one hour of pain education at the beginning of the rehabilitation program and an individual interview during the last week. The educational content covered the basics of pain physiology, extrinsic factors modulating pain, and beliefs and preconceptionsTo assess the allodynia surface, an adaptation of the allodynography technique was performed by carrying out lumbar mapping at the beginning of the treatment, at 4 weeks and then at 3 months.
To assess pain knowledge, we recorded the rate of correct answers to the Neurophysiology of Pain Questionnaire (Catley, O'Connell, and Moseley 2013) as well as the questionnaires typically used during management: DALLAS, EIFEL,

HAD, FABQ, and TSK. The questionnaires were distributed at the first week of hospitalization, at the beginning of the fourth week and at 3 months.

Results: The allodynia surface decreased more in the EG at 4 weeks, but the difference disappeared at 3 months. The rate of correct answers increased in the same proportion in both groups. We did not found any relation between these parameters.

References

Catley, M. J., O'Connell, N. E., & Moseley, G. L. (2013). How good is the neurophysiology of pain questionnaire? A Rasch analysis of psychometric properties. The journal of pain, 14(8), 818–827. https://doi.org/10.1016/j.jpain.2013.02.008

Conflicts of interest

The authors declare no conflict of interest.

An interactive e-learning module to promote bio-psycho-social management of low back pain in healthcare professionals: a pilot study.

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Abstract

Low back pain (LBP) is ranked as the first musculoskeletal disorder considering years lived with disability worldwide. Despite numerous guidelines promoting a bio-psycho-social (BPS) approach in the management of patients with LBP, many health care professionals (HCPs) still manage LBP patients mainly from a biomedical point of view. The purpose of this pilot study was to evaluate the feasibility of implementing an interactive e-learning module on the management of LBP in HCPs. In total 22 HCPs evaluated the feasibility of the e-learning module with a questionnaire and open questions. Participants filled in the Back Pain Attitude Questionnaire (Back-PAQ) before and after completing the module to evaluate their attitudes and beliefs about LBP. The module was structured and easy to complete (91%) and met the expectations of the participants (86%). A majority agreed that the module improved their knowledge (69%). Some participants (77%) identified specific topics that might be discussed in more detail in the module. HCPs knowledge, beliefs and attitudes about LBP significantly improved following module completion (t = -7.63, P < .001) with a very large effect size (d_s = -1.63). There is an urgent need to develop and investigate the effect of educational interventions to favor best practice in LBP management. The module seems promising to change knowledge, attitudes and beliefs of the participants. This type of e-learning support could promote the transition from a biomedical to a bio-psycho-social management of LBP in HCPs.

Conflicts of interest

The authors declare no conflict of interest.

From vulnerability to agency : the contingent path of patients with chronic low back pain

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Abstract

The multidisciplinary approach treating neuro-musculoskeletal disorders (NMSD). NMSD is fundamental in refining the understanding of the issue and improving the quality of monitoring. Understanding of chronic disease and intervention with patients is enhanced by the openness of practitioners to the patient's "private feeling" of pain and the patient's experience of the disease (Baszanger, 1991). An interdisciplinary perspective of the patient's physical and psychological relationship to his professional history and his work experience also allows the advancement of knowledge in NMSD (Davezies, 2013).

As part of the NOMADe research project, a study is being carried out by the Center for Training, Research and Community Service (Fors) of the Field of Political and Social Sciences of Henallux. This study aims to understand the experiences of patients with NMSD and, in particular, patients with low back pain.

Our contribution constitutes a presentation of the first results of the study, built on two complementary methodological components. The quantitative part, based on the technique of the questionnaire, allow to identify the objective characteristics of the population affected by NMSD. The qualitative component, based on the technique of semi-structured interviews conducted with people with NMSD, treat the experiences and perceptions of patients and their relatives. So we can identify the way each one formulate their needs and expectations and experiences the consequences of the pathology, on a family level, professional level as well as with the patient care network.

It is about understanding the patient's systemic experience with regard to four complementary aspects: his expertise, the care practices, the professional and family contexts. So, the project analyzes the experiences of patients concerning their NMSD, the symbolic value of NMSD and pain. It also deals with the patient's perception of the care practices administered. Finally, it aims to understand the professional and family contexts of the patient in relation to his ability to act and his expertise.

