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Problem-Based Learning

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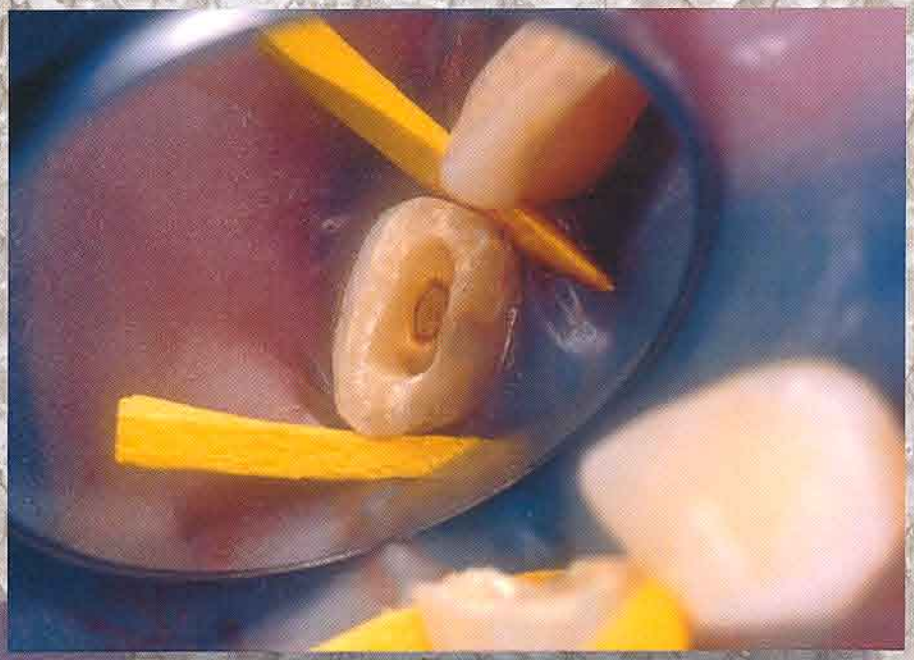
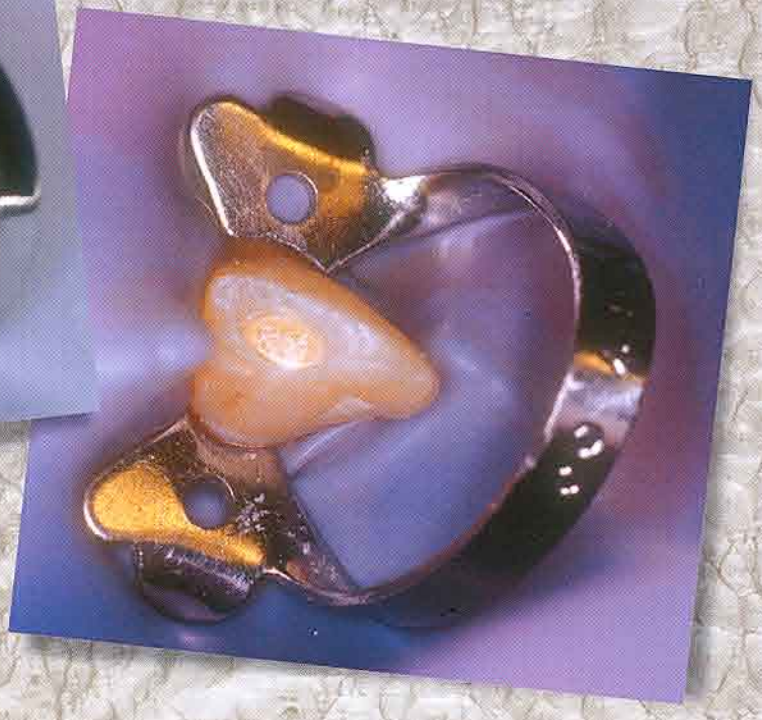
CROWN FRACTURES WITH EXPOSED PULPS





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DEPARTMENTS

FEATURES

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Amalgam, Autism and the Beauty of Holland

Steven A. Gold, DDS

By now, you may be aware of a recent lawsuit filed in Los Angeles County in which the California Dental Association was named as a defendant. The plaintiffs claim that their son was born autistic as a result of silver amalgam fillings in his mother's mouth. Among other defendants named are the American Dental Association and several amalgam manufacturers. The suit claims that there was a conspiracy on the part of the defendants to cover up both the facts that amalgam contains mercury and that amalgam has proven adverse health effects. Of course, most dentists feel this claim is unsubstantiated and, as one CDA leader put it, "completely without merit." The ensuing course and ramifications of this lawsuit remain for speculation, but we can be sure that the dental profession will, once again, mount a considerable effort to meet the challenge of defending its integrity. The case will likely receive ample coverage in association news publications.

While such claims are, at the least, alarming and frustrating to the dental profession, I cannot help but feel that the true victims in this situation are the parents of the autistic child. Not only do they have the challenge of caring for and raising an autistic child, but someone has also obviously misled them as to the potential cause. Perhaps in their own anger and frustration, they have sought this recourse as a way to pacify those feelings and gain some sort of satisfaction. However, the action they have chosen is likely only to produce a lose-lose-win situation for themselves, the dental profession, and their attorney, respectively.

I can only imagine the feelings parents must experience when they are faced with the prospect of raising a child who is anything other than normal and healthy. Perhaps there are no words that can adequately comfort those facing such a crisis, however the poignancy of the following story is a reminder that hope is always worth searching for. I heard it told by Dr. Marvin Berman, who lectures on dental behavioral management of children. I hope it inspires you, as it did me, to maintain an optimistic point of view as you meet the challenges of life; whether it is fighting for the integrity of the dental profession or caring for a loved one with a disability.

On the day they found out their child was autistic, a bewildered young couple asked one of their son's doctors how they could best cope with their child's condition. She responded in the following way: "Imagine that the two of you have decided to take a vacation to France. It has been a long-time dream, and so you begin to plan with excitement and enthusiasm. You research the best time of year to go. You decide on all the places in the country you want to visit and the activities you would like to do. An itinerary is drawn up, and travel and accommodation reservations are made far in advance. You study up on the culture, customs, and even take an intensive crash course in French

to maximize the enjoyment of your visit. Passports are secured. As your departure date nears, you carefully pack your bags for the trip with all the clothes and belongings appropriate for your stay in France. Your excitement builds and after a last-minute check to make sure everything is in order, you are off to the airport. The long flight is passed by pleasant thoughts of the experience ahead of you. You draw closer to your destination and finally touch down, ending a perfect flight. As the plane slows, a flight attendant happily announces, Welcome to Amsterdam.'

"You expect that this is either a cruel joke or a mistake and await a second announcement that you are, in fact, on the ground in Paris. But it does not come. First there is denial. Surely this cannot be. Perhaps proceed through customs and leave the airport to see for yourself. But there is no doubt. The architecture, the canals, and the sounds of Dutch being spoken finally convince you that you are in Amsterdam. Your denial turns to panic and confusion. You have no reservations for accommodations and you have no idea where to begin to look. The language, currency customs and countryside are all unfamiliar to you. You have clothes for the mild climate of France and outside it is cold and gray. At this point, you have a decision to make. You can spend your entire vacation trying to figure out what went wrong and who is to blame; and you can occupy your thoughts by longing for the beauty of France. However, if you do, then you will surely have a miserable vacation and more importantly, you will miss out on what is right in front of you: the beauty of Holland."

CDA JOURNAL, VOL 30, Nº6

UCSF Scientists May Have Found Link To Early Childhood Tooth Decay

By Collette Knittel

A two-year-old Latina child's mouth was aching, and she was quietly crying herself to sleep. But the pain, disease, and enormous costs of treatment for her tooth decay were all preventable, according to scientists at the University of California, San Francisco School of Dentistry.

