

# Acupuncture in the treatment of xerostomia: Clinical report

Warren M. Morganstein, DDS, MPH

**This article reviews the etiology and symptomatology of xerostomia and approaches for treating it, including the use of acupuncture. Seven xerostomia patients who were treated using acupuncture and the subsequent results of that treatment are discussed.**

**Actual outcomes exceeded the author's expectations with all patients reporting an increase in salivary flow and the ability to eat and speak and improved sleep.**

**Members of the dental team should consider referral for acupuncture as a viable adjunct when treating xerostomia. Dentists also might consider equipping themselves to provide such treatment in states that allow them to perform acupuncture.**

Received: December 21, 2004

Accepted: March 8, 2005

Xerostomia (the decrease in or total lack of saliva) is a serious condition that affects approximately 25% of the population and approximately 40% of adults over 50.<sup>1</sup> A 1993 article by McInnes et al studied the oral health status and treatment needs of elderly individuals living in retirement homes; 75% of the residents reported using at least one xerostomic drug.<sup>2</sup> For xerostomia patients, quality of life often is impaired profoundly. Symptoms include rampant caries; oral mucosal infections; difficulty speaking, eating, and swallowing; ulceration or soreness of the oral cavity; an altered sense of taste; and difficulty in wearing dentures.<sup>3</sup>

Xerostomia has a multifactorial etiology. It is a common side effect of medications, especially opioids, diuretics, anticholinergic drugs, and antihistamines. It also may be caused by endocrine disorders, autoimmune diseases (such as Sjogren's syndrome), and radiation therapy. Radiotherapy often is used to treat head and neck cancer patients; however, radiotherapy can lead to xerostomia, with a frequency approaching 100%.<sup>4</sup> More than 120,000 patients annually are diagnosed with cancer of the head and neck.<sup>5</sup> Cancer patients generally exhibit a high prevalence of xerostomia; according to a 1999 study, more than 70% of seriously ill cancer patients suffered from the effects of xerostomia.<sup>6</sup>

It is likely that the decreased salivary secretion among xerostomia patients is

due to the secretory cells of salivary gland tissue atrophying and/or dysfunctional changes in the vascular and connective tissues of the salivary glands.<sup>7</sup> Other studies have reported that salivary production usually does not improve for xerostomia patients but is associated with a gradual decrease in salivary gland function.<sup>8,9</sup>

Xerostomia treatment is primarily palliative and includes increasing saliva production by increasing water consumption, using sugarless mints and gum or salivary substitutes, and utilizing prescription medications such as oral pilocarpine (Salagen, MGI Pharma, Inc., Bloomington, MN; 800.562.5580).<sup>10,11</sup> Treatment results have been short-term at best. Pilocarpine therapy has been ineffective for a great percentage of patients (30–70% in one study); adverse reactions to pilocarpine include sweating, dizziness, headache, rhinitis, nausea, urinary frequency, tachycardia, and visual impairment.<sup>12</sup>

Amifostine has been used during radiation therapy via intravenous injection in an attempt to minimize the possibility of xerostomia (as well as mucositis) occurring during treatment through protection against radiation by the scavenging of free radicals. However, amifostine's impact on the efficacy of the radiation treatment (due to possible tumor protection) is controversial, with some studies reporting tumor protection factors as high as 2.8. In addition, the potential for adverse reactions is significant. Nausea, vomiting, hyperten-

sion, and allergic reactions were the most common side effects, with 53% of those patients who received amifostine experiencing at least one episode of nausea and/or vomiting.<sup>13,14</sup>

Studies have demonstrated that as a form of complementary and alternative medicine, acupuncture might serve as an effective long-term approach to the treatment of xerostomia and can significantly reduce, if not eliminate, untoward effects.<sup>15,16</sup>