References

Baszanger, I. (1991). Déchiffrer la douleur chronique. Deux figures de la pratique médicale. Sciences Sociales et Santé, 9(2), 31-78. https://doi.org/10.3406/sosan.1991.1190

Caneiro, J. P., Bunzli, S., & O'Sullivan, P. (2020). Beliefs about the body and pain : The critical role in musculoskeletal pain management. Brazilian Journal of Physical Therapy. https://doi.org/10.1016/j.bjpt.2020.06.003

Davezies, P. (2013). Souffrance au travail, répression psychique et troubles musculo-squelettiques. Perspectives interdisciplinaires sur le travail et la santé, 15-2, Article 15-2. https://doi.org/10.4000/pistes.3376

Delanau, S., Crocq, M., Decayeux, F., Joseph, J., Vecten, C., Yousfi, J., Lelard, T., & Telliez, F. (2018). Évaluation des facteurs de risques de troubles neuromusculosquelettiques dans une tâche simulée de découpe. Neurophysiologie Clinique, 48(6), 326. https://doi.org/10.1016/j.neucli.2018.10.040

Haeringer, A.-S., & Pecqueux, A. (2020). La vulnérabilité comme ouverture à la contingence. Deux enquêtes situées. SociologieS. http://journals.openedition.org/sociologies/14011

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The authors declare no conflict of interest.

Telerehabilitation of musculoskeletal diseases: Who wants it?

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Abstract

Telerehabilitation (TR) could replace traditional rehabilitation in situations that prevent travel, such as lockdown or isolated locations. Musculoskeletal diseases (MSD) are potentially concerned by telerehabilitation. Although the literature shows the effectiveness of TR in the follow-up of a patient suffering from MSD (Adikhari, 2020; Dierick, 2020; Fiani, 2020; van Tilburg 2020), these methods do not seem to have been used in our regions during the successive lockdowns. Our study focuses on the perception of TR by patients and therapists in Belgium and France.

We designed a questionnaire addressing patients and therapists' opinion about TR of MSD: whether they had already used it, under what circumstances, what they thought of this method as an alternative to traditional rehabilitation, etc. 107 therapists and 68 patients answered to the questionnaire.

It appeared that patients were more optimistic about the use of TR than the therapists (54% versus 38%, p = 0.002). Therapists were overall against TR, regardless of their age. This finding was not a matter of familiarity with technology, as the vast majority of therapists agreed that they had a good command of the technological tools requested (78% and 79%, p = 0.909).

Since TR appears to be a good alternative to traditional rehabilitation for MSD according to literature, it may be beneficial for therapists to positively reconsider the possibility of using telerehabilitation.

References

Adhikari, S. P., Shrestha, P., & Dev, R. (2020). Feasibility and Effectiveness of Telephone-Based Telephysiotherapy for Treatment of Pain in Low-Resource Setting: A Retrospective Pre-Post Design. *Pain Research & Management*, *2020*, 2741278.

Dierick F., Buisseret F., Brismée J.-M., Fourré A., Hage R., Leteneur S., Monteyne L., Thevenon A., Thiry P., Van Der Perre L., & Roussel N. (2020). Opinion sur l'efficacité de la prise en charge en kinésithérapie des troubles neuro-musculo-squelettiques par téléréadaptation. *Interreg France-Wallonie-Vlaanderen NOMADe*.

Fiani, B., Siddiqi, I., Lee, S. C., & Dhillon, L. (2020). Telerehabilitation: Development, Application, and Need for Increased Usage in the COVID-19 Era for Patients with Spinal Pathology. *Cureus*, *12*(9), e10563. https://doi.org/10.7759/cureus.10563

van Tilburg, M. L., Kloek, C. J. J., Staal, J. B., Bossen, D., & Veenhof, C. (2020). Feasibility of a stratified blended physiotherapy intervention for patients with non-specific low back pain : A mixed methods study. *Physiotherapy Theory and Practice*, 1‑13. https://doi.org/10.1080/09593985.2020.1756015

Conflicts of interest

The authors declare no conflict of interest.

Towards a new clinical test for assessing Low Back Pain

Design and implementation guided by movement variability and irregularity

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Abstract

Low back pain (LBP) is a complex condition contributing to both pain and disability, as well as reduced quality of life, and generates considerable direct and indirect costs. Musculoskeletal conditions account for one third of primary care consultations (Artus et al., 2017). In socio-economic terms, considerable direct and indirect costs are generated by acute and chronic non-specific low back pain (Maher et al., 2017). Therefore, the development of new diagnostic tools for the clinical assessment of low back pain would be useful (Descarreaux et al., 2005) especially if they are related to other causal factors of this pathology.