In a recent study published in the Journal of Clinical Pediatric Dentistry, clinicians and researchers worked together to study bacterial, behavioral, and environmental factors associated with early childhood caries. They found that ECC is a preventable condition characterized by decay of primary teeth that may begin as an infant's teeth erupt, long before his or her first year. What is also significant is that the 2-year-old was probably infected by her own mother's mouth bacteria due to lack of dental health care in underserved and poor communities, the study found.

In the UCSF study, researchers assessed salivary levels of the bacteria mutans streptococci and lactobacilli \ in underserved, predominantly Hispanic children. One hundred forty-six infants and toddlers aged 3 to 55 months with dental decay were identified and examined. The study demonstrated significant association between relatively low cariogenic bacterial levels and dental caries in infants and toddlers. The same bacteria strain \of the mother or caretaker was found in the infants and toddlers. The study also showed that ECC correlates significantly with the child's age and lack of dental insurance of the children and that ECC also correlates with both low family income and the less education of the mother of the child.

Francisco Ramos-Gomez, DDS, MSc, MPH, UCSF associate professor of pediatric dentistry in the department of growth and development and director of the Pediatric Dental Services at San Francisco General Hospital Medical Center, is lead author of the study. "This population needs help from all of us; from policy-makers, health care providers, and from those serving the children," Ramos-Gomez said. "The cost of a full-mouth rehabilitation under general anesthesia of a 2-year-old is about $10,000. If we can make an impact on the population by teaching them directly how to care for their infants before the damage is done, we can save the children from the pain and society from the costs of repairing the decay."

Study subjects were recruited from three sites based at the SFGH Medical Center -- the Family Dental Center; the Women, Infant and Children Program; and the Well Child Clinic. All of these sites serve primarily low-income Hispanic and African American families.

The population studied included the following demographics:

- All of the children were from San Francisco.
- 45 percent were female; 55 percent were male.
- The median age was 30 months (range from 3 months to 55 months).
- 137 were of Hispanic origin (Mexican, Mexican-American, Central American or from Puerto Rico).
- Two were African American and four were non-Hispanic whites.
- 15 percent of the children were from single-parent families.
- 95 percent of caregivers were mothers; 4 percent were fathers and 1 percent were other relatives.
- Median age of the mothers was 27 years.
- Median age of the fathers was 28 years.
- 73 percent of parents had less than a high school education.
- 71 percent of families earned less than $15,000 per year.

The majority of parents (55 percent) had not seen a dentist in the previous two years, but 79 percent reported they currently had tooth decay.

Dental caries in preschool children remain a significant health problem in the United States. The prevalence of caries is especially high among low-income children, particularly Native Americans, Mexican-Americans and African Americans.

"There was a statistically significant correlation between ECC and lack of dental insurance of the children," Ramos-Gomez said. Children without dental insurance were more than twice as likely to have ECC as children with dental insurance.

"The most striking finding of our study was the low levels of MS bacteria associated with ECC in very young children," Ramos-Gomez said. "This finding may put these infants and toddlers at higher risk than previously thought." In these young children, threshold levels of both bacteria associated with caries were lower than in older children and adults, meaning that infants and toddlers are more at risk.

Efforts to reduce ECC should include improving dental education and access to dental care for adult caregivers. The UCSF research suggests that these two factors could significantly reduce transmission of MS from adult to child.

"Our study has been validated recently by two papers which confirmed that baby's mouths can be colonized with cariogenic (decay causing) bacteria before their teeth emerge," John D.B. Featherstone, PhD, said. Featherstone, UCSF professor and chair of the department of preventive

and restorative dental sciences, added that the UCSF study found that the levels of bacteria for infants that cause the beginnings of decay are very low compared to older children and adults. "Unfortunately," he said, "the lack of oral health of the mother or caregiver seems to perpetuate itself with these youngsters."

Benefits of Laser Surgery for Sleep Apnea Deteriorate With Time

Treatment of obstructive sleep apnea with laser-assisted uvulopalatoplasty provides some short-term benefit but results in worsening of snoring and existing apnea over time, according to an article in the April issue of the Archives of Otolaryngology -- Head & Neck Surgery.

Yehuda Finkelstein, MD, from the Meir Hospital, Sapir Medical Center in Kfar Saba, Israel, and colleagues studied 26 patients with obstructive sleep apnea who underwent LAUP to evaluate medium- and long-term results.

LAUP, introduced in 1990, is a popular surgical treatment that controls snoring by removing part of the uvula. This procedure is also being used to treat obstructive sleep apnea, a sleep-related breathing disorder, despite controversy surrounding the use of LAUP for apnea.

The researchers found that despite favorable short-term results, the apparent benefits of LAUP diminished with time. "A significant decline in snoring improvement from 88 percent (23/26) to 65 percent (17/26) was recorded; furthermore, the state of snoring worsened from 4 percent (1/26) to 12 percent (3/26)," wrote the researchers.

"Re-evaluation of the five other sleep-related symptoms after completion of LAUP uncovered a 50 percent improvement rate (13/26), and a 15 percent (4/26) worsening rate. Overall, satisfaction from the procedure was 58 percent (15/26)," the authors continued.

The authors attribute the late decline in snoring improvement, aggravation of apnea symptoms, and the overall failure of the study's objective measures to progressive fibrosis caused by thermal damage from the laser beam. They explain that the LAUP procedure consists of cutting and vaporizing palatal tissue, which leaves raw tissue that eventually scars. Heavy scarring can lead to progressive fibrosis. Eventually, the area of the back of the throat may narrow, become rigid and lose some of the distendability needed during inhalation.

Refunds Should Be Given Only After Release Signed

If patients are unhappy with treatment, most of the time all they want is a refund, wrote Eric Ploumis, DMD, JD, in the January 2002 *New York State Dental Journal*.

Rightly or wrongly, a patient may feel the treatment didn't measure up to expectations. Providing a refund is fine, Ploumis wrote, but it's essential to get a release.

He cited many reasons dentists should have patients sign a release before any money is refunded. Simply put, he said, by signing a release in exchange for money, a patient gives up the right to sue the dentist. Ploumis said it doesn't matter how much money is returned, a release is necessary.

The lure of a refund will prompt most patients to sign a release, but if the release is too formal or frightening, they may balk. Ploumis advised tailoring a release to suit the situation. Once signed, refund the money promptly, he wrote.

Even if a dentist feels the patient deserved a refund and senses no breakdown in the doctor-patient relationship, get a release, he said. Situations change rapidly; and once a refund is given, a patient can simply pocket the money and take any and all actions

Scientists Find Gene Involved in Gum Overgrowth

Dental researchers have known for decades that some people are born with gums that grow abnormally over their teeth. What they have never known is why.

In a recent issue of the American Journal of Human Genetics, dental researchers have their first clue. An international team of scientists reported that it has identified the first gene that, when altered, triggers hereditary gingival fibromatosis, the most common of these rare, inherited gum conditions.

The researchers noted that the gene, called SOS1, encodes a protein that is known to activate the "ras" pathway, one of the key growth signals in \ cells. The authors say this finding suggests that, when the SOS1 gene is not mutated, its protein and the "ras" pathway likely are involved in the normal growth of healthy gums, or gingiva, an idea that was previously unknown.

If confirmed, they said, learning how to turn on relevant portions of the pathway, like flipping a biological switch, might help dentists one day regenerate the gingiva naturally in people with receding gums or advanced periodontal disease. Conversely, by switching off the growth signal, dentists could prevent gingival overgrowth, meaning people with HGF might not need to have the excess tissue surgically cut away, now the standard treatment.

available unencumbered by the legal shackle of a valid release.

According to Ploumis, except for a simple overpayment refund, dentists should never return money to a patient without a release.

