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Effect of Analgesics on Pulpal Sensitivity Tests

One of the most important tasks of the dental practitioner is making an accurate diagnosis before beginning treatment. For the endodontist, replicating the patient's symptoms can be helpful and may be aided by the use of pulpal sensitivity tests, such as the cold, heat and electric pulp tests. However, by the time the practitioner sees the patient, a painful tooth may no longer be symptomatic, especially if the patient is one of the >80% of patients who has taken an analgesic in response to the tooth pain. Typical analgesics used by patients include nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen, or, in those for whom NSAIDs are contraindicated, acetaminophen. Little research has been published assessing the impact of analgesic use on pulpal sensitivity testing.

Sooratgar et al from Tehran University of Medical Sciences, Iran, undertook a prospective, randomized, controlled clinical trial to investigate the impact of common dosages of ibuprofen and acetaminophen on pulpal sensitivity test results and whether analgesic use may mask endodontic symptoms.

Participants were adult patients who presented to a university dental clinic with moderate to severe pain due to symptomatic irreversible pulpitis. These patients had not used any analgesic or central nervous system depressant in the 6 hours preceding their visit and demonstrated prolonged pain in response to the cold test. They were divided into 3 groups, receiving one of

- 400 mg ibuprofen
- 500 mg acetaminophen
- placebo

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Before administration of the analgesic (or placebo), the cold test and electronic pulp testing were performed on the tooth with symptomatic irreversible pulpitis and on a tooth with healthy pulp in the contralateral quadrant, and this was done again 20, 40 and 60 minutes after taking the analgesic. Patients were instructed to tell the clinician as soon as they felt pain, a burning sensation or heat. Pain levels were recorded using a 100-mm visual analogue scale (VAS).

Table 1. Visual analogue scale (0–100 mm) pain scores in teeth with symptomatic irreversible pulpitis.

Time	Acetaminophen group	Ibuprofen group	Placebo group
Cold test			
0 min	82	66	78
20 min	64	56 ^a	82
40 min	56 ^a	51 ^a	84
60 min	40 ^a	29 ^a	79
Electronic pulp test			
0 min	28	36	33
20 min	26	30	34
40 min	28	33	34
60 min	31	30	34

^aSignificantly different from placebo group.

Results from the cold test showed significant differences between patients administered an analgesic or placebo. Patients who received acetaminophen had a significantly lower response to cold testing than did those who received the placebo at both 40 and 60 minutes, with their average pain lessening from severe to mild pain, while patients in the ibuprofen group had a significantly lower response at 20, 40 and 60 minutes, with pain lessening from moderate to mild. Interestingly, a significantly lower response at 40 minutes was also seen in the tooth with healthy pulp in both analgesic groups. Although pain scores tended to be lower in both analgesic groups compared to placebo at all time periods after baseline when undergoing electronic pulp testing, the differences were not significant (Table 1).

Conclusion

Clinicians need to ascertain their patients' use of NSAIDs and acetaminophen in the hours preceding their appointments and factor that into their diagnoses.

Sooratgar A, Khavanin N, Dibaji F, et al. Evaluation of the effect of common analgesics on pulpal sensibility tests: a clinical trial. *J Endod* 2023;49:362-368.

Differentiating Between Healthy And Unhealthy Dental Pulp Stem Cells

When pulp inflammation occurs subsequent to infection caused by caries, dental pulp stem cells create odontoblast-like cells to replace the odontoblasts killed by the inflammation, which aids in the tissue healing process. If the inflammation is resolved through the elimination of bacteria and bacterial byproducts, the tissue's early inflammatory response can lead to regenerative events; however, chronic inflammation leads to reparative events. Studies have shown that the presence of bacteria or biofilm

interferes with odontoblast-like cell differentiation and mineralization of dental stem cells. Moreover, stem cells from inflamed pulp show an impaired immunosuppressive ability.

Knowledge of how dental pulp stem cells function comes primarily from in vitro studies that use stem cells derived from healthy tissue nurtured in a bacteria-free environment. Results of these studies showing ideal differentiation of dental pulp stem cells have not been replicated in clinical experience; after revitalization of vital pulp therapy, tissue formed after healing processes involving stem cells is reparative tissue, not regenerative tissue. Given the promise of using stem cells in reparative or regenerative therapies in dentistry, understanding how these cells function in a clinical setting is critical.