Sensory-motor control is inherently variable for each movement. It appears that healthy subjects can avoid fatigue by performing less stereotyped and more varied lumbar movements presenting a more complex and less predictable range of lumbar movements, whereas people with low back pain do not (Bauer et al., 2017). These observations highlight two different concepts related to variation, namely the range of variation called variability and the complexity of variation called irregularity. As most human movements are non-linear, to avoid misinterpretation, we choose to observe lumbopelvic movements in a non-linear manner. In the analysis of non-linear time series, statistics based on sample entropy allow a better assessment of the irregularity of the movement (Richman & Moorman, 2000).

The aim of this study was to determine the minimal length of time series needed to analyze the variability and irregularity of kinematic data from a single Inertial Measurement Unit (IMU) and to define the optimal amplitude of movement for a test in a clinical setting.

Participants (13 women and 10 men) were asked to perform 2 series of 50 repetitions of lumbopelvic "bend and return" movements. Once by touching a 11.4 cm high cardboard box, and the other time by touching a 46 cm high stool. On return, the subjects were asked to touch metal bars placed behind them with the two hands. The IMU was positioned at S2. The angular velocity was recorded at a frequency of 100 Hz.

Our results showed that a duration of 60 seconds was enough to compute sample entropy for both the box test and the stool test. There was no significant difference (paired t-test: P-value = 0.45) between the box and the stool tests. With a similar speed of execution, the stool test required a lesser amplitude of lumbopelvic movements than the box test. Moreover, it was less physically demanding and should be less likely to be met with subject's kinesiophobia. As a conclusion, a 60 seconds "flexion and return" stool test should be implemented for clinical use with LBP patients.

References

Artus, M. Campbell, P. Mallen, C. D. Dunn, K.M. van der Windt, D. A. W. (2017). Generic prognostic factors for musculoskeletal pain in primary care: a systematic review. BMJ Open, 7(e012901). http://dx.doi.org/10.1136/bmjopen2016-012901

Bauer, C.M. Rast, F. M. Ernst, M. J. Meichtry, A. Kool, J. Rissanen, S. M. Suni, J. H. Kankaanpää, M. (2017). The effect of muscle fatigue and low back pain on lumbar movement variability and complexity. J Electromyogr Kinesiol., 33, 94-102. https://doi.org/10.1016/j.jelekin.2017.02.003

Descarreaux, M. Blouin, J. S. Teasdale, N. (2005). Repositioning accuracy and movement parameters in low back pain subjects and healthy control subjects. Eur Spine J., 14(2), 185-191. https://doi.org/10.1007/s00586-004-0833-y

Maher, C. Underwood, M. Buchbinder, R. (2017). Non-specific low back pain. The Lancet, 389(10070), 736-747. https://doi.org/10.1016/S0140-6736(16)30970-9

Richman, J. S. Moorman, J. R. (2000). Physiological time-series analysis using approximate entropy and sample entropy. Am J Physiol Heart Circ Physiol., 278(6), 2039-2049. https://doi.org/10.1152/ajpheart.2000.278.6.H2039

Conflicts of interest

The authors declare no conflict of interest.

Machine Learning can predict and identify non-specific neck pain patients assessed with the DidRen laser test

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Abstract

The understanding of neck pain appears to be an important societal issue (Blanpied et al., 2017; Vos et al., 2015). Conducting observational sensorimotor assessment studies using large databases holds great promise for improving understanding and management of the pathophysiological mechanisms associated with neck pain (Tack, 2019). Machine learning (ML) is a form of sophisticated artificial intelligence (AI) that can be used to predict status of Acute Non-Specific Neck Pain Patients (NPP) and identify discriminative data (Tack, 2019).

The objective of this study was to evaluate the potential usefulness of AI methods in the assessment of sensorimotor performance of the neck with the DidRen laser test (DR) compared to healthy control participants (HCP) (Hage et al., 2019).

Angular Speed and Acceleration data obtained thanks to the DR from thirty-eight acute non-specific neck pain patients were compared to forty-two asymptomatic and Healthy control participants. Dataset, composed of all data, was used by the ML algorithms (MLA) to compare training and testing sets. One supervised MLA has been selected to predict features in this study: non-Linear Support Vector Machine (SVM) (Lee et al., 2019).

