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Review Article

Innovative paradigms: Integrative models in orofacial pain treatment

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Abstract

Orofacial pain is a multifaceted condition encompassing various disorders such as temporomandibular joint disorders (TMD), neuropathic pain, and dental pain. Managing orofacial pain effectively requires an integrated approach that addresses its complex etiology and individual patient needs. This article provides a comprehensive review of evidence-based strategies for the integrated management of orofacial pain. The integrated approach begins with accurate diagnosis through comprehensive clinical evaluation and diagnostic testing. Pharmacotherapy forms the foundation of treatment, however, addressing the psychological and emotional aspects of chronic pain is equally crucial. Behavioral therapies such as cognitive-behavioral therapy (CBT) and biofeedback are integrated to manage pain perception and coping strategies. Physical modalities like physical therapy, yoga, occlusal splints, and acupuncture complement pharmacotherapy by targeting musculoskeletal dysfunction and promoting neuromuscular balance. This article also highlights the importance of spirituality and how it contributes to the overall well-being of an individual with orofacial pain. By synthesizing current evidence and clinical expertise, this article advocates for a holistic approach to orofacial pain management that recognizes its multifactorial nature and tailors' treatment strategies to individual patient needs. Through collaboration between healthcare providers and patients, the integrated approach offers a comprehensive framework for alleviating orofacial pain and improving overall quality of life.

Keywords: Orofacial Pain, Integrated pain management of orofacial pain, Physical therapy in pain mangement, Behavioural therapy in pain management

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1. Introduction

The revised definition of pain as given by international association for study of pain (IASP) has been, "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage," this was to address the facts like Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors. It is different from nociception, and influenced by an individual's life experiences. Although pain serves an adaptive role, it affects function, social and psychological wellbeing.[1] This is also why pain is the most common reason for dental emergencies world-wide.[2]

1.1 Acute and chronic orofacial pain

While acute pain is that which lasts for short period of time (hours to days), there is enough evidence of it chronicization. When this pain becomes chronic, it is characterized by hyperactivity known as "peripheral sensitization" caused due to abnormal ectopic charges at the end plate. The combination of peripheral sensitization and inflammatory process lead to the classic triad of spontaneous pain, hyperalgesia, and allodynia. At the neural level, pain is transmitted by the A-delta and C- fibers which transmit the information to brain centers and process pain. In case of chronic pain, the information is processed at the thalamus and somatosensory cortex and limbic system via trigeminal nucleus and the thalamic sensory nuclei.[3,4]

Once the pain becomes chronic and there is involvement of somatosensory cortex, phenomenon of central pain sensitization sets in which is characterized by heightened sensitivity to pain and the sensation of touch. They are called *allodynia* and *hyperalgesia*. Allodynia occurs when a person experiences pain with things that are normally not painful.[5] Descending pain pathway is also altered in

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chronic orofacial pain, with plastic changes in nociceptive signalling pathways and involvement of various cells such as satellite glial cells, astrocytes, microglia, and macrophages, as well as nociceptive neurons.[11]

Involvement of somatosensory cortex and limbic system reaffirms the fact that pain is dynamic and individual and necessitates the use of patient reported outcomes for assessment and management of patients. The inference, understanding and application of this makes diagnosis of orofacial pain difficult.[6] Chronic orofacial pain has also been related with the 'biopsychosocial model' this means that biological, psychological, and social aspects play an important role in development, maintenance, and severity of pain disorders.[7,8]Understanding the above stated facts suggest that if the pain rated on visual analogue scale by the patient is higher than that expected based on the clinical evaluation it appears to reflect patient's personal experiences which needs to be bridged when treating these patients. Addressing the psychological, emotional, environmental, and social factors ensured sustained pain relief and better treatment outcome which otherwise is a challenge in diagnosis and management of pain. (**Table 1**and **Table 2**)