Bucchi et al from Universidad de La Frontera, Chile, sought to determine how the inflammatory status of donor tissue and the inflammatory environment affected these 4 biological characteristics of dental pulp stem cells:

- viability
- adhesion to dentin
- mineralization
- release of immunomodulatory cytokines

They collected healthy pulp from caries-free premolars and third molars extracted from 3 adolescents as part of orthodontic treatment, and inflamed pulp from premolars of 3 patients in their 20s undergoing endodontic treatment for irreversible pulpitis or caries reaching the inner third of the dentin. The pulp samples were cultured in various media to replicate different environments and then evaluated for their

biological characteristics over varying periods ranging from 1 to 21 days.

At days 3, 5 and 7, healthy dental pulp stem cells cultured with an odontogenic medium showed significantly higher viability than did unhealthy stem cells, while the presence of lipopolysaccharides (which elicit a highly proinflammatory effect) in the medium had no effect on viability. Healthy dental pulp stem cells showed distinct signs of calcification at 21 days; the presence of lipopolysaccharides again had no impact on results. At the same time, unhealthy stem cells produced no obvious calcium deposits. Both healthy and unhealthy dental pulp stem cells, cultured with or without lipopolysaccharides, were able to adhere to dentin, with no significant differences between cells of different origin.

Interleukin (IL)-6, a proinflammatory cytokine that regulates many aspects of the immune response, and IL-10, which decreases the production of several proinflammatory cytokines (including IL-6), were the immunomodulatory cytokines measured in the study. IL-6 release was similar for healthy and unhealthy stem cells, and the presence of lipopolysaccharides augmented the release of IL-6 by day 7. IL-10 release was low or undetectable in every combination.

Conclusion

This study emphasized the ways that dental pulp stem cells from healthy and unhealthy teeth react to various environments. As therapies employing these stem cells develop, the need to recognize these differences could prove crucial to the success of stem cell treatment. For current practice, these results underline the need to treat superficial caries as quickly as possible, before chronic inflammation can occur.

Bucchi C, Bucchi A, Martínez-Rodríguez P. *Biological properties of dental pulp stem cells isolated from inflamed and healthy pulp and cultured in an inflammatory microenvironment.* J Endod 2023;49:395-401.

Middle Mesial Canals In Mandibular First Molars

Successful endodontic treatment requires cleaning, shaping and sealing the entire root canal system. Teeth in which canals have been missed suffer a higher incidence of posttreatment apical periodontitis and are 4.38× more likely to have a periapical lesion requiring further treatment. Typically, mandibular first molars, the teeth most frequently requiring root canal therapy, have 2 canals in the mesial root and 1 canal in the distal root. An additional canal, known alternatively as the middle mesial canal, intermediate mesial canal, third mesial canal and accessory mesial canal, may occur in the mesial root between the mesiobuccal and mesiolingual canals. These middle mesial canals may be overlooked when performing endodontic therapy. While several studies have attempted to determine the prevalence of middle mesial canals, the results have varied widely, ranging from 0% to 46%.

Because some evidence has suggested that genetic and ethnic factors influence root canal morphology and shape, Hatipoğlu et al from Niğde Ömer Halisdemir University, Turkey, hypothesized that those same factors might influence the prevalence of middle mesial canals. To test their theory, they undertook a mul-

tinational, cross-sectional study of mandibular first molars in patients from 15 countries in Africa, Asia and Europe.

The contributors to the study reviewed cone-beam computed tomography (CBCT) images obtained from patients at various locations, including private and university clinics, private practices, and imaging facilities. All included images, which may have been obtained for various reasons related to treatment, showed bilateral mandibular first molars; images of teeth with incomplete apex formation, crown-bridge prostheses, endodontic treatment or root resorption were excluded.

A total of 6304 CBCT images (12,608 mandibular first molars) were included in the study. Although the prevalence of middle mesial canals in the entire included population was 7%, the prevalence varied significantly on a country-by-country basis, ranging from a low of 1% in Croatia, Egypt and Poland to a high of 23% in Libya (Table 2). No significant patterns were detected when the surveyed countries were grouped by continent; indeed, some neighboring countries showed large differences in prevalence, including Germany (15%) and Poland (1%);

Table 2. Prevalence of middle mesial canals in mandibular first molars by country.