## Acupuncture

The term *complementary and alternative medicine* (CAM) refers to health and medical care practices and products that currently are not considered to be conventional medicine, including acupuncture, herbs, therapeutic massage, homeopathy, naturopathy, and yoga. Currently, CAM therapies are used widely in the U.S. and are increasing in popularity.<sup>17</sup> Eisenberg et al reported that over a seven-year period (1990–1997), the percentage of the U.S. population who used at least one form of CAM therapy increased from approximately 33% percentage to more than 42%.<sup>18</sup> Studies have shown that patients experiencing a high level of pain are more likely to use CAM approaches.<sup>19</sup> In 2002, Myers et al reported on an alternative medicine study that surveyed 196 members of a health plan; 36% of those who participated in the study reported used CAM for treating temporomandibular disorders (TMD); 7% had consulted acupuncturists.<sup>17</sup>

The earliest known written source describing the theories and practices of acupuncture is the *Huang Di Nei Jing* (Yellow Emperor's Inner Classic), which dates from the Han dynasty in the second century BC.<sup>20</sup> Interest in acupuncture expanded in the U.S. during the early 1970s as physicians and researchers visited China and reported on their observations of surgical analgesia using only acupuncture needles.<sup>21</sup> In 1996, the FDA reclassified acupuncture needles from experimental

medical devices to the same regulated category as surgical scalpels and hypodermic syringes. The following year, a consensus panel convened by the National Institutes of Health (NIH) issued a report stating that needle acupuncture is an effective treatment for postoperative dental pain and for nausea and vomiting caused by anesthesia, chemotherapy, and pregnancy.<sup>22,23</sup> The report concluded by suggesting that “further research is likely to uncover additional areas where acupuncture interventions will be useful.”<sup>23</sup>

Acupuncture involves inserting extremely thin and solid needles under the skin in various combinations for the therapeutic relief of pain and other disorders. According to traditional Chinese medicine, a vital energy known as *Qi* flows through meridians in the body. When the flow of energy (or *Qi*) is obstructed in a meridian, pain or symptoms result. The purpose of acupuncture treatment is to reopen the meridian and restore the flow of *Qi*.<sup>24,25</sup> Side effects of acupuncture are rare and usually are related to inadequate knowledge of anatomy or poor needle technique.<sup>26</sup> In the late 1970s, it was demonstrated that acupuncture analgesia was associated with central nervous system (CNS) activities involving endogenous opioid peptides and biogenic amines.<sup>27</sup>

In a 1995 book, Helms discussed the numerous characteristics and effects of acupuncture.<sup>28</sup> These included the demonstration of bioelectrical properties of acupuncture points and channels, including electrical propagation along channels; flow patterns of radioactive tracings along acupuncture channels; propagation of perceived sensation along channels; blood chemistry and immune system changes; and morphological features of acupuncture points that demonstrate intimate proximity to a concentrated array of vascular and neural structures. Possible mechanisms of action have been proposed, including the activation of central, peripheral, and autonomic nervous system pathways, diffuse noxious inhibitory control, and the release of numerous neurochemicals.<sup>28</sup>

Many articles have discussed the effectiveness of acupuncture. Many of these studies consist of case reports, case series, or intervention studies whose designs were inadequate for assessing efficacy; as a result, there is a paucity of high-quality

research that assesses the efficacy of acupuncture compared with placebo or sham acupuncture.<sup>23</sup> A recent review of 3,425 articles printed or abstracted in Western European languages demonstrated that approximately 25% of the research studies concerning acupuncture were associated with pain.<sup>28</sup> These studies related to pain were categorized as musculoskeletal (67%), headache (12%), arthritis (9%), neuralgia (7%), dental (4%), and malignancy (1%).

### Acupuncture and xerostomia

The use of acupuncture as a treatment for xerostomia first was reported by the Western medical literature in 1981.<sup>29</sup> Since 1992, Blom et al have published numerous articles concerning the effectiveness of acupuncture in the treatment of xerostomia.<sup>3,9,15,30</sup> A 1997 study showed a significant increase in saliva (compared to baseline levels) both during and after manual acupuncture stimulation; by contrast, electroacupuncture had no effect.<sup>31</sup> In a 1992 study, patients suffering from severe xerostomia, primarily associated with Sjogren’s syndrome and other systemic disease, were divided randomly into treatment and control groups to determine the effect of acupuncture on salivary flow rates.<sup>30</sup> The control group patients received placebo treatment through the superficial intradermal placement of acupuncture needles. Patients in the treatment group exhibited improved salivary flow rates both during and after treatment. These results lasted throughout the one-year post-treatment observation period. While salivary flow rates improved for patients in the control group during the experiment, these changes disappeared after the placebo acupuncture treatment was completed.<sup>30</sup>

