

## **Differential diagnosis Toothache or non-dental orofacial pain?**

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### **Abstract (125 words)**

Toothache is the most common orofacial pain and can present in varied ways including; mechanical and thermal allodynia and/or episodic throbbing intense pain both of which can mimic and/or precipitate primary headache disorders, and many other non-dental inflammatory or heterotopic pain conditions that can also mimic or aggravate toothache conditions.<sup>1</sup> It is reported that 12.2% American Adults experienced dental pain over the last 6 months.<sup>2</sup> Toothache was the primary complaint in 2.95 million adults and children presenting at US Accident and emergency departments from 1997 to 2000.<sup>2</sup>

Due to siloed professional training practitioners have no experience or knowledge of each other specialisms.<sup>3</sup> As a consequence many patients are mis-diagnosed and/or mis-managed leading to high volumes of litigation against dentists in the US and UK.

### **Introduction**

Differentiating odontogenic from non-odontogenic pain can be particularly challenging. (TR Headache). Healthy nociceptive and inflammatory pain are the common presentations to dentists however neuropathic and noci-plastic pain is a more common presentation to headache neurologists.<sup>3</sup>

Toothache and dental pain present in variable ways (**Figure 1**) The elicited and/or spontaneous allodynia can mimic Trigeminal neuralgia, post traumatic painful neuropathy, primary

headaches for example cluster headaches, SUNCT and SUNHA and other secondary neuropathies. The dull episodic intense spontaneous or elicited throbbing pain of irreversible pulpitis and periapical periodontitis can mimic myofascial pain, temporomandibular disorders, myofascial pain and migraine. It is also acknowledged that acute pain conditions and neuropathic pain may induce recurrence or re-emergence of existing chronic headaches.<sup>4</sup>

Many Orofacial pain classifications including International headache society (IHS),<sup>5</sup>international craniofacial disorders classification (ICHD 3),<sup>6</sup>American Association of Orofacial Pain (AAOP),<sup>7</sup>American Association of Craniofacial pain (AACCP)<sup>8</sup>and the International Association for the Study of Pain (IASP),<sup>9</sup> have to date solely addressed chronic pain. The International classification of orofacial pain (ICOP) endorsed by ICHD, IASP, IADR, IHS and AAOP was published in 2020, which includes for the first time, acute and chronic orofacial pain conditions are set out in one classification.<sup>10</sup>

This paper attempts to highlight how toothache and other non-dental orofacial pain presentation may mislead dentists, surgeons and headache specialists, excluding neuropathic orofacial pain conditions which are addressed in a separate paper in this series.

### **How can neurovascular pain mimic toothache or vice versa?**

#### ***Primary headaches***

Primary headaches include: Tensions Type Headache, Migraine (with or without aura, chronic or episodic), Trigeminal autonomic cephalalgias (TACS /cluster) and sinister headaches (resultant from neoplasia, heamorrhage or stroke). Pain distribution is specific for headaches (Figure 2). Episodic throbbing pain unilateral pain are a feature of both migraines and or TACs, thus mimicking dental pain leading to inappropriate antibiotic prescriptions and dental or surgical treatment. Conversely toothache (Figure 1) may mimic migraine, Trigeminal autonomic cephalalgia (TACs) and other neuralgias due to cracked tooth syndrome.<sup>16</sup> A table

summarising differential diagnoses is available in a previous publication.<sup>1</sup> A key differential feature distinguishing migraines and TACs from toothache is expression of autonomic and migrainous signs (Table 1). *Migraines*

Migraine headache are considered by non-headache specialists to solely affect the ophthalmic division of the trigeminal nerve (V1) including temporal, supraorbital, frontal, retrobulbar and C2C3 sites including parietal, auricular and occipital.<sup>11</sup> Patients meeting the the International Headache Society (IHS) criteria for migraine presenting with isolated V2 and/or V3 trigeminal intra and/or extras oral facial pain is considered rare but it is sometimes reported.<sup>12,13</sup> There are several reports of migraines resulting in dental pain mistakenly treated with dental restorations, root canal treatments and resultant extractions which unsurprisingly do not in pain resolution in two cases,<sup>13</sup> and seven cases.<sup>14</sup> This is unsurprising as dentists and ENT specialists have limited diagnostic skills in headache disorders phenotyping.

