Case Report

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2023.48.007586

Physical Care of Chronical Lowback Pain: Possible Help from Millimetric Waves Exposure: A 2 Cases Report

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ARTICLE INFO

Received: December 04, 2022

Published: January 10, 2023

Citation: Debouzy JC, Del Vecchio F, Debouzy V and Crouzier D. Physical Care of Chronical Lowback Pain: Possible Help from Millimetric Waves Exposure: A 2 Cases Report. Biomed J Sci & Tech Res 48(1)-2023. BJSTR. MS.ID.007586.

ABSTRACT

Osteoarthritis (OA) is an extremely frequent disease, both source of chronical pain and disability, and of social and emotional impairment. The mechanisms involved in OA are not yet fully elucidated, and classical medical, surgical and physiotherapy sometime not efficient enough. Besides, physical methods can be helpful in pain and function care. We present here two cases of OA, whose health and life status have been greatly improved after millimetric waves, low power exposure from a bracelet shaped device initially designed for well-being use or stress relief. Possible place of MMW among a multidisciplinary care of OA is discussed, especially if one considers a Nociplastic contribution in the chronical OA pain.

Keywords: Pain; Chronical Low Back Pain; Osteoarthritis; Millimetric Wave

Introduction

OA is the most frequently present osteoarticular affection after 65 years. Loss of articular cartilage (narrowing of the joint space) and bone neoformation (osteophytosis) lead to chronical pain, severe function impairment, disability and finally reduced quality of life. Facing this frequent an expensive disease, medical care, surgery, and physiotherapy are not ever sufficient, this partially related with the incomplete knowledge of the mechanisms involved in cartilage degradation. Besides, other "physical" care has been proposed for decades, with a special attention to chronical pain [1], e.g., acupuncture [2], physiotherapy, pulsed electromagnetic fields, ultrasounds, low intensity laser therapy or ultrashort wave diathermy, and recently millimeter waves exposure [3]. In this paper, we focus on two aspects, i.e., millimetre wave therapy, and chronical pain, (here OA and low back pain) specificities recently identified.

Millimetre waves (MMW) correspond to electromagnetic radiation at frequencies between 30 and 100 GHz. Initially used in military applications (radar and less lethal crowd dispersal weapons), millimetre waves have gradually reached the civilian domain with the advent of 5G mobile telephony. The analgesic effects of millimetre waves (MMW) have been observed and used clinically on various conditions for treatment of pain syndromes of various origins, from the 1970s to the 1990s [4] in former USSR [5-7]. Unfortunately, the size of the emission systems and the need for a hospital environment for their implementation prohibited any ambulatory use. At the time, these systems fell into oblivion in favour of pharmacological mean. Later, because of the public health problems posed by the extensive use of opiates (particularly in the USA [8]), non-medicinal methods experienced renewed interest. More recently, updated review by Ziskin [9], and some clinical

case reports [10-12] are consistent with historical findings. The basic mechanisms more recently identified are a local peripheral stimulation resulting in a central response under form of endorphin secretion [13]. Besides, especially during the last decade, both rapid electronics and the miniaturization of systems have made it possible to obtain very small transmitters. For instance, the devices used by the patients (whose cases are reported in this paper) are included in a wrist band and carried like a watch, e-commercialized under the name Remedee-1© [11,14]. This device emits a continuous electromagnetic wave of 60 GHz at a power density of 14mW/cm2 on 2cm of skin surface on the palmar face of the wrist, that is in close contact with the median nerve, for 2-3 sessions of 30 minutes per day.

Chronical pain

Knowledge and recognition of chronic pain have also greatly evolved in recent years. Pain is no longer considered a single symptom, but since ICD-11 has gained the dimension of chronic pathology in its own right [15], which must be taken care of in all its dimensions according to the biopsychosocial model [16]. These evolutions are strongly linked to the recognition of a third type of pain, coming out of the classical nociceptive/neuropathic binary schema. This is nociplastic pain. For instance, in the field of osteoarticular pain, OA, post-surgical (or not) chronic musculoskeletal or joint pain, (chronic low back pain, etc.), there is frequently a dissociation between pain, discomfort and medical imaging data, that is a dissociation between anatomic (nociceptive), neuropathic and nociplastic pain. Osteoarthritis (OA) is a complex multifactorial joint disease involving common risk factors such as aging, traumatisms, and metabolic disorders [17,18]. Whereas OA pathophysiology remains unclear, the nervous system, involved in pain signalling, appears also involved in these joint tissue alterations. At first MMW thus appears of interest for pain relief, in OA and chronical low back pain (LBP) care. Furthermore, some laboratory works evidenced that MMW can promote chondrocyte proliferation, induce cell differentiation [19], and inhibit inflammation and apoptosis of chondrocyte [20-22]. We report the clinical evolution in 2 cases (1 OA and 1 LBP) after local exposure to MMW with a device (MMW transmitter bracelet) marketed for the purpose of well-being.