Ploumis said a release should consist of the following elements:

- The names of both the releasor (the patient) and the releasee (the dentist). If the patient is a minor, a parent or legal guardian must sign the release.
- A specific dollar amount the dentist intends to return to the patient. Avoid "fuzzy" language such as the dentist will return "one-half of the treatment fee."
- A statement that in returning the fee, the dentist admits to no liability. If this clause is not included, the patient may assume the dentist is refunding money because he or she did something wrong.
- An indemnification clause. Clearly state that the patient, by accepting a refund, waives the right to any future actions against the dentist and his or her associates, partners, employees, corporation, and heirs.
- Termination of the doctor/patient relationship. Even though this may seem obvious, make sure the patient knows that by accepting the refund, he or she is no longer a patient.
- Confidentiality agreement. This should stipulate that the terms of the release are confidential and not to be revealed to any outside parties.
- Signature of the releasor, releasee and at least one witness. Along with the necessary signatures, make sure the release is dated.

Dental Teaching Positions Going Unfilled

The dental profession is losing faculty due to retirement or entry into private practice, creating a vacuum that is not being filled, wrote Janet Walzer in the Winter 2001 Tufts Dental Medicine.

According to a report in the September 2000 Journal of Dental Education, the number of vacant faculty positions in U.S. dental schools stands at 400 full-time faculty, Walzer noted.

Those retiring in the next 10 years could number between 820 and 1,300, and younger dentists are not following in their footsteps, Walzer wrote. The number of dental students who plan to pursue an academic career has remained between 0.5 percent and 1.3 percent since 1980.

While 36 percent of those leaving the teaching profession stated it was due to retirement, 23 percent left to enter private practice. According to Walzer's article, the numbers say much about the issues that characterize the dental teaching crisis: the "graying" of dental school faculty, the lack of enthusiasm for teaching by younger dentists and the financial appeal of private practice.

Dr. Jackson Brown, associate executive director for health policy resources for the American Dental Association, and Dr. Richard W. Valachovic, executive director of the American Dental Education Association and co-author of the September report, believe the profession must address faculty compensation in its broadest sense, highlighting the perks of an academic life in addition to reexamining salaries and benefits.

Some things could make it (teaching) more appealing, Brown noted, such as more time for research and intellectual pursuits as well as for clinical activities.

Dentists who choose academia have always had to make financial compromises in contrast to their peers who enter private practice, Walzer noted in her article. Even if dentists have a love of teaching, the reality of skyrocketing tuition and the resulting student debt have the potential to turn love into ambivalence, Walzer wrote.

Pet-Assisted Therapy Comes to the Dental Office

One thing one might not expect to see in a dental office is a dog. But for one Portland, Ore., dentist, a dog is "normal" in the office, according to an article in the January 2002 issue of Membership Matters, the newsletter of the Oregon Dental Association.

Not just any dog, but one who has been trained and certified for "animal-assisted therapy."

Julie Debansky, dental assistant for Dr. Alan R. Pike, a Portland-based pediatric dentist, owns two pet-assisted therapy dogs, Morgan and Madison. On her days off from the dental office, Debansky takes her dogs to a local hospital to visit patients.

She noticed that apprehensive children in the dental office became more relaxed when she showed them pictures of her dogs. One child requested that Debansky bring her dogs to the office.

After checking with Dr. Pike and the appropriate regulatory agencies, she began bringing her dogs to the dental office dressed in their office "Pet-Assisted Therapy" vests.

Pike said the effect on some of the children -- and their parents -- was amazing. Many children focused more on the dogs and worried less about their checkups, he said.

Pike said anecdotal evidence suggests he is able to offer a more homelike environment for his patients who might sometimes be a bit overwhelmed by the dentist's office. That makes the children and their parents more relaxed, and helps establish a good dentist-patient relationship, Pike said.

CDA JOURNAL, VOL 30, Nº6

Sucralose May Help in Caries Prevention

When used to replace sugar, both sucralose and the tested sucralose-based sweeteners may be useful in the dietary management of caries, wrote Irwin D. Mandel, DDS, and V. Lee Grotz, PhD, in the Journal of Clinical Dentistry, Vol. XIII, No. 3.

Sucralose, a new type of noncaloric, high-intensity sweetener, was recently approved for use by the U.S. Food and Drug Administration. Several studies of the drug show that sucralose is noncariogenic, the authors wrote.

Sucralose-based sweeteners that contain bulking ingredients, which allow them to pour and measure more like sugar, do have cariogenic potential due to the presence of added fermentable carbohydrate. Mandel and Grotz said, however, that the data suggest that both the currently marketed sucralose granular and packet products are less cariogenic than sugar.

Mandel and Grotz noted that diet modification to reduce the intake of sugar-containing foods is a widely accepted approach for the prevention of dental caries.

They wrote that the most significant dental-related studies of sucralose were conducted in the 1990s. The authors noted that the basic study of the effects of sucralose on bacterial metabolism was done by Young and Bowen on 10 strains of oral bacteria, including S. mutans and other acidogenic plaque organisms that can play a contributory role in the initiation and progression of caries.

Investigators found that sucralose, as a sole carbon source, was unable to support the growth of any strains tested.

Their article reviewed six studies that show that sucralose does not promote dental caries. The authors said the in vitro study established the inability of sucralose to be utilized by cariogenic bacteria.

Honors

Peter S. Young, DDS, of Arcadia, Calif., has been installed as the first Chinese American president of the Arcadia Chamber of Commerce. Dr. Young is an assistant professor at Loma Linda University School of Dentistry and maintains a family and cosmetic dental practice.

CDA JOURNAL, VOL 30, Nº6

Treatment of Crown Fractures With Exposed Pulps

Lucía Blanco, DDS, and Stephen Cohen, MA, DDS

ABSTRACT Traumatic injuries are a common cause of pulpal damage in anterior teeth. Crown fractures with exposed pulps represent 18 percent to 20 percent of the traumatic injuries that involve the teeth. This clinical study comprised 36 patients, who were referred for 40 crown fractures with pulp exposures. There were 39 maxillary incisors and one mandibular incisor. The partial pulpotomy (Cvek's technique) consists of amputating exposed pulp tissue to a depth of 1 to 2 mm below the point of pulp exposure. After partial pulpotomy, the pulpal wound is covered with calcium hydroxide; and the cavity is sealed with glass ionomer cement or a composite crown. Clinical and radiographic assessment of the hard tissue barrier was done after three months. Patients were monitored for periods ranging from one to 12 years. The purpose of this clinical report was to evaluate Cvek's technique in the management of coronal fractures with pulp exposures and the long-term outcome of the partial pulpotomy in immature and mature teeth. In virtually all of the cases, this treatment was successful. Careful partial pulpotomy remains a prudent treatment choice with proper case selection.

Author

Lucía Blanco, DDS, is a member of the International Council in Dental Trauma and maintains a private endodontic practice in Argentina. He is a consultant on dental trauma for several hospitals in Argentina and a professor in the postgraduate school of the Argentine Association of Dentistry. He is currently president of the Dental Trauma Committee of the Argentine Society of Medicine and Trauma Surgery.

Stephen Cohen, MA, DDS, is the senior editor of all eight editions of the endodontic text Pathways of the Pulp as well as senior content editor and endodontic subject matter expert for newMentor's series of dental continuing education CD-ROMs and Internet educational services. He is a diplomate of the American Board of Endodontics and has held leadership positions in all of the major professional and academic organizations in endodontics. He maintains a full-time endodontics practice in San Francisco, where he has practiced since 1969. From 1970 until 1988, Dr. Cohen served as chairman of the Department of Endodontics at the University of the Pacific School of Dentistry; and he has continued his involvement with UOP as an adjunct clinical professor of endodontics.

Traumatic injuries are a common cause of pulpal damage in anterior teeth. Crown fractures with exposed pulps occur in 18 percent to 20 percent of traumatic injuries involving the teeth.1 These traumatic injuries must be managed correctly for complete pulp repair. Most dental trauma occurs in recently erupted or young permanent teeth that have immature roots;1-4 for this reason the goal of prudent treatment is to preserve normal pulp function. The partial pulpotomy (Cvek's technique)5 provides dentists with an effective alternative to complete endodontic therapy. It consists of the clean amputation of the exposed pulp tissue to a depth of 1 to 2 mm within dentin of the pulp chamber. After pulpotomy, the pulpal wound is covered with calcium hydroxide powder; then the prepared cavity is sealed with a glass ionomer cement or a composite crown.