SVM gives binary results which are compared with dataset labels. A confusion matrix (True and False positives, and negatives) is computed for the SVM results. Thanks to the confusion matrix results positive predictions (precision) and ratio of positive instance correctly detected (recall or sensitivity) can be given. These results are used to compute the specificity (true negative rate). Then the Receiver Operating Characteristic (ROC) curve can be plotted. The curve link Recall and Fall-Out (1 – Specificity) and is characterized by the Area Under Curve (AUC).

Then the most significative features can be computed with an iterative process of testing each feature individually, find the best AUC score and then repeat the process combining last best features with all other features.

The Precision score was: 0.783. The Recall score was: 0.974. The AUC of the SVM was 0.799. The best significative feature is GyrX [deg/s] with Standard Deviation (std).

This study demonstrated that MLA could be used to predict NPP compare to HCP and identify discriminative data related to the same status.

References

Blanpied, P. R., Gross, A. R., Elliott, J. M., Devaney, L. L., Clewley, D., Walton, D. M., . . . Robertson, E. K. (2017). Neck Pain: Revision 2017. *J Orthop Sports Phys Ther, 47*(7), A1-A83. doi:10.2519/jospt.2017.0302

Hage, R., Buisseret, F., Pitance, L., Brismee, J. M., Detrembleur, C., & Dierick, F. (2019). Head-neck rotational movements using DidRen laser test indicate children and seniors' lower performance. *PLoS One, 14*(7), e0219515. doi:10.1371/journal.pone.0219515

Lee, J., Mawla, I., Kim, J., Loggia, M. L., Ortiz, A., Jung, C., . . . Napadow, V. (2019). Machine learning-based prediction of clinical pain using multimodal neuroimaging and autonomic metrics. *Pain, 160*(3), 550-560. doi:10.1097/j.pain.0000000000001417

Tack, C. (2019). Artificial intelligence and machine learning | applications in musculoskeletal physiotherapy. *Musculoskelet Sci Pract, 39*, 164-169. doi:10.1016/j.msksp.2018.11.012

Vos, T., Barber, R. M., Bell, B., Bertozzi-Villa, A., Biryukov, S., Bolliger, I., . . . Murray, C. J. L. (2015). Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 386(9995), 743-800. doi:10.1016/s0140-6736(15)60692-4

Conflicts of interest

The authors declare no conflict of interest.

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Fine adaptive control of precision grip after median nerve mobilization

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Abstract

Fine dexterity critically depends on information conveyed by the median nerve. Little is known about longitudinal tension and excursion. However, these mobilizations are frequently applied during physiotherapy interventions. The purpose of the study of Dierick *et al.* (2021) was to understand the physiological repercussions of median nerve mobilization on precision grip in healthy participants.

Using a force-sensitive manipulandum and Semmes-Weinstein monofilaments, we examined the adaptations of precision grip control and fingertips pressure sensation threshold before and immediately after the application of longitudinal tension and excursion mobilizations applied on the median nerve. Grip and load forces (normal and tangential forces, respectively) applied by the thumb, index and major fingers were collected in 40 healthy young participants during three different grip precision tasks along the direction of gravity.

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Our findings showed that median nerve mobilizations induced significant fine adaptations of precision grip control in the three different tasks but mainly during grip-lift-drop and oscillations with collisions. In the grip-lift-drop task, significant increases of maximal load force and its derivative were observed after the mobilizations. A significant increase of load force standard-deviation was observed after the mobilizations during the oscillations without collisions. A significant decrease of maximal load force and grip force at contact as well as an increase of load force at contact were observed after the mobilizations during oscillations with collisions in upward direction. A significant decrease of maximal grip and load and forces was observed after the mobilizations during oscillations with collisions in downward direction. Fingertips pressure sensation thresholds at index and thumb were significantly reduced after the mobilizations.

We conclude that precision grip adaptations observed after median mobilizations could be partly explained by changes in cutaneous median-nerve mechanoreceptive afferents from the thumb and index fingertips.

References

Dierick, F., Brismée, J. M., White, O., Bouché, A. F., Périchon, C., Filoni, N., Barvaux, V., & Buisseret, F. (2021). Fine adaptive precision grip control without maximum pinch strength changes after upper limb neurodynamic mobilization. Scientific reports, 11(1), 14009. https://doi.org/10.1038/s41598-021-93036-8

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