Sodium hypochlorite was inadvertently injected into the maxillary sinus during root canal treatment of the right maxillary first molar. Sterile water irrigation of the sinus was effected through the palatal canal. The expected sequelae of pain, significant edema, and hemorrhage were not experienced.

Sodium hypochlorite is used during endodontic treatment as an adjunct to mechanical debridement of the root canal system. It dissolves tissue, is antimicrobial, and provides lubrication. There have been numerous reports of soft tissue complications as a result of its inadvertent injection beyond the root canal system (1-5). The immediate sequelae of these sodium hypochlorite accidents have included severe pain, edema, and profuse hemorrhage both interstitially and through the tooth. Reports have described several days of increasing edema and ecchymosis accompanied by tissue necrosis, paresthesia, and, in some cases, secondary infection. The majority of cases have shown complete resolution within a couple of weeks while a few were marked by long-term paresthesia or scarring (2, 3).

This report describes an unusual case of inadvertent injection of sodium hypochlorite into the maxillary sinus followed by sterile water irrigation of the sinus through the tooth. The expected deleterious sequelae were not seen.

CASE REPORT

A 22-yr-old man was referred to the endodontic department for completion of root canal therapy of the maxillary right first molar. One month previously, after a carious exposure, the pulp had been partially extirpated and a temporary seal placed. The patient's medical history was noncontributory. The patient was asymptomatic upon clinical examination and the maxillary right quadrant was normal for percussion, palpation, mobility, periodontal probing, and soft tissue changes. The quadrant also responded normally to the electric pulp test except for the tooth in question, which gave no response. On radiographic examination the buccal roots of the maxillary right first molar appeared to be thin and convergent. The maxillary sinus appeared to be superimposed over the roots of the maxillary right molars (Fig. 1).

Local anesthesia was administered, a rubber dam applied, and access made through the temporary restoration. Three orifices were located, working length determined, and instrumentation begun with K files. Irrigation with 5.25% sodium hypochlorite was accomplished using a 10-ml syringe and 23-gauge hypodermic needle. Soon after irrigation of the palatal canal, the patient indicated he tasted sodium hypochlorite in his throat, whereupon the oropharynx was irrigated with water and suctioned. The rubber dam seal was verified. After further irrigation the patient again indicated the same taste and, simultaneously, a clear liquid was seen in the right nares. The patient appeared to be calm and relaxed, although, when questioned regarding symptoms, he reported some developing congestion and a mild burning sensation in the right maxillary sinus. There were no signs of edema either extraorally or intraorally, nor was any hemorrhage noted within the canal.

Treatment consisted of irrigating the sinus with 30 ml of sterile water through the palatal canal using a 10-ml syringe with a 23-gauge needle. The sterile water passed through the palatal canal into the maxillary sinus, into the nasal cavity via the ostium maxillae, and thence into the oropharynx. When the clinician pushed on the plunger of the water-filled syringe, the patient reported fluid accumulation in his throat and,

Fig 1. Maxillary right first molar in proximity to maxillary sinus.
conversely, when the plunger was not being pushed, the patient reported no accumulation of fluid. This verified the path of irrigation. Further root canal treatment of the tooth was postponed. The buccal canals were dried, but it was not possible to completely dry the palatal canal. Clear fluid remained in the palatal canal and the tooth was sealed. The patient was prescribed Entex LA twice a day, 500 mg of amoxicillin three times a day for 7 days, and 800 mg of Motrin every 6 h as needed for pain. Follow-up was scheduled for the following day or sooner if symptoms developed.

At 1 day postoperatively the patient appeared to be comfortable (Fig. 2) and complained only of mild soreness associated with the tooth and congestion of the right maxillary sinus. He reported that a small amount of a brownish color material was expressed on several occasions when blowing his nose. There was no facial or intraoral edema and his temperature was 98.7°F. The patient did not return for follow-up until 4 days after the procedure, at which time he was asymptomatic and the sinus congestion had resolved. Under rubber dam, the temporary seal was removed and a cloudy serous-type fluid was observed in the palatal canal. Instrumentation of the canals was completed using care not to force irrigant into the canals and they were filled with calcium hydroxide. At 27 days after the procedure, the canals were dry and were obturated with gutta-percha and Roth 801 sealer using lateral condensation.

