Original Article

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The dimension and severity of orofacial pain in patients with current and chronic odontogenic pain.

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Objective: The aim of this study was to evaluate the dimension and severity of orofacial pain in patients with current and chronic odontogenic pain.

Materials and Methods: 211 Outpatient Department (OPD) patients with a complaint of pain in the orofacial region were included in this study. The patients underwent clinical and radiographic examination to evaluate and diagnose the cause of their pain. The pain dimension and severity was evaluated using a questionnaire and posted to a data sheet for statistical analysis. The data was analyzed by GraphPad Prism 8. Statistical significance was determined by the Holm-Sidak method, with alpha = 0.05.

Results: A significant difference was found in the severity, affective dimension, and pain rating index total (PRI-T) between the current and chronic odontogenic pain groups (p = 0.0001, 0.005, 0.010 ; 95% CI level 0.810 - 2.449, 0.266 - 1.493, and 0.717 - 5.302 respectively).

Conclusion: Orofacial pain in patients with current and chronic odontogenic pain is a complex experience of a multidimensional nature that is always associated with emotional, cognitive, and psychological components.

Keywords: chronic pain, current pain, dimension, orofacial pain, odontogenic pain, severity

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Introduction:

Anticipation of aversive situations, such as pain, is beneficial for survival because it allows people to plan to avoid negative outcomes. The International Association for the Study of Pain (IASP) defines pain as an uncomfortable sensory and emotional experience associated with real or possible tissue damage or defined in terms of such damage [1, 2]. Pain is needed for survival to protect an individual from unfavourable potential consequences.

The orofacial area is widely innervated and has a disproportionately high sensorimotor representation in the central nervous system, as well as excellent sensory discrimination and sensitivity [3]. The orofacial area is a common site of pain, which can be current or chronic. Most sources of pain in the orofacial region are odontogenic [4]. Odontogenic pain is characterized as pain originating from the teeth and supporting tissue due to disease or injury to the teeth [5]. Untreated caries or damage to a tooth or teeth, as well as associated tissues, are common causes of chronic odontogenic pain (pulpal, periodontal,

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or gingival pain) which can impact daily routine activities. Odontogenic pain is a common problem and, depending on geographic location, may be highly prevalent [6]. Chronic pain is characterized as pain that lasts more than six months and is caused by nociception, the environment, and psychological factors [5]. In contrast, chronic pain is also characterized as constant or recurring pain that lasts more than three months [2]. This description offers a concise operationalization that covers many applicable requirements and commonly used parameters.

There are several major psychological dimensions of pain: sensory-discriminative, motivational-affective, and cognition-evaluative [7]. It has been hypothesized that these three dimensions interact with one another to provide perceptual information on the location, magnitude, and spatiotemporal properties of the noxious stimuli; motivational tendency toward escape or attack; and cognitive information based on experience and probable outcome of different response strategies [7].

The sensation of pain, by its inherent aversive nature, contributes to this function [8]. Current models of pain view it as a complex event. Therefore, pain is no longer considered a single entity. Rather, it involves many overlapping components [9]. Due to modulation and crossover in the central neural pathways, it may be difficult for a patient to describe their pain.

There are two relatively simple, patient self-reported, pencil and paper instruments that are available for dentists to use in a clinical setting, the Short-form of the McGill pain questionnaire (SF-MPQ) and visual analogue scale (VAS) [10]. Another pain assessment tool is Pain Assessment in Advanced Dementia (PAINAD) [11]. This scale is used in patients with advanced dementia who are cognitively disabled and may feel more or prolonged discomfort because of their condition's treatment. The Faces Pain Scale-Revised (FPS-R) is self-reported measure of pain intensity developed for children [12].

The IASP has announced a revised definition of pain [13]. The definition is “An unpleasant sensory and emotional experience associated with, or resembling that associated with actual or potential tissue damage,” and is expanded upon by the six key notes and the etymology of the word pain for further valuable context. This definition describes that pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors. It also mentioned that pain and nociception are different phenomena. Pain cannot be inferred solely from activity in sensory neurons. According to the revised pain definition, odontogenic pain is not solely from sensory neurons. There must be a psychological domain associated with comorbidities, such as anxiety and depression. Therefore, the aim of this study was to evaluate the dimension and severity of orofacial pain that is odontogenic in nature.