Figure 1a. Complicated distal crown fracture and incisal fracture in maxillary left incisor in 8-year-old boy three hours after accident. Facial view.

Figure 1b. Palatal view.

Figure 1c. Preoperative radiograph.

Figure 1d. Extraction of the fractured piece.

Figure 1e. After extraction, the exposed pulp tissue presents a little hemorrhage with a clot.

Figure 1f. After removal of restoration, a hard tissue barrier is observed, three months after partial pulpotomy.

Figure 1g. Radiograph three months after partial pulpotomy, pulp continued normal function.

The size of the pulp exposure, the time elapsed between the accident and treatment, and the maturity of the roots are important but not critical factors for the long-term success of this treatment.5-8 The purpose of this clinical report was to evaluate the outcome of the partial pulpotomy technique in 36 patients with 40 coronal fractures with exposed pulps. The followups ranged from one year to 12 years.

Material and Methods

The clinical study comprised 36 patients (26 males, 10 females), ranging in age from 6 to 42 years, who were referred for 40 vital permanent incisors with complicated fractures, 39 in maxillary incisors and one in a mandibular incisor. Twenty-one teeth had open apices, and 19 had mature apices. Two maxillary central incisors presented crown-root fractures with exposed pulps (Figures 1a through g and 2a through g).

Preoperative examination revealed that the exposed pulp tissue of two immature incisors had been previously covered with a zinc-oxide-eugenol cement. Because direct contact between ZOE cement and exposed pulp tissue produces predictable inflammation,9 a partial pulpotomy was performed in both teeth (Figures 3a through k).

The time elapsed between the accident and dental treatment ranged from one hour to four days: Five teeth were treated within one to three hours; 21 teeth were treated after two days; one tooth was treated after three days; and 11 teeth were treated after four days (Figures 3a through k, Figures 4a through f, and Figures 5a through f). Only one case had to be treated three months after the accident.

Following local anesthesia and rubber dam isolation, the pulp exposures were cleaned with copious sterile saline solution; pulps were amputated to a depth of 1 to 2 mm within dentin with a new, sterile round diamond bur #.010 or #.012 in a high-speed turbine with copious water-cooling.

Bleeding was controlled by flushing

Figure 2a. Complicated vestibular crown-root fracture in maxillary right incisor and uncomplicated vestibular fracture in maxillary left incisor, in 13-year-old girl 36 hours after accident. Facial view.

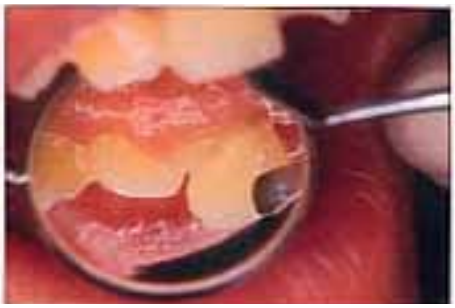

Figure 2b. Palatal view.

Figure 2c. Preoperative radiograph.

Figure 2d. After extraction of fractured portion, the exposed pulp shows some bleeding.

Figure 2e. Hard-tissue barrier three months after partial pulpotomy.

Figure 2f. Postoperative radiograph.

Figure 2g. Follow-up three years after partial pulpotomy, the pulp continued normal function and responded within normal range to thermal and electric pulp tests.

continuously with a sterile saline solution to avoid clot formation. Calcium hydroxide powder was passively applied over the pulpal wound with a sterile amalgam carrier with a small lumen and gently compacted with a sterile cotton pellet moistened with sterile saline (Figures 3a through k).

The partial pulpotomy cavities were sealed in four teeth with a ZOE cement, in 17 with a glass ionomer cement, and in 19 with a metal crown specially manufactured with a small facial opening to permit vitality testing.

Results

The teeth were examined clinically and radiographically after seven, 15, 30, 60, and 90 days. In 39 teeth, the temporary restoration was removed after three months. A hard-tissue dentinal barrier was formed in all 40 teeth and was covered with calcium hydroxide cement (Dycal, Caulk Dentsply, Milford, Del.). Then all teeth were permanently restored with a glass ionomer cement covered with a composite. One tooth was monitored only radiographically, because after partial pulpotomy the tooth was immediately restored with a glass ionomer cement and composite (Figures 6a through c). Follow-up periods ranged from one to 12 years. At each follow-up visit, periapical radiographs were exposed along with electric pulp testing. All teeth were re-examined after one year; 34 teeth were re-examined after four years; and six teeth were closely followed for 12 years. Pulp repair was considered to have occurred according to Cvek's criteria when the teeth:

- Remained asymptomatic;
- Showed no radiographic evidence of intra- or periradicular pathologic degeneration;
- Showed complete root development in immature teeth; and
- Retained normal pulp sensitivity.

Followups should continue as long as possible (Figures 3a through k and 6a through c).

Under the conditions of this study,

Figure 3a. Complicated crown fracture in maxillary left incisor and uncomplicated fracture in maxillary right incisor, in 7-year-old girl four days after accident. Maxillary right incisor showing a celluloid crown cemented with zinc-oxide eugenol cement.

Figure 3b. Preoperative radiograph.

Figure 3c. The exposed pulp shows surface clinical necrosis (there was direct contact with zinc-oxide eugenol.

Figure 3d. Preoperative radiograph without crown.

Figure 3e. Partial pulpotomy performed, the amputation was deeper.

Figure 3f. Calcium hydroxide powder applied over the pulp wound.

Figure 3g. Postoperative radiograph.

Figure 3h. Metal crown cemented with an opening to permit vitality testing.

Figure 3i. Radiograph showing the hard tissue barrier (arrow).

Figure 3j. Removal of the metal crown showing hard-tissue barrier three months after partial pulpotomy.

Figure 3k. Follow-up 10 years after partial pulpotomy, the radiograph showing normal function of the pulp in left incisor, the patient had a second accident, with a severe luxation in the right incisor, showing the endodontic therapy.

pulp repair was completely successful in almost every tooth treated; one tooth failed due to a severe luxation injury.

There was no observable difference between immature or mature teeth in terms of pulp repair. The time elapsed between the accident and dental treatment was not critical for success.10-11 All teeth showed radiographic evidence of dentin bridge formation.

Figure 4a. Complicated fracture in maxillary left central incisor in 9-year-old boy, two days after accident. The appearance of the exposed pulp.

Figure 4b. Preoperative radiograph.

Figure 4c. Radiograph seven days after partial pulpotomy, showing initial hard-tissue barrier (arrow).

Figure 4d. Radiograph three months after partial pulpotomy.

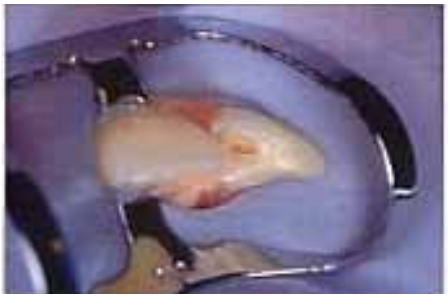

Figure 4e. Clinical aspect of the hard-tissue barrier.

Figure 4f. Radiograph three years after partial pulpotomy, showing a line of hard-tissue barrier into the canal.

