

Headache in Children and Adolescents

Andres Pinto, DMD, MPH; Maria Arava-Parastatidis, DDS, MS;
Ramesh Balasubramaniam, BDS, MS

Contact Author

Dr. Pinto
Email: apinto@dental.upenn.edu



ABSTRACT

The broad field of orofacial pain encompasses pain conditions affecting the head, face, neck and intraoral structures. Much has been written about headache specifically affecting adults, but little is known about the presentation of this problem in children. Dentists may be asked to participate in the differential diagnosis or management of headache in young patients. For their benefit, this article discusses the epidemiology, clinical presentation, diagnosis and treatment of headache in this population. An accurate history and careful examination can allow early diagnosis and the avoidance of unnecessary or inappropriate dental procedures.

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Pain is defined as an “unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.”¹ Headaches are associated with pain of various degrees and duration. This article discusses headaches in children and adolescents, with a focus on primary headaches, such as migraine, tension-type headache and cluster headache, and headaches secondary to an underlying condition. Emphasis is placed on the dental implications of these entities, as young patients who experience neurovascular pain may receive a misdiagnosis of toothache or other facial pain.²

Primary Headaches

Migraine

Epidemiology

Migraine is common among children and adolescents. Its documented prevalence ranges from 0.5% to 13.6% and increases with age.³⁻⁸ Migraine may be associated with other conditions. For example, one study reported a 50%

prevalence of migraine in 9- to 17-year-old patients with sickle cell disease.⁹ Factors related to the underlying disease, such as bony infarctions, anemia and the frequent use of opioid medications, were suggested as possible causes for this relatively high prevalence.¹⁰ Migraine is especially frequent among boys 3 to 7 years of age.^{5,11} The sex distribution is about equal between the ages of 7 and 11, and during puberty the balance shifts to a 3:1 ratio between females and males,^{5,11} which extends into adulthood. The 2 most common types of migraine experienced by children are migraine without aura and migraine with aura. Childhood periodic syndromes (cyclical vomiting, abdominal migraine and benign paroxysmal vertigo of childhood) are common precursors of migraine and occur exclusively in the pediatric population.

Clinical Presentation

Migraine without aura, previously known as common migraine, is the most frequent type of migraine, accounting for 60%–80% of all migrainous headaches.¹² Children

Table 1 Diagnostic criteria for migraine in children and adolescents¹⁴

Migraine without aura
A. At least 5 attacks fulfilling criteria B to D
B. Headache lasting 1 to 72 h
C. Headache having at least 2 of the following: <ol style="list-style-type: none"> 1. Bilateral location in young children, but may be unilateral in older children 2. Pulsating quality 3. Moderate or severe intensity of pain 4. Aggravation by or causing avoidance of routine physical activity
D. During the headache at least 1 of the following: <ol style="list-style-type: none"> 1. Nausea or vomiting 2. Photophobia and phonophobia, which may be inferred from behaviour
E. Not attributed to another disorder
Migraine with aura
A. At least 2 attacks fulfilling criteria B to D
B. Aura consisting of at least 1 of the following, but no motor weakness: <ol style="list-style-type: none"> 1. Fully reversible visual symptoms including positive features or negative features (flickering lights, spots or lines) 2. Fully reversible sensory symptoms including positive features (pins and needles) or negative features (numbness) 3. Fully reversible dysphasic speech disturbances
C. At least 2 of the following: <ol style="list-style-type: none"> 1. Homonymous visual symptoms or unilateral sensory symptoms 2. At least one aura symptom developing gradually over 5 minutes or different aura symptoms occurring in succession over 5 minutes 3. Each symptom lasting > 5 minutes and < 60 minutes
D. Not attributed to another disorder

experiencing migraine without aura often have prodromal symptoms such as changes in behaviour (e.g., irritability or decrease in energy) and appearance (e.g., pallor, pigmented macules in the infraorbital region or “dark rings under the eyes”).⁵

Migraine with aura is characterized by the occurrence of one or more fully reversible auras before the onset of the headache. The child may complain of visual disturbances (visual auras) and hallucinations.¹³ Somatosensory aura, though uncommon, consists of perioral paresthesias and/or numbness and tingling of the hands or feet (or both). The International Classification of Headache Disorders diagnostic criteria for migraine are shown in **Table 1**.