Materials and Method

This prospective observational study was approved by the IRB of the Chattagram International Medical College (IRB No. CIMC/IRB/24/17). 211 Outpatient Department (OPD) patients with a complaint of pain in the orofacial region were included in this study based on the inclusion and exclusion criteria. Patients who could answer the questionnaire and were diagnosed with pain caused by the teeth and surrounding structures were included in this study. If the pain arose from other structures, such as muscle, temporomandibular joint, or neurogenic causes the patients were excluded from the study. The condition of the teeth was evaluated by

clinical and radiographical examination. Prior to being examined, the patients completed an in-depth questionnaire concerning their facial pain characteristics and related co-morbidity. Current orofacial pain was defined as pain during the past month in the face, mouth or jaws that lasted for one day or longer. Chronic pain was defined as pain that began more than three months ago. This was measured by specific questions on whether the pain was unilateral or bilateral, localized or unlocalized. Pain Severity was measured using a VAS and was self-reported by the patients. The SF- MPQ was used to identify descriptions associated with pain. Co-morbidities were measured using Yes/No questions on facial trauma and teeth grinding. The questionnaire also included questions on bodily pain syndrome and fatigue, including chronic widespread pain, irritable bowel syndrome and chronic fatigue. Pain behaviour was assessed by the FPS-R and PAINAD [12, 13]. The data were collected using a questionnaire. The data used for analysis included only the subjects who had consulted for their pain. The data were analysed using multiple 't' tests in GraphPad Prism 8, and statistical significance was determined using the Holm-Sidak method, with alpha=0.05.

Results

Patient Characteristics

The odontogenic pain results indicated that 88.15% (n=186) of the patients had current odontogenic pain and 11.85% (n=25) had chronic odontogenic pain. 32.79% (n=61) males, and 67.21% (n=125) females were suffering from current odontogenic pain and 60% (n=15) males and 40% (n=10) females had chronic odontogenic pain (Table 1).

Co-morbidity and Prior dental treatment:

23.11% (n=43) patients had co-morbidity and 36.02% (n=67) had a history of previous dental treatment for their current odontogenic pain. 12% (n=3) patients had co-morbidity and 36% (n=9) had a history of previous dental treatment for chronic odontogenic pain (Table 2).

Odontogenic Pain Dimension and severity

The age of the patients with current odontogenic pain and chronic odontogenic pain was 37.12 ± 13.33 and 40.56 ± 15.06, respectively, which was not significantly different (p= 0.230; 95% CI -0.9125 - 2.240) (Table 3).

Table 1 Type of pain and number of patients in the study.

Number (Percentage)				
Odontogenic 211 (89.40%)	Current Odontogenic 186 (88.15%)		Chronic Odontogenic 25 (11.85%)	
	Male	Female	Male	Female
	61 (32.79%)	125 (67.21%)	15 (60%)	10 (40%)

Table 2 Co-morbidity and prior dental treatment for odontogenic pain.

Number (Percentage)				
Odontogenic 211 (89.40%)	Current Odontogenic 186 (88.15%)		Chronic Odontogenic 25 (11.85%)	
	Comorbidity	Prior Treat	Comorbidity	Prior Treat
	43 (23.11%	67 (36.02)	3 (12%)	9 (36%)

Table 3 Comparison of dimension and severity between the current and chronic odontogenic pain groups.

Duration of Pain (number)	Age (Mean±SD)	VAS (Mean±SD)	Sensory (Mean±SD)	Affective (Mean±SD)	PRI-T (Mean±SD)	PAINAD score (Mean±SD)	Facial Pain Score (Mean±SD)
Current odontogenic Pain (186)	37.12 ± 13.33	6.87 ± 1.91	9.66 ± 4.33	2.08 ± 1.50	12.85 ± 5.49	1.44 ± 1.47	1.65 ± 1.55
Chronic odontogenic Pain (25)	40.56 ± 15.06	5.24 ± 2.24	7.88 ± 4.16	1.20 ± 1.11	9.8 ± 5.22	0.88 ± 1.36	1.04 ± 1.30
p-value	0.230	0.0001*	0.053	0.005*	0.010*	0.072	0.061
95% CI level	-9.125 - 2.240	0.810 - 2.449	-0.030 - 3.590	0.266 - 1.493	0.717 - 5.302	-0.052 - 1.172	-0.029 - 1.247

* Significant differences were determined using the Holm-Sidak methods, with alpha = 0.05; VAS= Visual Analogue Scale; PRI-T= Pain rating Index Total.