Discussion

Patients with complicated coronal fractures were referred for dental emergency care at different periods following the trauma. Thus, the exposed pulps revealed either a fresh wound or proliferative changes (Figures 7a through f). The inflammatory changes in the pulp tissue in this time interval are superficial.5 Only 1 to 2 mm of the pulp should be removed to cover the non-inflamed pulp with calcium hydroxide because the inflammatory changes in the pulp are superficial (i.e., 1 to 2 mm).5

Partial pulpotomy has distinct advantages because the amputation of only the pulp horn is minimal, thereby permitting the preservation of the cell-rich coronal pulp tissue, a necessary element for healing and preserving the physiological apposition of dentin in the coronal area.12-14 By contrast, the cervical pulpotomy removes all coronal pulp tissue; and the coronal area remains without dentin apposition, thereby increasing the risk of cervical fracture.4 Furthermore, pulp capping might be an alternative treatment in certain types of crown fractures with exposed pulps; but it too has limitations, i.e., the time elapsed between the accident and the dental treatment must be very prompt -- not more than a few hours after accident.15-18 When exposed pulps present with a clot, the clot must be carefully removed because calcium hydroxide should not be placed over a blood clot12-13 (Figure 1e). Another advantage of partial pulpotomy (compared with pulp capping) is better retention of the dressing material.15

In partial pulpotomy, the time of exposure is a secondary factor, because the pulp has rich vascularization and produces a robust defense reaction against bacterial contamination.19-20 As stated earlier, one cause of failure could be severe luxation of the tooth, with the disruption in the blood supply to the pulp. Another cause of failure could be microleakage, because it produces bacterial contamination in pulp tissue ending in pulp necrosis.21 Still another cause of failure for partial pulpotomy could be an incorrect diagnosis of pulp vitality.

The material used over the fresh pulp wound is calcium hydroxide powder. Calcium hydroxide enables formation of a thin layer of coagulation necrosis because Ca(OH)2 exerts a low-grade irritation on the pulp sufficient to stimulate the formation of hard tissue barrier.22-23 A radiograph exposed after seven days shows early dentinal barrier formation (Figure 4c); a complete dentinal barrier was observed at three months.20

Recently, some other studies recommended different materials such as mineral trioxide aggregate24 to stimulate a dentinal bridge after pulp amputation. Although these studies are encouraging, more longitudinal information will be

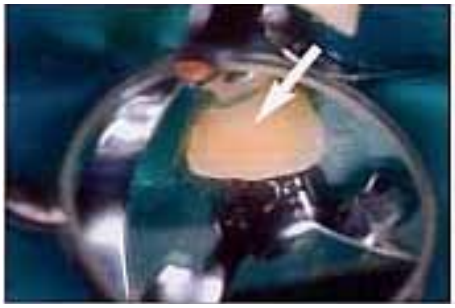

Figure 5a. Complicated fracture in maxillary left central incisor in 10-year-old boy two days after accident. The hemorrhage pulp can be seen through the dentin (arrow).

Figure 5b. Preoperative radiograph showing the apex of the maxillary left central incisor with the apex more open than the right central incisor

Figure 5c. Pulpotomy performed.

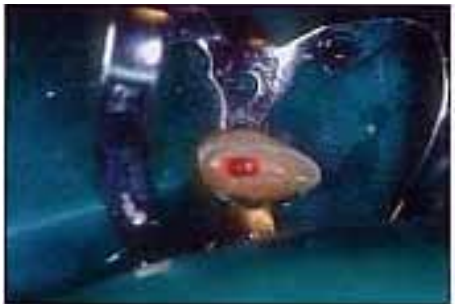

Figure 5d. Bleeding controlled.

Figure 5e. Clinical aspect of the hard-tissue barrier.

Figure 5f. Radiograph 3½ years after partial pulpotomy, the apex continued to mature and the pulp retained normal function.

needed before these newer materials can be adopted.25

The size of the exposure, the time elapsed between the accident and the treatment, and the maturity of the roots are not critical factors in selecting the partial pulpotomy. Because some variables (e.g., size of the pulp exposure initially) are not recorded, this type of study does not allow for a reasonable statistical analysis.

The long-term observations of the teeth treated with Cvek's partial pulpotomy technique appear to result in a successful permanent treatment.

Clinical and histological findings confirm that the partial pulpotomy is a successful permanent treatment in both immature and mature teeth.20

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Figure 6a. Complicated fracture in maxillary left incisor and uncomplicated fracture in maxillary right incisor in 42-year-old woman, two hours after accident. Photograph of the exposed pulp.

Figure 6b. Radiograph of the exposed pulp (arrow).

Figure 6c. Radiograph 12 years after partial pulpotomy and restoration. There are no pathologic changes.

Figure 7a. Complicated fracture in maxillary right central incisor in 12-year-old girl, two hours after accident. View of the exposed pulp.

Figure 7b. Another view of the exposed pulp revealing proliferate changes and hemorrhage.

Figure 7c. Preoperative radiograph.

Figure 7d. View of the hard-tissue barrier three months after partial pulpotomy.

Figure 7e. Another view of the hard-tissue barrier three months after partial pulpotomy.

Figure 7f. Radiograph six months after partial pulpotomy.

CDA JOURNAL, VOL 30, Nº6

Dental Care for Individuals With Developmental Disabilities Is Expensive, but Needed

H. Barry Waldman, DDS, MPH, PhD, and Steven P. Perlman, DDS, MScD

ABSTRACT More than $35 billion in additional lifetime costs will be expended for all children in the United States born with mental retardation in 1998 alone. The figure is $4.7 billion for California children. These numbers include neither the costs for individuals with other developmental disabilities, nor the costs for dental services. Despite the findings that individuals with mental retardation have more untreated dental needs than individuals in the general population, most dental students and many practitioners have limited experience in providing care for patients with special needs. The significant additional general costs for the care of people with mental retardation and other developmental disabilities are a reality, but the dental profession must not lose sight of the need for its members to provide services for these individuals.

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Between 6.2 and 7.5 million Americans of all ages, or 3 percent of the general population, experience mental retardation. Nearly 26 million, or 1 in 10 families in the United States, are directly affected by a person with mental retardation at some point in their lifetime."1

"Estimates of the per-person lifetime costs of specific developmental disabilities include $797,592 for mental retardation."2

The cost of raising a child continues to rise and is highest for families living in cities in the Western United States. The Department of Agriculture estimates that a middle-income ($36,900 to $62,000 a year before taxes) two-parent family in the urban West will spend $173,880 to raise a child born in 1999 to age 18.3 There are significant additional costs involved in raising a child with mental retardation.

In 1998, 44,500 children with mental retardation were born in the United States (including 1,681 children with Down syndrome4), 5,900 of those in California. It is estimated that $35.5 billion in additional lifetime costs will be expended for all U.S. children with mental retardation born in 1998, $4.7 billion for those born in Californiaa (**Table 1**).2 The estimated additional lifetime costs for children born with mental retardation in 1998 are more than $1 billion in Florida, Georgia, Illinois, Michigan, New Jersey, North Carolina, Ohio, and Pennsylvania;

CDA JOURNAL, VOL 30, Nº6

more than $2 billion in New York; and more than $ 3 billion in Texas (TABLE 2).

In addition, estimates of additional per-person lifetime costs for other developmental disabilities include $706,704 for cerebral palsy, $275,717 for hearing impairment, and $386,074 for vision impairment.2 Based upon these approximations, nationally, there would be $11 billion in additional lifetime costs for children born in 1998 with these three disabilities, $1.5 billion for those in California (TABLE 1).