Patients with xerostomia due to radiation therapy for head and neck cancer have shown increased salivary flow rates after acupuncture treatment.<sup>15</sup> Patients who had received more than 50 Gy of radiation were assigned at random to a treatment group receiving real acupuncture or a control group receiving placebo (that is, superficial) acupuncture. Both groups showed a significant increase in salivary flow rates during the one-year observation period, although the control group demonstrated a smaller improvement and one that took longer to achieve. The results of this study show the diffi-

culty in using superficial acupuncture as a placebo.<sup>15</sup>

A long-term study by Blom and Lundberg followed 70 patients who had been treated with acupuncture for xerostomia due to primary and secondary Sjogren’s syndrome, irradiation, and other causes. Results acquired over an observational period as long as three years indicated that acupuncture improved salivary flow rates. Compared to patients who chose not to continue acupuncture, the rates remained consistently higher for patients who received an additional series of 5–12 acupuncture treatments, as needed.<sup>9</sup>

A 1999 study of patients in a hospital-based home care setting investigated how acupuncture affected patients in late-stage palliative care with symptoms of xerostomia and related problems. The results indicated that “acupuncture had a dramatic effect on xerostomia and subsequently on dysphagia and articulation.”<sup>26</sup>

It has been suggested that acupuncture increases the release of neuropeptides and stimulates the autonomic nervous system, enhancing salivary secretion both in healthy subjects and those with xerostomia. Radio immunoassay analysis was used to examine xerostomia patients and determined that acupuncture significantly increased both vasoactive intestinal polypeptide (VIP) and calcitonin gene-related peptide (CGRP) in their saliva.<sup>3,31,32</sup>

Both the sympathetic and parasympathetic nervous systems influence the function of salivary glands and the rate and nature of salivary flow. Sensory, sympathetic, and parasympathetic nerve fibers innervate the salivary glands. Sympathetic system stimulation produces a low, viscous, protein-rich flow of saliva while parasympathetic system stimulation has the primary influence on salivary secretion and yields a strong increase of salivary flow with a low protein content.<sup>33,34</sup>

Acupuncture also has been shown to increase blood flow to the skin overlying the parotid gland. Blom et al studied a group that had received acupuncture and a control group that had received superficial acupuncture; using laser Doppler flowmetry, they discovered that blood flow to the skin overlying the parotid gland increased significantly (both during and after acupuncture) for the experimental (acupuncture) group.<sup>35</sup>

Most of the treatment provided in research that relates to acupuncture and

xerostomia has involved placing needles at numerous points both locally (in the area of the major salivary glands) and distally (that is, on the arms and legs). In some studies, the number of treatment sessions has ranged from 20–24.<sup>9,36</sup>

In recent years, physicians who practice acupuncture in the U.S. have developed an acupuncture treatment protocol for xerostomia that involves fewer acupuncture points and a great reduction in the number of treatment sessions.<sup>4,16</sup> This protocol limits the number of acupuncture points to three on each ear and one on each index finger, reducing the total number of needles used from 14–24 to 8. The average number of treatments also has been reduced from 20–24 to approximately 6.<sup>4,16</sup>

The xerostomia inventory (XI) is an instrument that is utilized to evaluate a patient's subjective sensation of dry mouth.<sup>37,38</sup> Johnstone et al used the XI to demonstrate a significant improvement in the symptoms of xerostomia as perceived by patients after treatment with the minimally invasive acupuncture protocol described above.<sup>4,16</sup>

### Case reports

Seven patients with xerostomia subsequent to head and neck radiation therapy were referred to the author for acupuncture. Six of the patients had undergone surgery prior to receiving radiation therapy, five for squamous cell carcinoma of the tongue and one for squamous cell carcinoma of the ear. The seventh patient received radiation therapy without surgery for nasopharyngeal cancer. The time between the completion of radiation therapy and the initiation of acupuncture treatment ranged from two months to ten years, with a median time period of nine months.

