

## Image Diagnosis: Dental and Skeletal Fluorosis

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## CASE REPORT

A 45-year-old man presented to the Department of Medicine at our institution with 1 year of noninflammatory pain in multiple joints. The pain had begun in both knee joints, followed by low-back ache and neck, wrist, and foot pain. There was no associated fever or swelling of any joint. The patient did not report any history of addiction or illness but did report using fluoridated toothpaste. The patient also lived in a region of India where the problem of fluorosis is endemic. On examination, we found his teeth had brown stains and rough, pitted enamel (Figure 1). There was diffuse tenderness at the cervical spine, the lumbosacral spine, and elbow, wrist, knee, and ankle joints. There was no swelling or restriction of movement in any of these areas. There were no neurologic deficits, and the rest of the physical examination was normal. X-ray scans showed osteosclerosis of the knee (Figure 2), ankle, wrist, pelvis, and vertebral column, and calcification of the sacrotuberous ligament (Figure 3) and the posterior longitudinal ligament (Figure 4). Twenty-four-hour urinary fluoride levels were elevated (18 ppm). The patient was advised to avoid fluoridated water, fluoridated toothpaste, and foods containing fluoride. He was kept under close follow-up and was educated about the potential development of neurologic symptoms and signs.



Figure 1. Teeth showing brown stains and rough, pitted enamel.



Figure 2. X-ray of the right knee. The white arrow indicates osteosclerosis.

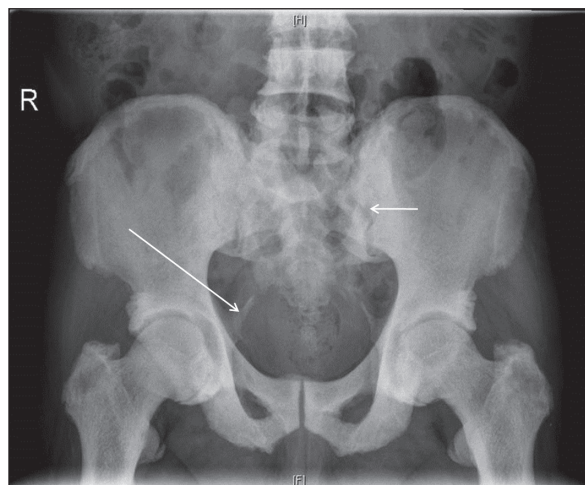


Figure 3. X-ray of the pelvis. The short arrow shows osteosclerosis of the pelvis and vertebral column. The long arrow demonstrates calcification of the sacrotuberous ligament.

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Figure 4. X-ray of the cervical spine. The white arrow shows osteosclerosis of the posterior longitudinal ligament.

## DISCUSSION

Skeletal fluorosis (SF) is endemic in India. India lies in the geographic fluoride belt that extends from Turkey to China and Japan through Iraq, Iran, and Afghanistan.<sup>1</sup> In India, 60 million people are estimated to have health problems because of consumption of fluoride-contaminated water.<sup>2</sup> In the US, data from a 1999-2004 national health and nutrition examination survey<sup>3</sup> and from a 1986-1987 national oral health survey<sup>3</sup> of school children showed that about 23% of the population aged 6-49 years had some form of SF. Prevalence of dental fluorosis was higher in adolescents than adults. SF is caused by prolonged ingestion or (rarely) inhalation of fluoride ions.<sup>4</sup> Chronic fluoride toxicity leads to poor bone quality and painful calcification and ossification of tendons and ligaments. The generally accepted average serum fluoride level is 0.15 ppm. The World Health Organization has set the upper limit of fluoride concentration in drinking water at 1.5 mg/L.<sup>5</sup> The Bureau of Indian Standards has decreed that 1.0 mg/L is the maximum permissible limit of fluoride in drinking water in India.<sup>6</sup>

Dental fluorosis, also known as mottling of teeth enamel, is divided into three grades<sup>7</sup>:

Grade 1: White, chalky opacities or patches on tooth enamel with or without faint yellow lines.

Grade 2: Distinct brownish discoloration of the tooth.

Grade 3: Pigmentation and pitting of tooth enamel surfaces, sometimes with chipping of edges.

Changes in fluorosis are most marked in the spine, pelvis, and ribs. Radiologic features of SF include increased bone density (osteosclerosis); osteopenia/osteoporosis; trabecular blurring or haziness; ossification of the attachments of tendons, ligaments, and muscles; interosseous membrane calcification<sup>8</sup>; and ossification of the posterior longitudinal ligament.<sup>9</sup> Urinary fluoride levels are the best indicators of fluoride intake. Since fluoride concentration is not the same throughout the day, 24-hour samples of urine are more reliable. Normal urinary fluoride levels range from 0.1 ppm to 2 ppm. Endemic fluorosis can manifest with both dental and skeletal changes. Management of fluorosis generally focuses on symptom treatment. Patients with SF are advised to keep away from fluoride intake. Fluoride mobilized from the skeleton gets excreted very slowly through urine and feces,<sup>10</sup> and patients with SF will excrete large amounts of fluoride for years. ❖

## Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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