Box 1 Questions used in obtaining history of headache

1. Can you describe a typical episode of headache (location, frequency, quality, severity, duration, symptoms)?
2. When did it start? Did it start suddenly?
3. Do you experience symptoms such as visual disturbances (visual aura) or numbness or tingling, or both (somatosensory aura)?
4. What makes the pain worse (precipitating factors)?
5. What makes the pain better? Do medications help?
6. What medications have you used in the past? Did they offer any relief?
7. Does the headache occur at any particular time of the day?
8. Does the pain interfere with your daily activities?
9. Is there a family history of headaches?
10. How is your relationship with your parents, siblings, teachers and classmates?

The International Classification of Headache Disorders diagnostic criteria for migraine are shown in **Table 1**.

Diagnosis

The diagnosis of migraine is based on a thorough history and detailed clinical and neurologic examinations. The dentist has the fundamental knowledge to perform these procedures and to determine if the facial pain that a child is experiencing corresponds to a migraine or if it has a probable oral component. Taking a pain history for a young patient may be challenging; nevertheless, posing appropriate questions (**Box 1**) usually elicits the necessary information.^{5,11,13}

The clinical examination should include blood pressure assessment (to exclude hypertension), evaluation of body temperature (to screen for infection) and measurement of head circumference (to exclude elevation in intracranial pressure resulting from the premature fusion of cranial sutures).¹⁵ The teeth, ears and sinuses should be examined to rule out possible sources of infection. The neurologic examination should include assessment of mental status, consciousness, orientation and behaviour; a visual examination (to check for blurred or double vision); an evaluation of the cranial nerves and of motor

Table 2 Symptomatic treatment of pediatric migraine

Drug	Dose	Maximum dose	Adverse effects (caution)
Analgesics			
Acetaminophen	20 mg/kg PO followed by 10–15 mg/kg every 4 h	75 mg/kg per day	Hepatotoxicity Nephropathy Hemolytic anemia Thrombocytopenia
Ibuprofen	10 mg/kg PO every 4–6 h Age > 12 yr: 200–400 mg PO every 12 h	50 mg/kg per day	Nausea or vomiting Abdominal pain Anorexia Diarrhea
Naproxen	2.5–5 mg/kg every 12 h	750 mg/day	Nausea or vomiting Abdominal pain Anorexia Diarrhea
Antiemetics			
Promethazine	Age > 2 yr: 1 mg/kg; can be repeated at doses of 0.25–1 mg/kg every 4–6 h	Age > 2 yr: 25 mg/dose Adolescents: 50 mg/dose	Drowsiness Confusion Depression Extrapyramidal symptoms
Metoclopramide	0.1–0.2 mg/kg	Children: 0.4–0.8 mg/kg per day Adolescents: 40 mg/day	Drowsiness Fatigue Nausea or diarrhea

coordination and force in the lower and upper extremities; and an assessment of posture and gait.

For most patients with chronic or recurrent headache who have normal results on a neurologic examination, no further diagnostic tests are required. However, abnormalities discovered during the examination justify referral to the appropriate medical professional for further diagnostic testing. Abnormal findings might include persistent and severe vomiting; changes in behaviour, orientation and mental status; headache that worsens with coughing, sneezing or lying flat; headache that worsens at night or immediately after waking; changes to a previous headache pattern; and sudden onset of extremely severe headache.^{5,16}

Treatment

Once the diagnosis of migraine has been established, the next step is to institute an individualized treatment plan, incorporating both nonpharmacologic and pharmacologic therapies.