2. Possible Causes of Orofacial Pain

Broadly pain can be neuralgic, neuropathic, neurovascular, musculoskeletal,[10]

Table 1: Difference between acute and chronic orofacial pain

Acute pain	**Chronic pain**
Short duration: hours or days.	Lasts longer: e.g. longer than expected for healing: 3 months.
Cause can be easily established	Cause may or may not be clear.
Effects on behaviour are usually easy to recognize.	Effects on behaviour can be subtle and hard to understand.
Treatments are highly effective, depending on access	Treatment approach is multi-modal as it involves biopsychosocial model.
Pain Transmission is via peripheral nerves to the central nervous system without the involvement of amygdala. Central sensitization does not occur.	Involves peripheral and central sensitization.

Table 2:

	Subtypes	**Identifying factors**
Pain attributed to dentoalveolar and related structures	Toothache Chronic mucosal pain	Rarely chronic (>3 months) Well-localised Clinical and radiographical findings Maybe related to headache. Maybe associated with burning mouth syndrome Maybe associated with red and white lesions, ulcerative lesions Identified by clinical examination and histopathological examination.
Temporomandibular disorders	Arthralgia or myalgia Arthritis Degenerative joint disease	Examination of range of motion, Gait of joint Joint sounds Muscle tenderness Load test Radiographical imaging Systemic autoimmune arthritis such as rheumatoid, Psoriatic arthritis Radiographic changes Occlusal changes Lab investigations Tenderness around joint on palpation Joint sound - CrepitusRadiographic Imaging
Myofascial Pain	Localised Myalgia Myalgia with referral	Clinical and palpatory findings Referral pattern Dull-aching pain, moderate in intensity, increases with function. Mouth opening may be reduced
Neuropathic Pain (Pain due to lesion or disease in cranial nerve)	Trigeminal Neuralgia Post-Traumatic trigeminal neuropathy	Active systemic or local diseases Short lasting (>2mins) Severe pain Nearly daily One or more branch affected Trigger zones Refractory period History of trauma or surgical procedure Burning, continuous, moderate in intensity with occasional paroxysm of severe intensity Localised initially may spread to adjacent dermatome when becomes chronic Analgesia or hyperalgesia present

		Topical therapies may alleviate pain
Neurovascular pains	Migraines Tension-type headache Trigeminal Autonomic Cephalgia Other primary headaches	Autonomic signs specifically tearing, nasal congestion, feeling of fullness in cheek and ears Phonophobia, Photophobia Nausea Paroxysmal, continuous, combined temporal patterns. May have unique characteristics that mimic dental pain however no pathology may be found in dentoalveolar region.
Idiopathic orofacial pain	Burning Mouth syndrome	Common in peri and post-menopausal women candida infections, uncontrolled diabetes avitaminoses, iron deficiency, thyroid, polypharmacy may be associated. Increased intensity as day progresses Poor sleep Anxiety, depression may be associated Hypofunction of dopaminergic receptors
Persistent idiopathic facial pain		Pain occurs nearly daily and constant Pain is deep, poorly localized radiating, mostly unilateral Aching burning throbbing and stabbing Mild to severe Hypoesthesia Diagnosis based on exclusion

3. Discussion

3.1 Integrative pain management

Integrative pain management is a person-cantered model of pain care based on the principles and practices of integrative medicine, including a focus on the restoration of function, health, and wellness. It is an individualized therapeutic option that includes a spectrum of biological, interventional and lifestyle approaches guided by healthcare professionals. The patient herewith is alleviated by attempts to reduce pain, improve function, quality of life and self-care by nutritional, behavioural, spiritual, and self-management approaches.[9]