These figures do not include the costs of care for children born with other disabilities in the same year, including:

- 4,639 babies born with heart malformations;
- 838 babies born with spina bifida/ meningocele;
- 3,127 babies born with cleft lip/palate;
- 3,258 babies born with polydactyly, syndactyly/adactyly; and
- 2,178 babies born with clubfoot.4

Table 1. Estimated lifetime costs (in billions) for children with selected birth disabilities born in 1998 (United States and California) [2]

	United States	California
Mental retardation		
Number	44,468	5,889
Costs ($797,592 per person)	$35.5	$4.7
Cerebral palsy		
Number	11,603	1,548
Costs ($706,704 per person)	$8.2	$1.1
Hearing impairment		
Number	4,715	631
Costs ($275,717 per person)	$1.3	$.2
Vision impairment		
Number	3,885	531
Costs ($386,074 per person)	$1.5	$.2
Total		
Number	64,671	8,599
Costs	$46.5	$6.2

Dental Costs Not Included

Oral health problems, visual impairment, and mental health disorders are among some of the more significant secondary health conditions that contribute to the compounding difficulties faced by individuals with mental retardation.5 But because specific costs of dental services for individuals with mental retardation are unavailable, estimates of additional lifetime costs do not include oral health services (Personal communication, M. Yeargin-Allsopp, National Center on Birth Defects and Developmental Disabilities, September 2001)

Significant Oral Disease

- Children and adults with mental retardation have more untreated caries than the general population."5,6
- (Studies on oral health indicate) prevalence estimates of gingivitis in the range of 60 percent to 97 percent among individuals with mental retardation with estimates of 28 percent to 75 percent in the general population."5-7

National and international studies do not provide definitive data on the prevalence of dental conditions among those with mental retardation.8,9 An extensive series of local studies do indicate that, as in the general population, two of the most common oral heath problems of children and adults with mental retardation are dental caries and periodontal disease. For example:

- Studies of youngsters and adults living in institutions and in local communities report decayed, missing and filled teeth scores close to those in the general population.6,10,11 However,
  - The proportion of missing teeth to filled teeth was much higher among individuals with mental retardation than in the general population, suggesting that extraction, rather than restoration, is the primary treatment of dental problems among individuals with mental retardation.10
  - Youngsters with severe mental retardation had fewer dental caries than children with mild or moderate mental retardation.8,12,13
- Specific studies of athletes at Special Olympic events report that 6- to 8-year-old children with mental retardation had similar patterns of dental caries as children of the same age in the general population. But overall prevalence of untreated caries and gingivitis in athletes was greater than in the general population.b14-16

Table 2. Estimated lifetime costs (in millions) for children with mental retardation born in 1998 by state2

State	Costs (in millions)	State	Costs (in millions)
Alabama	$558	Missouri	$678
Alaska	89	Montana	97
Arizona	704	Nebraska	211
Arkansas	331	Nevada	258
California	4,697	New Hampshire	129
Colorado	536	New Jersey	1,031
Connecticut	394	New Mexico	245
Delaware	95	New York	2,325
Dist. Of Columbia	69	North Carolina	1,005
Florida	1,761	North Dakota	71
Georgia	1,101	Ohio	1,375
Hawaii	158	Oklahoma	445
Idaho	174	Oregon	407
Illinois	1,644	Pennsylvania	1,313
Indiana	766	Rhode Island	113
Iowa	335	South Carolina	485
Kansas	345	South Dakota	92
Kentucky	489	Tennessee	696
Louisiana	602	Texas	3,082
Maine	123	Utah	406
Maryland	648	Vermont	59
Massachusetts	733	Virginia	849
Michigan	1,203	Washington	717
Minnesota	587	West Virginia	186
Mississippi	386	Wisconsin	607
		Wyoming	56

- Overall prevalence of untreated dental decay among Special Olympic athletes of all ages is 24.6 percent, compared with prevalence estimates in the general population (20 percent among school-aged children and 14.2 percent among working adults).16-19
- Individuals with Down syndrome are more susceptible to gingivitis and periodontal disease because they are thought to have underlying abnormal immunological responses.20
- The increased prevalence of oral health problems among individuals with mental retardation may be related to their oral habits -- poor oral hygiene (i.e., limited brushing) which, in the cases of moderate or severe mental retardation, may be associated with impaired physical coordination.10

Much of the variation in oral health status stems from where the individuals with mental retardation reside (i.e., the availability of service in a large state institution and the need to secure services from community practitioners) and the availability of community practitioners to provide needed services.21

Mainstreaming and Community Residences

During the past 30 years, the circumstances have changed for one large group of individuals with disabilities -- the hundreds of thousands of people with mental retardation/developmental disabilities who once were housed in large state institutions and psychiatric institutions. From 75 percent to more than 90 percent of these people now reside within local communities.22

Changing social policies, favorable legislation for people with disabilities, and class-action legal decisions, which delineated the rights of individuals with mental retardation, have led to deinstitutionalization (i.e., establishment of community-oriented group residences and enhanced personal family residential settings) and closure of many state-run large facilities.

The success of community-based programs depends upon the availability of support services, particularly by private practitioners who are convenient and accessible to the deinstitutionalized individual, and trained and willing to provide the needed care. The reality is that, "for some individuals with disabilities who reside in the community, comprehensive oral health care is inaccessible."23 The perceptions of staff members of community residences are that residents receive poorer quality health care, with particular emphasis on the limitation of dental services.24 In the past, large state institutions (to some degree) offered a wide range of in-house health services provided by medical and dental staff employees. Most of the current community residential facilities, however, are too small in size to provide intramural services. As a consequence, the monitoring and delivery of health care can be difficult when the services and health records are disseminated among multiple providers and locations. And most importantly, the residents in the community facilities are dependent upon local practitioners for health services.

Producing New Dentists

In 1993, the Academy of Dentistry for Persons with Disabilities surveyed all U.S. and Canadian dental schools to determine

the amount of curriculum time devoted to the care of patients with special needs. The average number of lecture hours devoted to the dental management of individuals with disabilities in a typical four-year curriculum was 12.9 hours, and 14 schools reported fewer than five hours of time. The average clinical instruction per student was 17.5 hours. Thirty-two schools reported fewer than 10 hours in the curriculum (or five patient appointments).25

In 1999, a second study showed an actual decrease in the time spent by students in the didactic and clinical phases of care for patients with special needs. Fifty-three percent of dental schools reported that they provided fewer than five hours of didactic training in special care dentistry. Clinical instruction in the care of patients with special needs constituted 0 percent to 5 percent of a predoctoral student's time in 73 percent of the responding dental schools.26,27

"The results of these two studies clearly indicate that, during their predoctoral education, current dental school graduates do not gain the necessary expertise to treat the special-needs patient."26,28

The procedures used for the treatment of patients with special needs usually do not differ from those used for the general population, except that certain modifications of these procedures may be required. The most important aspects of student clinical practice involving patients with disabilities are learning to apply previously learned procedures to the particular situations. Graduates who haven't had sufficient number and variety of patients with special needs during their formal years of training, "will not feel confident inviting these individuals into their private practices."26 Should recent graduates join ongoing practices, they still may not gain sufficient experience since most private practices exclude special need patients from their patient pool. (The reality for this exclusion is that dentists who are willing to treat people with disabilities often are inundated with referrals from colleagues who are not so inclined.26)

Barriers to Care

Reports suggest that individuals with mental retardation have four times more preventable mortality than individuals in the general population -- suggesting that care may alter the health trajectories of individuals with mental retardation.29 But there are real obstacles. For example:

- Managed care and fee schedules: As with the general population, many individuals with mental retardation who receive Medicaid have been transferred into managed care plans. The combining emphasis, however, on financial "bottom lines" and closed panels may not provide the additional necessary resources for people with special needs or the coordination of providers experienced with mental retardation.30,31
- Worth of individuals: Many writers have reported that health providers have negative attitudes and stereotyped ideas about individuals with mental retardation and their ability to maintain their health status, as well as "value judgments about the worth of individuals with mental retardation suggest(ing) that (providers) with negative attitudes may withhold treatment."32 (Unfortunately, there is the added reality that other patients in the waiting room may feel uncomfortable sharing waiting rooms with some of these patients.33)
- Communication: Individuals with mental retardation may be reluctant to seek health services because they are frightened of new surroundings and treatment procedures -- in particular dental visits. Premedication, sedation, use of physical or medical restraints, general anesthesia, and hospital operating room procedures may be necessary for behavioral management difficulties.34
- Physical and behavioral impairment: Physical and behavioral difficulties associated with comorbid neurological conditions (e.g., individuals with athetoid cerebral palsy have increased involuntary movement during stressful situations).5

Care for People With Mental Retardation Is Expensive

Whether it is care in general, or dental care in particular, services for people with mental retardation may be expensive and complicated by the inadequacy of third-party reimbursement and the difficulties of providing care to patients with mental retardation.35

While the significant general costs for the care of people with mental retardation may seem overwhelming, dentistry must not lose sight of the need for dental profession to provide necessary services for these individuals who increasingly reside in local communities. Or, as recently stated in the Journal of the American Dental Association,

"If we do not take a major step toward improving access to care, we will soon be forced to do this on someone else's terms."3

Notes

a. Per-person lifetime cost estimates are based on a cost-of-illness approach that measures the value of all resources used or lost because of a disability (excluding home care costs). Resources include physician office services, prescription medications, hospital inpatient services, therapy and rehabilitation services, long-term care services, special education services, illness, and premature mortality.2

b. Special Olympic athletes are not a random sample of the population with mental retardation. They are a "convenience" sample of individuals who may be at a higher I.Q. level, have more caregiver support, and may receive more services. As a consequence, the results from these oral screenings (without radiographs) may understate the oral conditions of the general population of individuals with mental retardation.