The severity of pain (measured by VAS) in the current odontogenic pain group was 6.87 ± 1.91 and was 5.24 ± 2.24 in the chronic odontogenic pain group which were significantly different (p= 0.0001; 95% CI level 0.810 - 2.449).

The sensory, affective dimension of pain numeric value and Pain Rating Index- Total (PRI-T) was measured by the McGill scale. The PRI-T was measured from the sum of the sensory, affective dimension and present pain intensity (PPI) numeric value. The current odontogenic pain group demonstrated, a sensory value of 9.66 ± 4.33, affective value of 2.08 ± 1.5 and PRI-T of 12.85 ± 5.49. The chronic odontogenic pain group demonstrated, a sensory value of 7.88 ± 4.16 and affective value of 1.20 ± 1.11. The sensory dimension of pain was not significantly different between groups (p= 0.053; 95% CI level -0.030 - 3.590), however, the affective dimension of pain was significantly different (p= 0.005; 95% CI level 0.717- 5.302).

Odontogenic Pain Behaviour

Pain behaviour in the current odontogenic pain group on the PAINAD scale was 1.44 ± 1.47 and facial pain score was 1.65 ± 1.55. In the chronic odontogenic pain group, the PAINAD scale was 0.88 ± 1.36 and the facial pain score was 1.04 ± 1.3. The pain behaviour between the current and chronic odontogenic pain group was not significantly different based on the PAINAD scale (p= 0.061; 95% CI level -0.029 - 1.247) and Facial Pain Score (p= 0.061; 95% CI level -0.029 - 1.247) (Table 3).

Discussion

Pain is a multidimensional physical, cognitive, and behavioural experience. Pain may be a defensive mechanism (current pain) or a harmful mechanism in chronic pain. Current odontogenic pain can be easily managed depending on the underlying anatomical process, and the pain usually goes away when the problem heals or resolves [14]. In the present study, 88.15% (n=186) of the patients had current odontogenic pain and 11.85% (n=25) had chronic odontogenic pain.

67.21% (n=125) female patients reported suffering from current odontogenic pain and 40% (n=10) females experienced chronic odontogenic pain. In this study, although more female patients were suffering from current odontogenic pain, more male patients were suffering from chronic odontogenic pain. These findings are not surprising because a meta-analysis of studies with experimental noxious stimuli revealed that women tend to be more 'pain sensitive'; i.e, women respond more readily with pain from a stimuli that men may report as not painful, and women report more pain from stimuli that both sexes find painful [15]. In contrast, females typically act more positively towards oral health and routine health care services. [16, 17]. These findings likely explain why there more female patients in the current odontogenic pain group compared with males. Moreover, animal studies demonstrated that male mice use microglial-dependent pathways for pain processing, whereas female likely use adaptive T lymphocytes [18]. T cells possibly make female more susceptible to certain conditions due to being more reactive [18]. In contrast, microglia activation plays an important role in the pathogenesis of chronic pain, including chronic orofacial pain and contributes to the transition from acute to chronic pain [18].

Co-morbidity and Prior Dental Treatment

Comorbidity is defined as the presence of multiple disorders in the same person [19]. In the present study 23.11% (n=43) of the patients in the current odontogenic pain and 12% (n=3) in the chronic odontogenic pain groups had co-morbidity. The co-morbid relationship with pain, such as body pain, irritable bowel syndrome, fatigue, and chronic fatigue were documented in this study. It was unexpected to find the highest number of comorbidity patients in the current pain group than the chronic odontogenic pain group. High pain intensity and protracted pain duration enhance the chances of pain and comorbidity coexisting [20]. In contrast, higher pain intensity was reported to be associated with a higher number of comorbidities [20]. This difference may be related to pain duration, in that the pain did not long last enough to induce central sensitization [21]. In our study, the intensity was significantly higher in the current odontogenic pain group. Patients had a 1.045-fold higher likelihood of pain beyond the orofacial area and a 1.028-fold higher risk of comorbidity when their pain lasted one month [21]. In our study, patients with current odontogenic pain

for less than 3 months were included. Therefore, the intensity of pain and duration of pain more than 1 month in the current odontogenic pain group involved patients suffering from comorbidity. Consequently, more patients in the current odontogenic pain group had comorbidity and a history of previous dental treatment in this study.