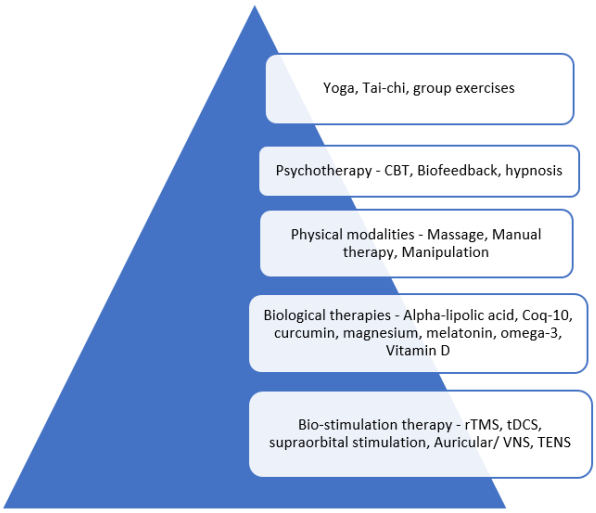

Figure 1: Modalities used as complimentary therapy

*3.2 Modalities used as complementary therapy: (**Figure 1**)*

Behavioural / psychosocial approach – CBT, Biofeedback, Hypnosis, Psychological / spiritual support Physical modalities – Massage, manual therapy, manipulation, yoga, tai-chi, group exercises Biological Therapies – Alpha lipoic acid, Coq 10, curcumin, magnesium, melatonin, Omega-3, Vitamin D Biostimulation therapies – rTMS, tDCS, supraorbital stimulation, Auricular / VNS, TENS

1. **CBT:** Cognitive–behavioural therapy (CBT) is a practical, goal-focused approach that helps patients understand the relationship between their thoughts, feelings, and behaviours. It is devised to identify the dysfunctional and distorted cognitions associated with their psychological problems and to create more functional and balanced cognitive patterns that create less emotional distress and more helpful behaviours.[12] CBT has strong evidence as an effective intervention for patients with chronic orofacial pain. Nome et al published a systemic review to evaluate role of CBT in orofacial pain management.[13]

2. **Hypnotherapy:** Hypnosis is a mind activity characterized by focused attention, absorption, dissociation, and plastic imagination. Hypnosis was used as an anaesthetic when no anaesthetic was available, which describes its strength in focussing attention. There are increased number of studies on hypnosis that have shown its capacity to modify the activity of the prefrontal cortex, default mode network and pain neuromatrix (including anterior cingulate cortex, amygdala, thalamus, insula, and somatosensory cortex) and increased pain threshold up to the level of surgical anaesthesia.[14]

3. Abrahamsen et al.[15] has shown evidence for decreased VAS scores for patients with orofacial pain, however this study also recommends that stress coping skills and unresolved psychological problems need to be included in a comprehensive management plan in order also to address psychological symptoms and quality of life. Baad-Hansen et al, Abrahamsen et al, Flamand-Roze C

et al, Merz E et al, Lu DP et al, Abrahamsen et al (2019), Zhang Y et al, Gerschman J et al, Simon EP et al, Ferrando M et al, Khoe MJ et al, Stam HJ et al, have discussed the use of hypnotherapy in facial pain management.[15,16,17,18,19,20,21,22]

4. **Spirituality:** Spirituality is often defined as the experience of transcendence, connectedness, meaning and purpose in life, integrating aspects of the self or the search for the sacred. Spirituality and beliefs can influence an individual's way of life, attitudes and feelings about life, pain and death. They often play a role of great significance at the time of illness than any other time in a person's life and help individuals accept their own illness. Religion on the other hand is traditionally connoted set of beliefs and practices around the existence of something divine or sacred or divine such as God, a higher power, or an ultimate truth. Religion is a social institution in which a group of people participate rather than an individuals search for meaning. Religion can provide a platform for the expression of spirituality. Spirituality as a concept has now been included into the biopsychosocial model recognizing its role and impact on healing.[23]

Several studies have concluded the role of spirituality in pain sensitivity[23,24,25,26,27,28,29,30,31] Research has also shown negative spiritually based cognitions (e.g. God is abandoning me) is related to pain sensitivity. Various studies have elicited the importance of spirituality in pain management.[25,26,27,28,29,30,31]

Interventions have been applied in nursing practices such as prayer, use of honey. Various interventions have been studied and applied in holistic care of patients and have been found to be very effective for individuals health, illness and in recovering from diseases. Understanding patients' way of life which have different beliefs, attitudes, style, norms, habits, and communication styles are important role in healing patients in the most appropriate and effective way.