Africa:		Asia:	
Egypt	1%	India	10%
Libya	23%	Jordan	2%
South Africa	2%	Kazakhstan	5%
Europe:		Malaysia	2%
Croatia	1%	Pakistan	8%
Germany	15%	Saudi Arabia	13%
Poland	1%	Turkey	8%
Portugal	4%	Yemen	2%

Libya (23%) and Egypt (1%); and Saudi Arabia (13%), Yemen (2%) and Jordan (2%). No significant differences in the presence of middle mesial canals were found between left and right mesial first molars or between women and men, nor was age a factor.

Conclusion

Given the substantial agreement for intraobserver reliability shown in this study, it appears likely that genetic and ethnic factors play a major role in the prevalence of middle mesial canals in mandibular first molars. When planning root canal treatment, the practitioner must be cognizant of the possibility that this extra canal may be present.

Hatipoğlu FP, Mağat G, Hatipoğlu Ö. Assessment of the prevalence of middle mesial canal in mandibular first molar: a multinational cross-sectional study with meta-analysis. J Endod 2023;49:549-558.

Prevalence of Maxillary Sinusitis of Odontogenic Origin

Sinusitis affects 1 in 8 American adults, resulting in >30 million cases annually, with a concomitant economic and health impact on both the societal and individual level. Inflammation of the Schneiderian membrane lining the maxillary sinuses may be caused by respiratory tract infections, inhalation of irritants and infection. Because the maxillary sinuses lie very close to the apices of maxillary teeth, particularly the molars and second premolars, infections in these teeth can create inflammatory changes in the Schneiderian membrane. When odontogenic pathology

or iatrogenic injury from a dental procedure causes inflammation of the sinus mucosa, the result is termed maxillary sinusitis of odontogenic origin (MSOO).

Patients with MSOO may have sinusitis symptoms such as facial pain or pressure, nasal obstruction, and rhinorrhea, but frequently do not present with odontogenic symptoms, which leads to underdiagnosis and potentially ineffective treatment. To determine the prevalence of MSOO in adults and verify the relationship of MSOO to different odontogenic conditions, Vitali et al from the Federal University of Santa Catarina, Brazil, undertook a systematic review and meta-analysis of published studies that addressed this topic.

The authors searched for publications that studied adults diagnosed by computed tomography (CT) with sinusitis attributable to odontogenic origin. They identified 38 studies, all but 3 of which had been published no earlier than 2011; 32 of the studies were radiological retrospective studies using records from hospitals or dental schools. The combined studies evaluated more than 7458 patients and 13,968 maxillary sinuses. Most studies defined sinusitis as mucosal thickening >2 mm, the presence of partial or total sinus opacification, or both.

Based on the results from the 30 studies that met the criteria for inclusion in the meta-analysis, the prevalence of MSOO in patients diagnosed with sinusitis was 50%. CT findings revealed that the prevalence of mucosal thickening was 49%; that of partial or complete opacification of the sinus was 50%. Maxillary sinuses adjacent to teeth with apical lesions were 4.03× more likely to have MSOO than those adjacent to teeth without apical lesions.

Compared to sinuses adjacent to teeth without these conditions, those adjacent to teeth with periodontitis were 5.49× more likely, moderate periodontal bone loss 2.57× more likely and severe periodontal bone loss 13.80× more likely to have MSOO. Previous endodontic treatment of an adjacent tooth, however, did not increase the chance of MSOO.

Conclusion

These results indicated that approximately half of all cases of maxillary sinusitis have an odontogenic origin. Most of the time, dental lesions are asymptomatic and thus not an obvious cause of sinusitis. The American Association of Endodontists highlighted the need for a correct diagnosis of the odontogenic cause of MSOO. This systematic review and meta-analysis highlighted the need for dental practitioners to review CT scans of their patients for possible sinus pathology.

Vitali FC, Santos PS, Massignan C, et al. Global prevalence of maxillary sinusitis of odontogenic origin and associated factors: a systematic review and meta-analysis. J Endod 2023;49:369-381.

In the next issue:

- Treatment outcomes in necrotic teeth with apical periodontitis
- Apical periodontitis in patients with autoimmune disorders
- Update on citric acid use in endodontic treatment

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