Most parents of children who present with symptoms of migraine have an underlying fear that the condition is due to an organic cause such as tumour or intracranial infection. Therefore, reassurance as to the benign nature of the headache is perhaps the most important aspect of treatment. Identification of potential triggers and their avoidance may play a role in preventing mi-

graines. Migraine triggers include alterations in sleep patterns (prolonged sleep or lack of sleep); exposure to bright or flickering lights or to particular odours; and ingestion of particular foods, such as chocolate, cheese, citrus fruits, caffeine-containing beverages, hot dogs and sausages.^{13,17,18} Although it is widely held that stress precipitates migraine attacks, this relationship remains unproven.¹⁷ Nevertheless, stress management strategies are used to modify the negative behaviours that may increase the risk of migraine. Biofeedback and relaxation therapies are additional nonpharmacologic approaches that may be effective.¹⁷

Symptomatic treatment is administered to alleviate pain and relieve symptoms (Table 2). Although the triptans have been confirmed as effective and safe for the treatment of adult migraine, the U.S. Food and Drug Administration has not approved their use in children. Nonetheless, preliminary data suggest that the nasal spray sumatriptan is more effective than placebo in both children and adolescents.^{19,20} Placebo-controlled studies have shown significant improvement in migraine pain after the administration of sumatriptan, and the use of rescue medications such as acetaminophen was significantly greater in the placebo group.^{19,20} Unfortunately, side effects occurred significantly more often among patients who received sumatriptan by nasal spray than among those who received placebo; however, these side effects

were mostly minor, including taste disturbances, nausea, vomiting, “triptan sensation” such as warmth or burning sensation, paresthesia, lightheadedness and stiffness of the jaw.²⁰ No difference has been observed between oral triptans (sumatriptan, rizatriptan) and placebo in terms of clinical improvement of migraine.^{19–21} Administration of medication at the onset of an attack is key for pharmacologic efficacy (**Table 2**). Abuse of analgesics should be discouraged, as it increases the risk of medication-overuse headache (formerly known as “rebound headache”), a daily headache related to the frequent use (more than 5 times per week) of analgesics.¹¹

Preventive measures are an option in cases of frequent migraine that interferes with the patient’s daily activities, if the child experiences severe and prolonged attacks, for uncommon types of migraine and if the treatment of acute episodes is ineffective or has severe side effects.^{5,22} A plethora of agents, such as antihypertensives, antiepileptics and antidepressants, have been suggested.^{11,13,16} A more detailed description of these drugs is beyond the scope of this paper.

Tension-Type Headache

Epidemiology

The prevalence of tension-type headache ranges from 0.5% to 72.8%.^{4,6,7–9,23} The wide range in reported prevalence is due to variations in inclusion criteria and in the methods used to collect data and variations in the accuracy of responses of children and their parents during medical history-taking. Tension-type headache is more common among adolescents than among children⁶ and affects both sexes equally until the age of 11 or 12. Among adolescents, the condition is more common among females.

Clinical Presentation

Children and adolescents with tension-type headache report symptoms similar to those of migraine (**Table 3**). Many precipitating factors for tension-type headache have been identified, including emotional stress, problems with peers or a negative family environment, fatigue, sleep deprivation and missed meals.²⁴

Diagnosis

The diagnosis of tension-type headache is based on a detailed history (**Box 1**) and meticulous clinical and neurologic examinations. For patients with abnormal findings on examination, additional testing may be required to rule out secondary or organic headaches. In some children, it may be difficult to distinguish between tension-type headache and migraine without aura. In this situation, the “non-migraine” features of the tension-type headache — the quality (pressing but not pulsating) and the intensity (mild or moderate but not severe) of the pain, and the lack of nausea, vomiting, photophobia and

Table 3 Diagnostic criteria for chronic tension-type headache¹³

A. Headache occurring on at least 15 days per month for at least 3 months (and at least 180 days per year) and fulfilling criteria B to D
B. Headache lasting for hours
C. Headache with at least 2 of the following characteristics: <ol style="list-style-type: none"> 1. bilateral location 2. pressing or tightening (not pulsating) quality 3. mild or moderate intensity 4. not aggravated by routine physical activity (walking, climbing stairs)
D. Both of the following: <ol style="list-style-type: none"> 1. no more than 1 of photophobia, phonophobia or mild nausea 2. neither moderate or severe nausea nor vomiting
E. Not attributed to any other disorder
F. Pericranial tenderness on bimanual palpation may be increased

phonophobia, in addition to the fact that the pain is not aggravated by physical activity — help the clinician to reach the correct diagnosis.