Cases Description

First patient, Mrs VO, 42 years old (born in 1980), was employed in the army with no history of surgery, ongoing medical treatment, or addiction. She had been suffering from chronic low back pain for long time since 2011, with an acute episode of L5 right sciatica. Hip and low back osteoarthritis were identified as responsible of her chronic pain. Radiological examinations identified L4/L5 and L5/S1 discopathies, including bilateral isthmic lysis of L5, lower lumbar stepped posterior inter-articular osteoarthritis, osteophytosis at the femoral head/neck junction of the 2 hips in favour of a femoro-acetabular impingement with a possible postero-inferior begining protusive coxopathy. At the hip level, echographic assessment showed a dysmorphic appearance and crack on the edge of the acetabular pad on the left side, particularly in the anterolateral region with longitudinal cracking, responsible for a flat type of appearance. Arthroscan confirmed a significant coxofemoral chondropathy predominant in the postero-superior and antero-superior region. In April 2020, on picking up a heavy object on the ground, she felt acute and extremely low back pain violent (initial VAS estimated at 9). This pain considered as neuropathic type of mixed schedule was irradiating down to the ankle with a morning unlocking of 15 minutes, impulsive to efforts with closed glottis. Besides, bilateral hip pain was ever present, sometimes associated with right knee pain. Current pain level was scaled from 4 to 8 for several months(august). Physical examination revealed spinal stiffness with a Lasegue sign to the right of 30 degrees, limitation in internal rotation at the level of the bilateral coxo-femoral joints. There was no Babinski sign.

Whereas physical functioning limitations are well present in the SF36 (items 1-2) [23], they are even more detected on Oswestry [24] (54%) and EMIR [25] (7) tests, or specific WOMAC [26] (40) and EIFEL (13/24) scores. Specifically, some all-day life gests were affected, such as difficulty standing static (5min); stiffness precluding leaning forward or picking up something, or even shoe lacing… By the way of contrast specific "hands" questionnaire (DREISER) [27] showed no limitation, in agreement with the absence of hands osteoarthritis localisation. Anxiety depression test (HAD) [28] only evidenced limited perturbation (A:11/21; D: 9/21); conversely, SF36 (items 3,5,6, respectively at 33 ,35 and 37) clearly confirmed social and psychological repercussion of such chronical pain. Medical care during the following months consisted of Méloxicam, pregabaline, lamaline, prednisolone, sodic naproxene, omeprazole, laroxyl, dafalgan codéine, Doliprane, para étalon codeine, without providing complete pain relief (at best, a VAS level of 4). Table 1 presents the different evaluation scores obtained at this time. Physical care involved physiotherapy and osteopathy. She decided to test the millimetric wave device commercially designed for well-being improvement. Using 3 sessions a day (1/2 Hr each) led to a significant pain reduction (VAS from 8 to 4). A supplementary pain reduction was obtained after association epidural infiltration, infusions of solumedrol (dose 20mg) morning and evening for 4 days, combined with Dafalgan codeine ® 3 times a day. From august, as VAS was currently about 1, MMW was only required when she resumed the physical activities she had abandoned for long time (i.e., after walking, hiking, picking up objects…). Besides, a diet low in gluten and lactose was put in place, providing additional comfort. The results are summarized on Table 2 (right column). First, an overall status improvement

was noted, as shown from SF36 score (jump from 325 to 699). Subcategories gave more precise indications. From pain decrease, the functional alterations were dramatically attenuated: this appears especially from WOMAC score (from 40 to less than 10, or not), EIFEL evolution from 13 to 2 and from SF36 (improvement from 85 to 90).

Table 1: Calculated physical, functional and psychosocial scores score before and after 3 months MMW trial.

Questionnary	Before mmw	After 3 months mmw
SF36 :		
1.Physical functioning	85	90
2.Role limitation due to physical health	25	50
3.Role limitation due to emotional problems	33	67
4.Energy/fatigue	35	80
5.Emotional well-being	40	92
6.Social functioning	37	100
7.Pain	35	70
8.General health	35	55
WOMAC	40	≤10
EMIR	7	3
DREISER	0	0
HAD	11/21(A) 9/21(D)	≤5(A, D)
OSWERTY	54%	22%
EIFFEL	13/24	2/24*
VAS	8	4 to 1**

Note: *extrapolated from womac and SF36 **Although lowered to 1-2 after association with infiltration (MMW device used only when EVA reached 3 or more).

Table 2: Calculated physical, functional and psychosocial scores score before and after 2 months MMW trial.