Any type of tissue trauma may result in 'chronic pain', which is described as pain that lasts longer than the usual healing period [22]. Pain persisting in a body region after surgical treatment has been well documented and is associated with increased suffering, reduced quality of life and disability [23]. Dental treatment involves the distal aspect of the second and third branches of the trigeminal nerve innervating the teeth. It has been estimated that at least 5% of patients experience persistent tooth pain after root canal treatment (RCT) [23]. However, the persistent tooth pain after RCT may be related to the presence of endodontic lesions, infection, incomplete or complete root fracture or surgical complication [24, 25]. Predisposing factors that may result in the occurrence of chronic pain, such as the presence or level of presurgical pain and psychosocial factors, have been elucidated for other regions of the body following surgery [26]. In our study, 36.02% (n=67) patients in the current odontogenic pain group had a history of previous dental treatment. 36% (n=9) patients had a history of previous dental treatment for chronic odontogenic pain. Although chronic postsurgical pain may occur regardless of the procedure, certain procedures are riskier due to the extent of tissue damage and the possibility of a significant inflammatory reaction or nerve injury. People with a decreased capacity to cope with pain, predict pain, or control pain when it happens make up a vulnerable population. Anxiety, depression, hypervigilance, and catastrophizing are also risk factors for chronic pain [26, 27].

Odontogenic Pain Dimension and Severity

Pain is a multifaceted phenomenon with sensory-discriminative, affective-motivational, and cognitive components. In this study, current odontogenic pain was more severe than chronic odontogenic pain; patients in the two groups were significantly different from each other. Although the sensory dimension score in the current odontogenic pain group was higher compared with the chronic odontogenic pain group, the difference was not significant. The PRI-T was significantly higher in the current odontogenic pain group than the chronic odontogenic pain group. The sensory-discriminative dimension, often referred to simply as 'intensity' or given the level 'sensory', includes the spatial and temporal characteristics and quality of pain [28].

In this study, the affective dimension in the current odontogenic pain group was significantly higher compared with the chronic odontogenic pain group. The affective-motivational dimension, often referred to simply as 'unpleasantness' or given the level 'affective', captures how 'bad' or how 'unpleasant' the pain is. This dimension captures the motivational aspect of pain [28]. It is not uncommon to find an increasingly affective dimension in chronic non-odontogenic pain, such as TMD [21]. These co-occurrences can be best explained by 2 distinct factors, a more sensory and more affective one, which have a common genetically determined underlying factor and by influences specific to each phenotype [19]. It is common for a person's anxiety about personal issues and situation to manifest as increased fear and anxiety when presenting for dental treatment [29]. The moment-to-moment unpleasantness of pain is generated by emotional feeling that pertain to the present or short-term future, such as distress or fear, dental anxiety [30]. Psychological measures revealed the highest levels in the State Trait Anxiety Inventory, Dental Anxiety Scale, and