Three of the patients were men and four were women, ranging in age from 41–62, with an average age of 51.5 and a median age of 59. Two of the patients had not used pilocarpine to stimulate salivary secretion, while two had stopped using it due to adverse reactions and a lack of effectiveness. Three patients who had been taking pilocarpine at the time of their first acupuncture visit decreased usage and subsequently stopped it during and after the acupuncture treatment. Two patients received amifostine initially during radiation therapy but discontinued it due to severe nausea and vomiting.

Patients typically came to their first acupuncture appointment with a bottle of water and, on occasion, a bottle of artificial saliva. All of the patients reported suffering from the xerostomia-related symptoms discussed earlier; in addition, all of the patients awoke frequently throughout the night to drink water.

During each patient's first visit, the need for a rigorous home care/prevention program was discussed. At that time, the patient received written information describing various artificial saliva products and medications designed to help patients suffering from xerostomia.<sup>39</sup> Patients were advised to work closely with their oral health care professionals to develop an appropriate program.

Patients were treated with the acupuncture protocol developed by Neimtzow.<sup>4,16</sup> Three points were needled on each ear (Fig. 1). These points were Shen Men (reported to represent the parasympathetic nervous system), point Zero (designed to bring about homeostasis), and Salivary Gland 2'. In addition, the LI-1' (large intestine) point was needled on each index finger (Fig. 2). Patients were given sugarless mints during treatment to help stimulate salivary flow, although the mints usually produced little, if any, saliva without the use of acupuncture.

Patients usually were seen once a week for four to five weeks, followed by two or three biweekly sessions; each treatment session lasted 45–50 minutes. The number of treatment sessions for the seven patients ranged from 6–14, with a mean of 8 visits.

Salivary flow often improved during the first visit and the duration of improvement increased with each subsequent visit. In the eight months after treatment, all of the patients continued to report a reduction in the symptoms of xerostomia, the need to awaken at night for water, and difficulty in eating and swallowing; increases were reported in the flow of saliva, the ability to speak for longer periods of time, and the ability to eat a wider range of food.

Studies have demonstrated that although acupuncture increases the volume of saliva, salivary flow does not reach the full level exhibited prior to radiation treatment.<sup>4,16</sup> While all of the patients in this study have reported being pleased with the results of treatment to some degree, none of the patients reported 100% return of saliva.



Fig. 1. Auricular acupuncture points.



Fig. 2. An acupuncture point on the index finger.

Both before the start of treatment and at its completion, patients were asked to subjectively rate their level of salivary flow against their pre-radiation/presurgery level. These levels were rated with a Visual Analog Scale (VAS), in which 0 indicated no saliva and 10 indicated a level of saliva equivalent to pre-radiation/presurgery treatment levels. VAS scores prior to acupuncture treatment ranged from 0.0–2.5, with a mean score of 0.86. VAS scores after acupuncture treatment ranged from 2.5–7.0, with a mean score of 3.5. One patient reported that the increased flow of saliva is intermittent instead of continual, while another patient reported that sugarless mints were necessary to stimulate maximum salivary flow.

All of the patients treated by the author, including those patients inconvenienced by the need to travel from surrounding states for their appointments, have indicated that they were pleased they elected to pursue acupuncture treatment for their xerostomia. For these patients, xerostomia was only part of a series of traumatic life events with potentially serious physical and emotional consequences;

others included the diagnosis of a malignancy, surgical intervention, radiation treatment, pain, disfigurement, and dysfunction.

### Summary

Numerous xerostomia patients are seen in a dental office on a daily basis. Dentists should develop and implement a rigorous home care/prevention program for these patients, including the use of appropriate products and medications. Members of the dental team also should consider referral to an acupuncturist as a viable adjunct in the treatment of this disorder. In states that allow dentists to perform acupuncture, dentists might elect to receive specific training that would allow them to provide such treatment.