Questionnary	Before mmw	After 3 months mmw
SF36 :		
1.Physical functioning	60	95
2.Role limitation due to physical health	25	100
3.Role limitation due to emotional problems	100	100
4.Energy/fatigue	50	50
5.Emotional well-being	65	65
6.Social functioning	50	75
7.Pain	50	100
8.General health	55	65
WOMAC	33	19
EMIR	9	0
DN4	4	0
EIFFEL	12/24	0/24
VAS	6-8	0

This made it possible again to realize physical all-day gests, sport practice (cross, yoga, body balance, and trek), and more intense physiotherapy (SF36/2 from 25 to 50). Psychologic aspects were also dramatically improved. SF36 scores were more than doubled (items 3, 4, 5 including well-being, fatigue, and emotional consequences); HAD levels dropped down to negligible, and social

life came back to normal (SF36/6; 33 to 100). Note also that she recovered sleeping quality (except after hikes exceeding 2 hours, that reactivated pain and prevented sleep).

Second patient, Mrs. YY..., 38 years old (born in 1984). Until the age of 29, she was obese (100kg for a height of 1m55, body mass index of 42). She finally decided in 2013 to have surgery by performing a gastric bypass, which allowed her to lose 38kg (current weight of 62kg). From this period, chronical low back pain suddenly appeared without any obvious organic cause being identified. The radiological assessment found lumbar scoliosis (29°) without lystesis and posterior joint osteoarthritis staged from L3 to L5; Whereas there has never been any radicular, crura or sciatica irradiation, regional pain impaired physical activity, social behaviours and sleep. Neither analgesic treatment nor physiotherapy could bring her any relief leading to the overall score summarized in Table 2 (first column) in December 2021.

Note that VAS was estimated to 8. In the hope of improving her condition, she procured a remedee 1®14 device. Following regular use of this bracelet (3 sessions per day), the level of pain fell rapidly (2 weeks) to VAS 2 (end of December) then 1 (mid-January) and finally 0 (end of January). Note that from December 15, no more analgesic treatment was used. Besides, sleep, all day life and physical activity were also greatly improved, even if a long walk remained sometime painful. The score presented on the Table 2 (second column) clearly shows these improvements. From pain (item 7 of SF36: 50 to 100 means here disappearance of pain, and VAS), to physical and functional recovering (item 1, 2 of SF36, WOMAC-lumbago score lowered to 19 and EIFEL score brought to 0). Although emotional contributions have never been impaired by her pathology (according to the constant values for SF36 (3 and 5)) EMIR score fell to 0, according with the global SF36 score improvement. Note that the DN4 neuropathic score [29] was initially of 4 (indicating possible neuropathic contribution to pain) also vanished after MMW treatment [30].

Discussion/Conclusion

The two cases of low back pain reported here are different from common low back pain, or acute low back pain attacks, for which the treatments are established and generally short-term, based on analgesics (first level 1 at the highest dose). lowest possible), NSAIDs, and physical exercise (HAS). This is chronic pain, for which, even if a possible triggering factor exists (exertion, surgery for weight loss), the initial organic context (sciatica from effort-osteoarthritis, overweight-scoliosis) does not explain the transition to chronicity. As mentioned by Morris42, "patient exhibits a vulnerability to dysregulation of central feedback circuits that control sympathetic tone, inflammation, circadian rhythms (central and peripheral clocks), gut microbiome, metabolic redox and whole joint pathology". The consequences are a loss of autonomy, the limitation of daily physical activities, dissociation, etc., especially since long-term drug treatment is generally disappointing. In the cases reported here, even if the nociceptive/neuropathic components dominate, neuroplastic processes lead to imbalance of the inhibitory systems and of a sensitization mechanism.

For Wallace, et al. "The decline in descending inhibitory activity is directly correlated with dysregulation of dopamine, serotonin, norepinephrine, epinephrine, and endogenous opioids. In a context of multimodal pain management, the secretion of endorphins caused by MMW can act directly on dysregulation but also, by reducing the level of pain, as an initiator of global rehabilitation and social reintegration. This means that, whereas nociceptive pain ("anatomic lesions") is not accessible to MMW, such is not the case for neuropathic contributions, and especially to nociplastic pain. A global approach is therefore a key element and cannot be limited to the sole use of a device or the administration of a drug treatment. The understanding and adherence of the patient to his treatment is a crucial point, which requires support, as does the fight against a sedentary lifestyle and re-socialization (HAS). If validated clinically, the use of millimetre waves could represent hope in the care of pains with not only nociceptive, neuropathic, but especially nociplastic components, particularly by fitting into the first phases of a of a multidisciplinary patient care pathway.

Declarations of Interest

JC Debouzy is indpendant medical advisor, Remedee is one of hie custumers; D Crouzier works for Remedee Labs.

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ISSN: 2574-1241

DOI: 10.26717/BJSTR.2023.48.007586

Debouzy JC. Biomed J Sci & Tech Res