In addition, primary headaches can be initiated by surgical intervention,<sup>4,15,16</sup> this ‘remapped migraine’ pain may also have associated autonomic symptoms (such as vomiting, phonophobia, nausea and photophobia). This sensitisation may also initiate expression of the migraine symptoms in trigeminal sensitised areas in those subjects with a pre-existing migraine biology (personal and/or family history of migraine). This is reported in 47% of the patients present with V2 and or V3 migraine reported the onset of facial pain in temporal relationship with a cranio-facial procedure or dental treatments over the migraine affected areas.<sup>13</sup>

Due to the lack of taking as simple pain history, by non-headache neurologists, that includes migrainoid or autonomic associated signs or past history of headaches, these patients are exposed to continued inappropriate surgical invasive procedures and medication.

### ***Trigeminal autonomic cephalalgias (TACs)***

TACs present with severe intense episodic multiple unilateral neuralgic stabbing pains (suicidal pain), mainly in the V2 (maxillary region), peri retro-ocular region (V1), with associated autonomic signs including ptosis, meiosis, conjunctival irritation, unilateral nasal congestion with cheek flushing on the side of pain (Figure 2). The pain is severe and has a number of presentations such as burning, tightening or throbbing with sharp shooting neuralgic attacks and the pain experienced by patients is often described as the worst pain they have ever experienced, and cluster headaches have been termed ‘suicidal headaches’ as patients have been known to develop suicidal thoughts.

The prevalence in males over 50 is increased.<sup>17</sup> The areas of orofacial region most commonly affected by TAC neurovascular pain mimicking toothache include the Premaxilla (30%), V2 (17%), V3 (31%) with an age of onset 21 years to 51 years, with a pain duration 9-16 hours and mainly affecting male patients.<sup>17</sup>

Patients with TACs will often consult dentists (34-45%), ENT consultants (27-33%) with an average 4.3 physicians consulted prior to diagnosis with 4% of patients undergoing sinus surgery. 15% of Paroxysmal Hemicrania patients have pain similar to dental pain.<sup>18</sup> A recent paper highlighted the prevalence of TACs presenting to a chronic orofacial pain service,<sup>19</sup> which is likely to be underestimated in most centres.<sup>20</sup>

It is likely that many patients may be wrongly diagnosed with persistent idiopathic facial pain rather than migraine and or TACs. This is likely due to the episodic nature providing a false positive response to treatment. It is essential that practitioners enquire about associated migrainous and autonomic signs during the intense pain attacks to ensure a correct diagnosis is made.<sup>1</sup>

Sinister headaches

Recent onset of a headache or sudden worsening of headache in a middle-aged patient is rare. If it is associated with sensory or motor neuropathy, nausea, loss of consciousness or other aberrant signs immediate referral to the patients' general medical practitioner or advice to attend A&E is advised, as exclusion of ischaemic or haemorrhagic stroke and or neoplasia must be undertaken urgently. Exclusion of a recent history of head injury must be excluded and any patient with co morbid poorly controlled or undiagnosed Hypertension may indicate a potential stroke risk.

### **Non dental inflammatory pain mimicking headache or vice versa?**

***Sinusitis*** Rhinosinusitis is a condition of inflammation of the nose and paranasal sinuses. Chronic Rhinosinusitis (CRS), symptoms last more than 12 weeks without complete resolution which may be caused by dental pathology.<sup>21</sup> Odontogenic sinusitis, where a dental origin is identified clinically, radiologically, or suggested by anaerobic predominance on culture, may present as an acute or chronic picture. It is estimated that 10% of all sinusitis cases have an odontogenic cause, and up to 40% of recalcitrant maxillary sinusitis cases,<sup>22</sup> and increasing, likely due to dental implantation.<sup>23</sup>

In addition the Sinus Allergy and Migraine study (SAMS) highlighted the diagnostic difficulty with the majority of patients who meeting the IHS criteria for migraines, 84% of patients reported sinus pressure, 82% reported pain in the sinus areas, 63% reported nasal congestion, and 40% reported rhinorrhea at the time of their initial consultation.<sup>24</sup> In another cross sectional study up to 88% of people who self-report or have physician diagnosed sinusitis actually have V2 migraine.<sup>25</sup>

***Salivary gland disease*** Sialadenitis may cause pain overlying the parotid, submandibular or sublingual regions with radiation causing lower facial pain.. Obstructive salivary gland disease

can present as episodic high intensity (neuralgic) pain, particularly on salivation and may respond to antibiotics.

***Temporal arteritis*** Should be suspected in patients over 50 years, presenting with sudden onset persistent headache centred on one or both temples precipitated by cold and accompanied with visual acuity changes or intermittent jaw claudication during attacks. Pain related to giant cell arteritis is generally distributed in the V1 distribution but can radiate to V2 and 3. The temporal artery affected may be prominent and tender to palpation. Erythrocyte sedimentation rate and/or C-reactive protein will be significantly elevated in these patients. Urgent referral of the patient is required for assessment and steroid medication to prevent blindness.