Treatment

As is the case with migraine therapy, effective treatment of tension-type headache must balance both behavioural interventions and pharmacotherapy. Nonpharmacologic treatment begins with reassurance and explanation of the nature of the headache. Since stress is considered a major precipitating factor, steps should be taken to recognize and avoid any stress-provoking situations. Sometimes the source of anxiety is easily identified. For example, the pediatric patient may describe the onset of headache on school days, particularly during examination periods, and an absence of headaches during vacation times.

For treatment of acute headache episodes, an analgesic such as acetaminophen, ibuprofen and naproxen is often all that is required. Acetylsalicylic acid must be avoided, especially for children with signs and symptoms of infection (e.g., varicella, influenza), as there is a risk, albeit still disputed, of Reye’s syndrome.²⁵ This rare, serious disorder typically begins as a viral infection, most often influenza or chicken pox. The recovery period, which lasts 1–3 days, is followed by repeated vomiting and subsequent symptoms of encephalopathy. Left undiagnosed, the condition progresses to lethargy, confusion and delirium, leading to coma, seizures and death.

Prophylactic treatment is instituted for tension-type headache that is unresponsive to medication administered during acute episodes. A neurologist is the most

Box 2 Causes of secondary headache in children and adolescents

- Head and neck trauma
- Epidural hematoma (due to trauma)
- Subdural hematoma (due to trauma)
- Bacterial meningitis
- Viral meningoencephalitis
- Brain abscess
- Intracranial neoplasms
- Idiopathic intracranial hypertension (pseudotumour cerebri)
- Postlumbar puncture headache
- Epilepsy
- Sinusitis
- Otitis media
- Refractory errors (myopia, hyperopia, astigmatism)
- Substance exposure (nitric oxide, carbon monoxide, food components, alcohol, cocaine, cannabis, medications)
- Substance withdrawal (caffeine, opioids, estrogen)
- Hypertension
- Hypothyroidism
- Hypoglycemia
- Sleep apnea
- Fasting
- Chiari malformation type I
- Stroke
- Arteriovenous malformation

appropriate health care professional to prescribe this kind of treatment.

Cluster Headache

Cluster headache is rare in children, with an estimated prevalence of 0.1%.²³ This condition tends to occur after the age of 10, although cases of earlier onset have been reported,²⁶ and is more frequent among males. Cluster headache is characterized by clusters of severe pain lasting 15 minutes to 3 hours. The pain is unilateral, limited to the orbital, supraorbital or temporal regions, and accompanied by ipsilateral autonomic features such as conjunctival injection, rhinorrhea, eyelid edema, forehead and facial sweating, restlessness and agitation.²⁷

Neither symptomatic nor prophylactic treatments have been well documented for children and adolescents.

Secondary or Organic Headache

Secondary headaches are headaches attributable to an underlying abnormality (**Box 2**).^{4,14,27} Therefore, the clinician should consider the likelihood of a primary disorder during the evaluation of any pediatric patient complaining of headache. Failure to accurately identify and treat a primary disorder is associated with a high mortality rate.