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CDA JOURNAL, VOL 30, Nº6

Application of Problem Based Learning to Clinical Dental Education

CHARLES F. SHULER, DMD, PHD

ABSTRACT Problem-based learning provides a mechanism for learning in a manner that most closely simulates the future practice environment. PBL was initiated in medical education in the 1960s, and two-thirds of U.S. medical schools use PBL in their programs. The University of Southern California School of Dentistry has moved to the PBL model to give its dental students the knowledge base required for the accreditation standards and to prepare them to be beginning general practitioners. This article explains how USC uses PBL in its dental curriculum.

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Problem-based learning requires three specific components for successful use of the pedagogy: small student groups, problems to evaluate, and student-centered analysis of the problem.1-3 The students investigate a problem following a specific process under the guidance of a faculty facilitator (Figure 1). In the PBL process, the students first identify the facts related to the problem -- those pieces of information known to be true. The facts are what the student group knows. Based on the facts of the problem, the students engage in a stage of critical thinking to determine their ideas about the nature of the problem. The ideas represent what the student group thinks about the case. The group's ideas can be prioritized from most likely to least likely and then used to establish the areas of research and learning needed to more clearly evaluate their ideas. The learning needs represent what the students need to know. Achieving the learning needs results in the generation of a series of new facts based on the content of the resources applied to the learning that can be used to evaluate the ideas and refine the student group's thinking about the problem. The learning needs represent new facts available to both the student and the group. Each student masters these learning needs and advances his or her individual knowledge base of the content which is critical to developing those competencies associated with a new graduate dentist. The learning needs

CDA JOURNAL, VOL 30, Nº6

are the curricular content of the dental education program and can be predicted by the faculty based on the presentation of the problem. All the problems presented throughout the four years of dental education contribute to the knowledge base required for accreditation and to prepare a student to be a beginning general practitioner.

The development of problem-based learning as a pedagogy in health education is not unique to dental education.4 PBL was initiated in medical education in the 1960s, and two-thirds of U.S. medical schools use PBL in their programs. In half of the medical schools using PBL, it is the primary pedagogy; while in the other half it represents the pedagogy of a subset of courses or curricular emphases. In the literature on medical education, it has been shown that the students who were enrolled in medical schools using primarily PBL were more prepared for clinical patient care and performed better in their clinical clerkships. They had learned the material in a context that was similar to the final application, and this was judged critical to knowledge retention and subsequent application. Professor H. Schmidt of the University of Maastricht in the Netherlands has published extensively on the outcomes of students learning in a PBL environment. He has concluded: "The closer the resemblance between the situation in which something is learned and the situation in which it is to be applied, the better the performance and the easier it is in respect of recall and application." The origin of PBL in medical education was based on the manner in which physicians approached the evaluation and treatment of patients.

In patient care, the PBL stage of identifying the facts is equivalent to determining the chief complaint, reviewing the history of present illness, reviewing the past medical history, and completing a physical evaluation. These facts of the clinical presentation of a patient are a critical first step and require the development of a process of evaluation so that all of the important aspects are reviewed. Based on these findings, the health professional develops a set of differential diagnoses, equivalent to the ideas, since these are meant to be inclusive and will become focused when additional data is obtained. Additional tests, radiographs, laboratory findings, and specialty consultations provide new data that is equivalent to the outcomes of the learning needs that students pursue while investigating a PBL problem. In the clinic, the chief complaint is further defined; and ultimately a definitive diagnosis is obtained that permits the initiation of a course of therapy. The development of a comprehensive approach to patient diagnosis is critical, and the PBL pedagogy has been shown to provide students with a process to comprehensively evaluate a problem.

Medicine has used an approach very similar to the PBL pedagogy in the education of residents. The use of "rounds" to involve all physicians on the service with the care delivered to all patients is based on the patient "problem." Each patient is reviewed and residents learn their clinical skills based on the care of these patients. Those areas that are not well-understood require additional tests, consultations, and review of the literature, equivalent to the process used in PBL. This is true of both medical and surgical specialties, and the technical aspects of surgery are reviewed with the resident groups during rounds and later applied by the individual in either the operating room or clinic. The group of residents who participate in the rounds support the cognitive learning of each individual with respect to the indications for and applications of a specific procedure. The group further provides a valuable resource to review outcomes, suggest alternative approaches in the future, and define experiences essential to advancing the necessary technical expertise.

Concerns have been raised that using PBL as a primary pedagogy in dental education may not provide the learning environment necessary to master the clinical skills required to demonstrate the competencies necessary prior to dental school graduation. The University of Southern California School of Dentistry has embarked on a strategy to use the student-centered, inquiry-based PBL pedagogy for both the basic and clinical sciences. In the basic sciences, PBL has been shown to be associated with improved performance on standardized tests.5 The use of PBL to support clinical learning is presented in this paper through the example of a case used to help students master the fundamentals of cariology and the procedures necessary to restore tooth surfaces to their appropriate form and function following carious destruction.

A Problem Used to Learn Cariology and Restorative Dentistry

The "problem" is the fundamental unit for the activities of the PBL student-learning groups. Two problems are presented here that are learned in sequence, the first to introduce the pathogenesis of dental caries and the second to introduce the restorative procedures required to treat the patient's dental caries. Each problem is pursued in a series of facilitated sessions with a faculty mentor. At the first session, the students meet their problem. In the present example, the patient with the

CDA JOURNAL, VOL 30, Nº6

problem is named Ivan Joyce Jr. (**Figure 2**). The students also receive critical documentation for the patient using the identical format they will use in the future in the USCSD dental clinic, including radiographs of the chief complaint region (**Figure 3**). Based on the information provided, the investigation of the problem will begin and range widely through the microbiology, pathology, histology, radiology, community, nutrition, behavior, and epidemiology. The problem will be pursued from "the molecule to the community." The students rapidly become engaged in their learning because the situation is easily visualized as a future patient care setting in their career.

The students continue to investigate the problem as additional facts become available and refine the nature of their investigations (Figures 4, 5 and 6). This investigation includes reviewing caries charting from exploring in the clinic, reviewing the appearance of Ivan's mother's teeth, and careful evaluation of a full-mouth set of radiographs. Ultimately, the student is charged with explaining to the simulated patient exactly what is wrong, what pathology requires treatment, and the etiology of the dental disease (**Figure 7**). The patient problem served as the "vehicle for learning"; however, the content mastered by the student is identical to the content in traditional lecture-based courses. The primary difference is that there is an absence of an artificial separation of content areas based on different course titles. Instead, the material is all mastered in a context highly relevant to a future practice experience, which, again, is the type of learning methodology that has been shown to be highly effective in generating student engagement and retention of knowledge.6 The students accomplish these learning outcomes in a two-week period meeting Monday, Wednesday, and Friday in facilitated sessions that push the content and advance the student understanding (**Table 1**). The major learning outcomes of the case of Ivan Joyce, Jr., are listed in **Table 2**. The intended goal of this case is to introduce the fundamentals of dental caries, fluoride, nutrition, and patient diagnosis. At the conclusion of the problem, each student now has a "practice" that includes a patient with dental disease that requires specific technical therapies. The practice includes a complete record with the data required to generate the appropriate diagnoses and develop a comprehensive treatment plan.