### Author information

Dr. Morganstein is Associate Dean, Enrichment Program, and Dean's Faculty and Professor, Health Promotion and Policy, Baltimore College of Dental Surgery, University of Maryland Dental School. Dr. Morganstein completed his training in acupuncture at the UCLA Medical School Medical Acupuncture for Physicians Program, where he now serves as a clinical faculty preceptor. He practices acupuncture for oral and craniofacial disorders in the Brotman Facial Pain Center at the University of Maryland Dental School.

### References

1. Sreebny LM, Banoczy J, Baum BJ, Edgar WM, Epstein JB, Fox PC, Larmas M. Saliva: Its role in health and disease. *Int Dent J* 1992;42:291-304.
2. MacInnis WA, Ismail A, MacDonald RM, Friars CA. Oral health status and treatment needs of an insured elderly population. *J Can Dent Assoc* 1993;59:465-475.
3. Dawidson I, Angmar-Mansson B, Blom M, Theodorsson E, Lundeberg T. Sensory stimulation (acupuncture) increases the release of calcitonin gene-related peptide in the saliva of xerostomia sufferers. *Neuropeptides* 1999;33:244-250.
4. Johnstone PA, Peng YB, May BC, Inouye WS, Niemtzow RC. Acupuncture for pilocarpine-resistant xerostomia following radiotherapy for head and neck malignancies. *Int J Radiat Oncol Biol Phys* 2001;50:353-357.
5. Greenlee RT, Murray T, Bolden S, Wingo PA. Cancer statistics, 2000. *CA Cancer J Clin* 2000;50:7-33.
6. Rydholm M, Strang P. Acupuncture for patients in hospital-based home care suffering from xerostomia. *J Pall Care* 1999;15:20-23.
7. Greenspan D. Oral complications of cancer therapies. Management of salivary dysfunction. *NCI Monogr* 1990;9:159-161.
8. Baum BJ, Bodner L, Fox PC, Izutsu KT, Pizzo PA, Wright WE. Therapy-induced dysfunction of salivary glands: Implications for oral health. *Spec Care Dentist* 1985;5:274-277.
9. Blom M, Lundeberg T. Long-term follow-up of patients treated with acupuncture for xerostomia and the influence of additional treatment. *Oral Dis* 2000;6:15-24.
10. Fox PC. Management of dry mouth. *Dent Clin North Am* 1997;41:863-875.
11. LeVeque FG, Montgomery M, Potter D, Zimmer MB, Rieke JW, Steiger BW, Gallagher SC, Muscoplat CC. A multicenter, randomized, double-blind, placebo-controlled, dose-titration study of oral pilocarpine for treatment of radiation-induced xerostomia in head and neck cancer patients. *J Clin Oncol* 1993;11:1124-1131.
12. Johnson JT, Ferretti GA, Nethery WJ, Valdez IH, Fox PC, Ng D, Muscoplat CC, Gallagher SC. Oral pilocarpine for post-irradiation xerostomia in patients with head and neck cancer. *N Engl J Med* 1993;329:390-395.
13. Lindegaard JC, Grau C. Has the outlook improved for amifostine as a clinical radio protector? *Radiother Oncol* 2000;57:113-118.
14. Brizel DM, Wasserman TH, Henke M, Strnad V, Rudat V, Monnier A, Eschwege F, Zhang J, Russell L, Oster W, Sauer R. Phase III randomized trial of amifostine as a radioprotector in head and neck cancer. *J Clin Oncol* 2000;55:3339-3345.
15. Blom M, Dawidson I, Fernberg JO, Johnson G, Angmar-Mansson B. Acupuncture treatment of patients with radiation-induced xerostomia. *Eur J Cancer B Oral Oncol* 1996;32B:182-190.
16. Johnstone PA, Niemtzow RC, Riffenburgh RH. Acupuncture for xerostomia: Clinical update. *Cancer* 2002;94:1151-1156.
17. Myers CD, White BA, Heft MW. A review of complementary and alternative medicine use for treating chronic facial pain. *J Am Dent Assoc* 2002;133:1189-1196.