3.3 II. Physical Modalities Yoga

Yoga has its roots in Indian philosophy and is one of the most used mind body interventions for management of pain, depressive disorders, cancer, menopausal symptoms, anxiety disorders amongst others. Traditional yoga is a complex intervention that comprises advice for ethical lifestyle, spiritual practice, physical activity, breathing exercises and meditation. In most parts of the world, yoga is associated with physical postures (asanas), breathing techniques (pranayama), and meditation (dhyana).[32,33]

Anxiety and depressive disorders are almost always found secondary to chronic pain conditions and orofacial pain is no exclusion.[34] This causes biochemical and neurophysiological functions such as alterations in monoamine (noradrenaline, serotonin, dopamine). There is preliminary evidence from imaging studies that prove increased endogenous dopamine release in the ventral striatum and thalamic GABA levels, as also increased plasma serotonin levels in patients who practiced yoga.[35,36,37] Yoga also decreases the dysregulation in hypothalamic-pituitary-adrenal axis in response to stress. Besides, there in evidence of reduced salivary cortisol levels in patients after yoga interventions along with steeper diurnal salivary cortisol slope.[38,39]All these factors rationalise the use of yoga as an intervention in chronic pain patients.

Evidence of use of yoga as an intervention in chronic orofacial pain is low, however can be understood by its analogous use in management of chronic pain.[40,41,42]

3.3.1 Massage

Massage therapy is used as a part of treatment in myofascial pain with the goal to re-establish the proper length and flexibility of muscles. A few basic forms of manual therapy may be used: enfleurage, kneading, friction, and petrissage.

Effleurage, kneading is a massage based soothing, stroking movement used at the beginning or end of session to warm up the muscles and make both blood and lymph flow better. Kneading is a technique in which underlying tissues are moved in a circular, rotating motion to increase blood level in a particular part of the body. Friction is a technique in which fingertips pressure in trigger point therapy resulting in local tissue remodelling that may lead to congestion and local inflammatory response. It also leads to reconstruction of muscle microstructure and restores proper architecture. Stretching is done via two techniques – "Petrissage" and "rolling" these improve range of motion, provide for viscoelastic changes, and decrease muscle contraction. The range of motion achieved by stretching persists after manual therapy indicating adaptation of muscle occurring on m-RNA level, it also lowers level of muscle tautness

This causes increased blood flow and thereby decreased muscle tension that leads to faster recovery around muscle and improved range of motion. It also has short term analgesic effect due to activation of pain-gate mechanism that disables pain signals travelling to CNS through larger and faster conductive nerve fibres. Massage produces good psychological effects, reduces stress and anxiety, and improves patients' mood.[43]

There is evidence of massage therapy reducing tension headaches, pain in masseter muscle and restoring equilibrium in muscles, improved functional movements of organ of mastication.[44,45,46,47,48,49,50,51]There is also evidence of massage therapy used in combination with dry needling and laser therapy.[52]

3.3.2 Manual therapy

Manual therapy includes joint mobilization, manipulation, or treatment of soft tissues, sore muscles passive or active stretching exercises, guided opening and closing of mandibular movements, along with therapeutic exercises in physical therapy treatments. Manual therapy restores normal ROM, reduces local ischaemia, stimulates proprioception, breaks fibrous adhesions, and stimulates synovial fluid production and reduced pain.[53,54]

Various studies have been done to understand the effectiveness of manual therapy in chronic orofacial pain, especially TMDs, De Melo and colleagues,[53] conducted a systemic review to understand the effectiveness on manual therapy and found that manual therapy was more efficacious than home therapy alone, not more efficient than botulinum toxin, and no better than counselling. Other systemic study done by Susan Armijo-Olivo[55] and colleagues concluded that there was greater uncertainty about effectiveness of exercise and manual therapy for treatment of TMD. The treatment of these disorders requires a guideline, for which RDC-TMD and/or IHS guidelines serve the purpose.