**DISCUSSION**

A review of the anatomy of the maxillary sinus explains the phenomenon of the sodium hypochlorite reaching the pharynx (6). The normal anatomy of the paranasal sinuses includes ostia which communicate with the nasal cavity. The ostia maxillae are found in the anterior superior portion of the middle sinus wall and open into the posterior one-third of the semilunar hiatus in the middle meatus of the nasal cavity. An accessory opening is often present behind and below the main opening. The location of these openings preclude the possibility of good drainage when the individual is in a vertical position, but in a reclined patient they would tend to be in a more dependent position. The roots of the maxillary molars are often in intimate contact with the floor of the maxillary sinus and may be separated from the sinus by only the sinus lining and a very thin lamina of bone or even no bone at all (7). In this patient such a proximity of root apices and sinus can be seen on the periapical radiograph (Fig. 1). Apparently, instrumentation beyond the apical foramen resulted in communication between the palatal canal and sinus. Consequently, the sodium hypochlorite was able to pass through the palatal canal and subsequently arrive in the oropharynx.

Sodium hypochlorite has a pH of approximately 11 to 12 and causes injury primarily by oxidation of proteins. Pashley et al. (8) state that it can elicit severe inflammatory reactions and is cytotoxic to all cells except heavily keratinized epithelia. In a study on the effects of sodium hypochlorite on cat esophagus, Weeks and Ravitch (9) observed severe edema with areas of hemorrhage, ulceration, necrosis, and stricture formation. In a similar study on dogs, Yarington (10) observed that the minimum amount of sodium hypochlorite to cause a burn was 10 ml over a 5-min period. He concluded that, although it appeared bleach did have the potentiality of causing a caustic burn, the vast majority of instances did not achieve the time-dosage requirement for the production of a burn. It seems that, provided the time of contact with sodium hypochlorite is minimal, it does not have the same untoward effect on the mucosal surface as is evidenced when it is introduced interstitially. In this case the sodium hypochlorite was irrigated from the sinus with 30 ml of sterile water within 5 min of exposure. As the capacity of the average adult antrum is 10 to 15 ml (6), this treatment provided at least a 2-fold turnover of sterile water irrigant.

In spite of the fortunate result in this case and because sodium hypochlorite mishaps do result in harm to the patient, a great deal of care should be exercised during its use. In the case reported here, there was no resistance whatsoever to irrigation with sodium hypochlorite. Therefore, it is suggested that during all root canal treatments the clinician determine, both clinically and radiographically, if there is communication from the canal system to the surrounding tissue due to an immature apex, resorption, or apical perforation. Irrigation should be performed slowly while maintaining gentle movement of the needle to ensure that it is not binding in the canal.

Dr. Ehrich is a student, Advanced Clinical Program in Endodontics, Dr. Brian is director, and Dr. Walker is chairman, Endodontic Department, Naval Dental Center, San Diego, CA. Address requests for reprints to LCDR Daniel Ehrich, PSC 561 Box 1464 Iwakuni, FPO AP 96310-1464.
References


You Might Be Interested to Know

One by one our little pleasures, our seemingly harmless vanities, are exposed as unhealthy—contributing to an early demise. Now can be added to the dolorous list of pleasures and practices denied, the use of hair dyes, of all things. It is concluded (Am J Pub Health 82:955) from recent studies that excessive use of hair dyes could account for 20% of all non-Hodgkin lymphomas in women.

Think of the historical implications . . . remember Barbara Frietchie?

Up rose old Barbara Frietchie then
Bowed with her four score years and ten . . .
Shoot if you must this old grey head
But spare your country's flag she said

John Greenleaf Whittier

Clearly, if she had dyed her hair, she would not have reached 90, etc. etc. and where would the country be now??

Ann Wiley