#### **How can referred (heterotrophic) pain mimic toothache or vice versa?**

***Cervicogenic pain*** There is significant neuronal interplay between the trigeminal system and the great and lesser occipital complex which may also complicate pain presentation.<sup>26</sup> Cervical spine or muscular problems can cause headaches (ICHD classification of cervicogenic headache), and the pain usually presents within the trigeminal and upper cervical (C2, C3) dermatomes. C2-3 provide general sensation over the skin at the angle of the mandible.<sup>27</sup>

***Cardiac heterotrophic pain*** ‘Mandibular ‘Toothache pain’ of angina origin has been frequently reported, and can be bilateral, though mainly reported on the left side.<sup>28</sup> This heterotopic pain, usually transferred via the first five thoracic roots, causing pain in the chest and arms, may cause pain in the face and jaw caused by the parasympathetic system, via the trigeminal nucleus.<sup>28</sup>

Referral to the patient’s medical practitioner is recommended if suspected

***Oropharyngeal carcinoma*** referred pain presenting as toothache in posterior mandible is reported. Oropharyngeal cancer being one of three cancers increasing in prevalence (along with melanoma and hepatocellular cancer) and association with HPV.<sup>29</sup> Oropharyngeal cancer

presenting as pain mimicking rare orofacial pain conditions, for example glossopharyngeal neuralgia, preauricular pain and jaw pain. Pain is reported to be the initial symptom of oral cancer in 19.2% 1412 patients. Missing a cancer diagnosis is not only a serious event and also results in complaints and fitness to practice for those dentists involved.

If the patient presents with recent onset pain symptoms, with sensory or motor neuropathy, neoplasia it must be first excluded before continuing with treatment.

### **How can temporomandibular disorders (TMDs) mimic toothache pain or vice versa?**

TMDs can be subcategorised into three broad groups, arthritis, dysfunction (clicking, locking) and arthromyalgia (including arthralgia, myogenic, temporalis tendinitis and myofascial pain). The most common chronic orofacial pain conditions presenting in the orofacial region are Temporomandibular myogenic disorders often present comorbidly with headaches.<sup>30</sup> Both of these conditions can refer pain to the second (maxillary or V2) and third division (mandibular or V3) of the trigeminal nerve mimicking toothache, emphasising the importance for dental practitioners to understand the possibility of TMD myofascial pain mimicking posterior maxillary and mandibular molar pain. In addition, the C2-3 dermatome representation continues superiorly behind and above the ear further confusing a diagnosis of TMD. TMD is associated with comorbid pain conditions particularly headaches and cervical pain.<sup>30</sup>

Interestingly there is increasing evidence that TMD, particularly the myogenous, myofascial and arthromyalgic presentations may be part of migraine presentation and possible share pathophysiology.<sup>31</sup>

### **How can idiopathic pain mimic toothache or vice versa?**

***Persistent Dentoalveolar Pain (PDAP)*** PDAP is a chronic disorder with persistent daily gingival or dental pain (> two hours per day over more than three months), without clinical neurological deficit. Many terms have previously been used for secondary and primary neuropathic gingival and tooth pain (atypical odontalgia, phantom tooth pain, idiopathic toothache or nonodontogenic tooth pain). The majority of these cases are likely to be painful posttraumatic trigeminal neuropathy (PTTN) if associated with previous interventions. However, primary dental neuropathic pain may precede TN as 'Pre-Tic' and must be differentiated from routine toothache in order to prevent unnecessary treatment.

***Chronic widespread pain CWP*** Co-existent migraine, TMDs, idiopathic pain conditions characterise CWP and Fibromyalgic presentation which may indicate a predetermined susceptibility and or psychosocial factors in development of CWP and or FM which must be borne in mind when assessing and managing these patients.

**Conclusion** Many patients present to chronic orofacial pain services with undiagnosed primary headaches treated as dental pain and conversely dental pain treated as other neuropathic conditions. The complexity of the anatomy, neurobiological importance of the orofacial region, and the variable presentation of toothache, make potential pitfalls of diagnosis inevitable. These issues are compounded by the siloed training of clinicians providing often conflicting advice, or worse undertaking unnecessary surgery, given to patients on their desperate journey to seek out a clear diagnosis and effective treatment for their OFP pain. Multidisciplinary care is essential for this patient group. By using a holistic approach (Axis I and Axis II assessment) with good history and focussed investigations when indicated, a suitable diagnosis will be reached. There are clear treatment guidelines for many of the OFP conditions described, however, these are not personalised and the variable response may be due to the multiple



components of pain. There is a need for conjoint education in orofacial pain to prevent further patient harm. (word count 3005)

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