3.4 III. Biological therapies

Nutritional therapy in OFP has been over simplified in the name of "soft-diet", this needs to be taken care of understanding that 'soft buns/rolls' may require more masticatory force than foods such as chopped tomatoes which would have more fibre and more nutritional benefits than soft bread. Various OFP conditions may also elicit normal movements and pain on function which leads to desire to manipulate food to help address decreased function. Clinicians should advise alternative dietary choices or food preparation such as peeling and cutting fruits that allow balanced diet. Excluding food such as vegetables, whole grains, and dietary fibre than dietary sources of antioxidants and vitamins, minerals and phytonutrients lacking. In case of neuropathic and neurovascular disorders, the food composition or temperature may exacerbate or play a triggering role in pain. As also, conditions such as BMS are closely linked to folic acid and vitamin B levels.[58] There is also some preliminary evidence that micronutrient deficiencies of vitamin C and zinc may represent a risk factor for post-herpetic neuralgia.[59] Studies have shown that modifying diet and advising gluten-free diet seemed to reduce pain sensitivity in women with TMD and may be beneficial as an adjunctive therapy for chronic myofascial pain in masticatory muscles.[60]

1. Vitamin D and Magnesium – Vitamin D plays an important role in calcium homeostasis and bone metabolism. It is clinically proven to benefit chronic pain without any side-effects of currently available analgesics[56] As also its definite role in sleep and quality of life necessitates its administration in patients with low levels.[57] Vitamin D and magnesium have been shown to be low in chronic pain states, chronic cephalgia and dysfunction pain syndrome.[64] Using 300 mg of magnesium citrate alone or in combination with amitriptyline in patients with fibromyalgia. Magnesium alone also improves many pain parameters.[9]

2. Omega 3 fatty acids – Omega 3 fatty acids (e.g. docosohexanoic acid and eicosapentanoic acid) have an established role in dampening inflammation by reducing the synthesis of pro-inflammatory prostaglandins (PGE2) and leukotriene B4; however, the impact on OFP is unknown. Li and colleagues in their meta-analysis noted that marine-derived n-3 polyunsaturated fatty acids supplementation provided significant reduction of CRP, IL-6, TNF-alpha.[61,62,63]

3. Coenzyme q10 and alpha-lipolic acid – Chronic pain creates significant oxidative stress which coexist with nutritional depletion. Antioxidants reduce the nutritional deficiency associated with oxidative stress and improves pain levels.[9]

4. Omega 3s, Curcumin– curcumin is a component of spice turmeric, like omega 3s, curcumin can reduce the inflammation when used at typically 1000 mg per day. Curcumin has also shown to reduce CRP levels as these substances are known to have intrinsic central antinociceptive effects they also have some local anti-inflammatory effects that modulate central inflammation and pain signalling. In comparison with acetaminophen, COX-2 selective NSAIDs curcumin at 2mg per day demonstrated similar analgesic effect with greater tolerability, however onset of relief was delayed. Evidence of use of curcumin in orofacial pain management has also been documented by Sterniczuk et al, Mittal N et al, Maulinna T et al, Luca A et al.[65,66,67,68,69]

5. Melatonin – Chronic orofacial pain is often associated with sleep deprivation and thereby increased pain sensitivity and hyperalgesia. Sleep disorders lead to increased susceptibility to stress and have a negative impact on intestines. Thus, there is a well-noted interaction between sleep disturbances, gut microbiota alteration and chronicization of pain.[69] A reduction in melatonin production is noted when circadian rhythm is out of balance, this further leads to increased inflammation and increased oxidative stress. Further the cortisol production is affected as well.[69] Evidence of melatonin use in chronic pain has been established by various lab and clinical studies.[70,71,72,73,74]