Obtaining a detailed history is the first step in ruling out an underlying disorder in the differential diagnosis of headache. Reports of persistent vomiting, previous trauma, especially in the region of the head and neck, aggravation of the headache by activities such as coughing or sneezing, and deterioration of pain at night or after waking should arouse suspicion. The clinical and neurologic examinations provide further information. Elevated blood pressure implies pediatric hypertension,²⁸ whereas fever can be a symptom of intracranial infection, such as bacterial meningitis, viral meningoencephalitis and brain abscess, or extracranial infection, including sinusitis and otitis media. Observation of the skin for scars or bruises may provide clues of previous head and neck trauma. The neurologic examination should begin as soon as the child enters the practice location. Interactions with the parents, the child's ability to play with toys or draw pictures while waiting, and the child's play behaviour can all provide information about level of consciousness, orientation and mental status. If the evaluation of a young patient complaining of headache raises the suspicion of an underlying disorder, the patient must be referred immediately to the appropriate medical specialist.

Dental Considerations of Neurovascular Headaches

Patients with pain in the distribution of both the first and the second branches of the trigeminal nerve, with or without accompanying pain in the third branch, and who report nausea, photophobia and/or phonophobia often receive a diagnosis of migraine. Conversely, for those with pain restricted to the distribution of maxillary and/or mandibular nerve the correct diagnosis of migraine is often overlooked.^{3,29} Some reports have described cases of migraine confined to the distribution of the maxillary and mandibular branches of the fifth cranial nerve, so-called "facial migraine."²

Although cluster headache is usually limited to the orbital, supraorbital or temporal regions, it may also present as pain affecting the dental structures or the temporomandibular joint. Patients with this type of headache may visit the dentist, believing that the pain is of dental origin, and may undergo unnecessary treatment such as extractions or root canal therapies. The

diagnostic features of cluster headache (Table 3) should always be kept in mind in cases of pain in the teeth or the temporomandibular joint when there is no evidence of dental pathology or temporomandibular disorders.

The lack of reports of neurovascular headaches affecting oral and dental structures in the pediatric population does not entail the nonexistence of this phenomenon in children and adolescents. On the contrary, because the neuroanatomy and pathophysiologic mechanisms of headache are similar for children and adults, it is therefore reasonable for the pain to refer to the intraoral structures.³⁰ The information about headache in children that is currently available is inadequate, and it is therefore challenging to make the correct diagnosis. Nonetheless, the dentist should be familiar with the various orofacial pain entities, as an incorrect diagnosis may prove detrimental for the young patient. For any child with questionable headache and dental or temporomandibular symptoms, the application of noninterventional procedures would be more prudent than clearly invasive dental treatments such as endodontic therapy or extraction. When the oral health provider feels that such a case is beyond his or her expertise, referral to a physician with appropriate expertise would be the best solution for the patient's health.

Appliance Therapy

Few studies have looked at the role of appliance therapy for the treatment of headache in children. In studies of appliance therapy for adult patients with temporomandibular disorders and headache, use of an appliance was associated with improvement of headache.^{14,31,32} It appears that patients with neurovascular orofacial pain often present overlapping myofascial components and may benefit from multidisciplinary therapeutic approaches developed by neurologists, physical therapists and dentists. According to the current literature, treatment of headaches related to temporomandibular disorders with a full-coverage appliance may reduce headache frequency. However, to our knowledge, the use of an oral appliance for the treatment of headache in the pediatric population has never been studied; therefore, we advise caution in using appliances in this setting. ✦

THE AUTHORS



Dr. Pinto is an assistant professor of oral medicine and director of the Oral Medicine Clinical Centre at the University of Pennsylvania School of Dental Medicine. He is also a university associate at the Children's Hospital of Philadelphia, Pennsylvania.



Dr. Arava-Parastatidis is a resident in oral medicine at the University of Pennsylvania School of Dental Medicine, Philadelphia, Pennsylvania.



Dr. Balasubramaniam is co-director of the Perth Orofacial Pain and Oral Medicine Centre, St. John of God Hospital, Subiaco, Western Australia, Australia, and a senior lecturer, School of Dentistry, University of Western Australia, Nedlands, Western Australia, Australia.

Correspondence to: Dr. Andres Pinto, University of Pennsylvania School of Dental Medicine, Robert Schattner Centre, 240 S. 40th Street, Suite 214, Philadelphia, PA 19104.

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