18. Eisenberg DM, Davis RB, Ettner SL, Appel S, Wilkey S, Van Rompay M, Kessler RC. Trends in alternative medicine use in the United States, 1990-1997: Results of a follow-up national survey. *JAMA* 1998;280:1569-1575.
19. Boisset M, Fitzcharles MA. Alternative medicine use by rheumatology patients in a universal health care setting. *J Rheumatol* 1994;21:148-152.
20. Helms JM. An overview of medical acupuncture. *Altern Ther Health Med* 1998;4:35-45.
21. Complementary medicine. Chinese acupuncture gets nod from the west. *Harv Health Lett* 1998;23:4-5.
22. Lao L, Bergman S, Langenberg P, Wong RH, Berman B. Efficacy of Chinese acupuncture on postoperative oral surgery pain. *Oral Med Oral Pathol Oral Radiol Endod* 1995;79:432-438.
23. Acupuncture. NIH Consensus Statement 1997;15:1-34.
24. Stux G, Pomeranz B. Acupuncture: Textbook and atlas. Berlin: Springer-Verlag 1987:35.
25. O'Connor J, Bensky D, eds. Acupuncture: A comprehensive text. Chicago: Eastland Press;1981.
26. Wright RS, Kupperman JI, Liebhaber MI. Bilateral tension pneumothoraces after acupuncture. *West J Med* 1991;154:102-103.
27. Pomeranz B. Electroacupuncture and transcutaneous electrical nerve stimulation. *In: Stux G, Pomeranz B, eds. Basics of acupuncture.* Berlin: Springer-Verlag;1991:250-260.
28. Helms JM. Acupuncture energetics: A clinical approach for physicians. Berkeley: Medical Acupuncture Publishers;1995:19-70.
29. Perminova IS, Goidenko VS, Rudenko IV. [Experience with using reflexotherapy in treating Sjogren's syndrome]. *Stomatologia (Mosk)* 1981;60:37-38.
30. Blom M, Dawidson I, Angmar-Mansson B. The effect of acupuncture on salivary flow rates in patients with xerostomia. *Oral Surg Oral Med Oral Pathol* 1992;73:293-298.
31. Dawidson I, Blom M, Lundeberg T, Angmar-Mansson B. The influence of acupuncture on salivary flow rates in healthy subjects. *J Oral Rehab* 1997;24:204-208.
32. Dawidson I, Angmar-Mansson B, Blom M, Theodorsson E, Lundeberg T. The influence of sensory stimulation (acupuncture) on the release of neuropeptides in the saliva of healthy subjects. *Life Sci* 1998;63:659-674.
33. Emmelin N. Nerve interactions in salivary glands. *J Dent Res* 1987;66:509-517.
34. Garrett JR. The proper role of nerves in salivary secretion: A review. *J Dent Res* 1987;66:387-397.
35. Blom M, Lundeberg T, Dawidson I, Angmar-Mansson B. Effects on local blood flux of acupuncture stimulation used to treat xerostomia in patients suffering from Sjogren's syndrome. *J Oral Rehab* 1993;20:541-548.
36. List T, Lundeberg T, Lundstrom I, Lindstrom F, Ravalid N. The effect of acupuncture in the treatment of patients with primary Sjogren's syndrome. A controlled study. *Acta Odontol Scand* 1998;56:95-99.
37. Thomson WM, Chalmers JM, Spencer AJ, Williams SM. The Xerostomia Inventory: A multi-item approach to measuring dry mouth. *Community Dent Health* 1999;16:12-17.
38. Thompson WM, Williams SM. Further testing of the xerostomia inventory. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000;89:46-50.
39. Wynn RL, Meiller TF. Artificial saliva products and drugs to treat xerostomia. *Gen Dent* 2000;48:630-636.

To order reprints of this article, contact Donna Bushore at 866.879.9144, ext. 156 or [dbushore@fostereprints.com](mailto:dbushore@fostereprints.com).