3.5 IV. Bio stimulation therapies

1. Electric stimulation - Electric stimulation can be mediated by various devices namely TENS, MENS, SCENAR. TENS is a non-invasive neuro-modulating therapy effective in treatment of Trigeminal neuralgia, temporomandibular joint disorders, migraines and headaches, ocular pain, Post-herpetic neuralgias. various orofacial pain conditions. Tens works on the gate -control theory of pain. Electrodes are placed on intact skin and short electrical impulses are applied along the affected region. Primary afferent signals enter the spinal tract of trigeminal nerve and synapse within the trigeminal nucleus. Second order neurons decussate further ascend via trigeminal-thalamic tract and synapse within thalamus. Third-order neurons project to the postcentral somatosensory gyrus within the cortex.

   High-frequency TENS activates the supraspinal descending inhibitory pathway. Low frequency TENS has supraspinal effects and modulates pain via spinal serotonin receptors specifically 5-HT receptors.[75] Evidence of TENS in facial pain is well-documented and well understood by various authors.[75,76,77,78,79,80,81,82,83,84,85]

2. SCENAR (self-controlled electrical neuroadaptive regulator) on the other hand is a device allows you to generate electrical impulses of various amplitudes and frequencies, the shape of which is identical to the impulses generated by a nerve Fiber in response to its stimulation. This device is used in various branches of medicine to relieve pain symptoms, stimulate metabolic processes, accelerate the healing of various kinds of wounds, burns, and frostbites. In TMD, SCENAR is used for muscle relaxation of masticatory and cervical muscles in patients with TMJ dysfunctions and parafunctions of masticatory muscles.[86] The role of SCENAR on analgesia and reducing oxidative stress has been noted.[87,88] Reported evidence for use of SCENAR in orofacial pain has been recorded well in various publications.[89,90,91]

   Low-level laser therapy - Low level laser therapy (LLLT) is an option for the treatment of musculoskeletal disorders, it is easy application, limited treatment time and minimum contraindications, due to its analgesic, anti-inflammatory and regenerative effects.[92] For patients with all types of temporomandibular disorders (TMDs) (myogenous, arthrogenous, and mixed), the following lasers and parameters are recommended: diode or gallium–aluminum–arsenide (GaAlAs) laser, wavelength of 400–800 or 800–1500 nm, and a dosage <25 J/cm2. For patients with arthrogenous TMDs, the following lasers and parameters are recommended: Diode laser and a wavelength between 400 and 800 nm. For patients with myogenous TMDs, the following lasers and parameters are recommended: diode laser, wavelength between 800 and 1500 nm, and dosage of <25 J/cm2. For patients with mixed TMDs, the following lasers and parameters are recommended: diode, GaAlAs, or infrared laser, a wavelength of 800–1500 nm, a dosage >100 J/cm2, and an application time between 15 and 30 s or >60 seconds (98). Evidence for use of LLLT is well tested in clinical trials.[93,94,95,96,97]

4. Conclusion

The intricate nature of orofacial pain necessitates a comprehensive approach that acknowledges its multifaceted origins and subjective manifestations. Integrative pain management emerges as a promising framework, combining conventional medical treatments with complementary therapies to address the complex interplay of sensory, emotional, and psychosocial factors underlying chronic orofacial pain. From cognitive-behavioural therapy to physical modalities like yoga and massage, the evidence supports the efficacy of integrative approaches in improving pain relief, functional outcomes, and overall quality of life for affected individuals. By embracing this comprehensive perspective, clinicians can better meet the diverse needs of patients and enhance their well-being in the management of chronic orofacial pain.

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6. Conflict of Interest

None.

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