attitude differences in an outpatient dental emergency clinic [31]. Beta endorphin-like (B-END) immunoreactivity was significantly increased in plasma cells and related to higher levels of pain intensity [31]. Beta endorphin release suggested that there is a relationship between pituitary B-END release and the perception of pain [31]. The results of the present study indicated that the intensity was significantly higher in the current odontogenic pain group compared with the chronic odontogenic pain group. Moreover, a cognitive manipulation to increase the affective dimension of pain i.e. to make it more painful, but not more 'intense' resulted in increased anterior cingulate cortex (ACC) activation; a cognitive manipulation to decrease the affective dimension to make it less unpleasant but not less intense resulted in decreased ACC activation [23]. The cortical activity patterns associated with the sensory and affective dimensions of pain have been separated through cognitive manipulation during brain imaging [23]. According to a previous study, the ACC is involved in the subjective aspect of unpleasant pain in particular [32]. Most evidence suggests that somatosensory cortices (S1) are more important for the perception of sensory location whereas the limbic and paralimbic regions are more important for the emotional and motivational aspect of pain [23]. Pain-related activity within S1 was larger in response to hypnotic suggestion for increased pain intensity [23]. Pain-related activity was evident in the ACC during pain increased and decreased intensity [32]. The significant correlation found between ACC activity and subject rating of unpleasantness strongly implicate the involvement of this region in the affective dimension of the pain experience [31]. The ACC is more related to affective than to sensory components of the pain experience [23]. Interesting, the difference between the sensory dimension in the current and chronic odontogenic pain groups was significant. People who consider their pain to be a greater threat to their health rated the pain unpleasantness higher compared with those who considered their pain to be a lower threat to their health [33]. This result suggested that current odontogenic pain was more unpleasant, and the ACC was activated.

The present study used the SF-MPQ to determine the dimension of orofacial pain. The SF-MPQ has 4 major objectives in assessing pain; 1) to diagnose pain intensity, pain quality, and duration, 2) to aid in diagnosis, 3) to help decide the choice of therapy, and 4) to evaluate the relative effectiveness of therapy. The SF-MPQ meets these objectives to some extent [10]. The SF-MPQ was developed for use in specific research settings when the time to obtain information from the patient is limited and when more information is desired than that provided by intensity measures such as the VAS or present pain intensity [10]. Due to patient load levels, Out-Patient Departments need to be able to evaluate a patient quickly. Therefore, the SF- MPQ scale was used in this study. Furthermore, the SF-MPQ contains 15 representative words from the standard long form's sensory (n=11) and emotional (n=4) categories. The present pain intensity and visual analogue scale are included to provide indices of overall pain intensity that is present as PRI-T.

Behaviour and Facial Coding of Severity of Orofacial Pain

The expression of pain on the face has sparked extensive interest in both experimental and clinical research. We used the PAINAD and facial pain scale to evaluate the pain behaviour and the facial encoding of orofacial pain. As already mentioned, pain is a multidimensional experience involving sensory, affective, and

cognitive dimensions. The sensory and affective dimensions are inextricably linked, with self-ratings of pain intensity and unpleasantness frequently highly connected [7]. A previous study reported that the facial expression of pain is a multidimensional response system that differentially encodes the sensory (mostly encoded by contractions of the muscles surrounding the eyes) and affective (mostly encoded by upper lip raise and wrinkles on top of the nose as well as contraction of the eyebrows) aspects of pain [34]. Because various forms of clinical pain differ in both sensory and affective dimensions, this differential facial encoding of both sensory and affective attributes may be developed to ensure that the unique characteristics of one's pain experience are conveyed facially [35]. In the present study, the affective dimension was more closely linked to PAINAD and FPS. Because facial expressions are often connected with a person's emotions, facial responses accompanying pain might be anticipated to be more closely associated with the affective dimension of pain [34]. The results of the present study indicated that the PAINAD score, and Facial Pain Score were higher in the current odontogenic pain group compared with the chronic odontogenic pain group. The occurrence of facial pain displays was associated with activity in brain areas involved in processing affective qualities of pain in the ACC and in areas processing sensory qualities e.g. the primary somatosensory cortex (S1) of pain [36]. The sensory and affective dimensions in the current odontogenic pain group were higher compared with the chronic odontogenic pain group. The novelty of the present study is that facial expressions accompanying pain encode both dimensions. This finding might be crucial to ensure multidimensional management of orofacial pain and social support from others.

Conclusion

Odontogenic pain (current or chronic) is a complex experience of a multidimensional nature, which is always subjective, always associated with emotional and cognitive factors, and always a psychological state. Psychological approaches for odontogenic pain include a wide range of methods from simply informing patients about their condition to comprehensive counselling. The cognitive aspect should also be addressed, especially in the treatment of pain.

Limitation of the study

The number of patients in our study was insufficient. In the chronic odontogenic pain group, more patients were required. The patients in this study were self-reported and outdoor based. Thus, they required sufficient time and a consistent atmosphere. This is something that this research centre could not provide.

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