The students are not finished with Ivan Joyce, Jr., after the initial two-week PBL experience. Mr. Joyce remains a patient in the "practice," and he returns a few weeks later in the curriculum (**Figure 8**). His return models the experience that students will have in practice linking the diagnostic phase with the development of a treatment plan and the initiation of therapy. In the patient's return to the practice, he has decided that he wants to have the teeth treated to remove the disease and return them to optimal form and function. The second experience evaluating Mr. Joyce results in an in-depth analysis of the methods to restore teeth with Class I, II and V dental caries. In the problem, the patient is provided with the necessary information to make an informed consent regarding treatment and selects amalgam restorations. In this way, the problem leads the students to the critical learning needs related to the fundamental direct intracoronal restorations. In their second experience, the students master the basic information related to preparation design, the criteria to evaluate preparations, the dental materials required, and the appropriate instruments to complete the tasks (**Table 3**). At the completion of the problem "Ivan Joyce, Jr., Returns," the students have mastered the fundamental principles and basic content related to direct intracoronal restorative dentistry. What remains is the application phase to develop the psychomotor skills necessary to complete the restorative procedures. The treatment plan developed in the problem serves as the vehicle to move the PBL problem from the small-group sessions to the simulator laboratory.

Problem-Based Learning in the Simulator Laboratory

Treating a simulated patient represents the educational ideal, learning in a context relevant to the eventual application. Ivan Joyce, Jr., is the patient who will be "treated" in the simulator laboratory in weeks three to 16 of Trimester 3 as indicated in **Table 4**. The simulator laboratory provides a venue for the students to treat the "patients" in their practice and apply the restorative principles that have been learned in the problem setting. The students use the simulator laboratory with the approach they will ultimately use in all the clinical venues of the School of Dentistry. This includes adherence to infection control procedures and clinical record-keeping of the course of therapy of the patient. The treatment plan for the simulated patient is followed and dictates the procedures that will be completed on the typodont at each preclinical session. In the simulator laboratory, the only real differences from the ultimate setting in dental school clinics is the absence of saliva, the lack of anesthesia, and the absence of a patient behavior component. The treatment plan for the simulated patient has been developed by the faculty so that the progression of learning the clinical skills

CDA JOURNAL, VOL 30, Nº6

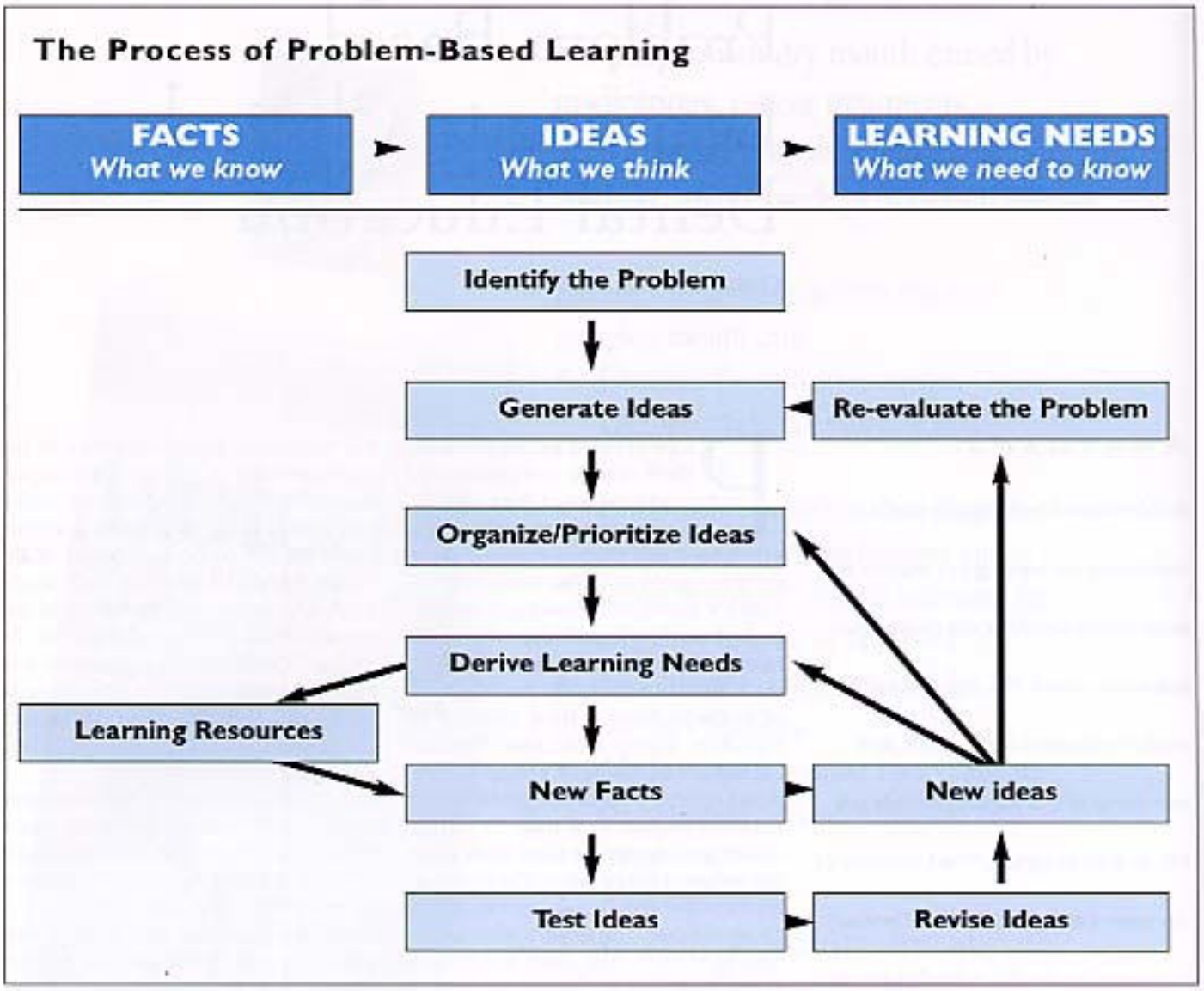

Figure 1. The Process of Problem-Based Learning

is quite similar to a traditional preclinical laboratory. In that manner, the learning can be structured however the students are engaged in the process since they are beginning to deal with the simulated patient in exactly the same manner as in their future student and private practices.

Another element key to PBL in the preclinical and clinical areas is the adoption of the learning strategies used in medical residencies. Each preclinical experience is initiated with a pre-session during which a group of students meet with their clinical mentor and discuss the procedures that will be applied to the simulated patient during the session (**Table 4**). The treatment plan is used as a guide; and the preparation design, materials, and clinical considerations are reviewed. This models the behavior that students will need to be prepared to deliver care to their patients and to understand the requirements for each clinical session. Following the pre-session discussion, each student individually treats the simulated patient following the protocols that were discussed. During this individual application phase, faculty experts continuously monitor student progress and provide assistance to achieve the calibrated outcomes that were intended. Several identical procedures can be completed on the simulated patients and can help the student to progressively build his or her clinical expertise. The progress of treating the simulated patient is recorded in the progress notes section of the preclinical record of Ivan Joyce, Jr., to continue

CDA JOURNAL, VOL 30, Nº6

modeling the types of activities that are required in the clinic and build the necessary expertise in patient record-keeping. At the close of each application phase, the student group reconvenes for a post-session to discuss the outcomes of the treatment of their simulated patient (**Table 4**). In these sessions, students identify areas of difficulty and areas that require both additional practice and additional learning. The new learning topics become subjects for discussion at future pre-sessions, and in this way the entire group of students benefits from the clinical experiences of all their peers. The treatment of the simulated patient follows the highest levels of quality and builds an approach to patient care that is readily transferable to the clinical setting.

Summary

The procedures and techniques used in the simulator laboratory and clinic have not changed from those traditionally taught at the USC School of Dentistry. Rather, the manner in which the students discover the learning has changed to an origination from the study of a patient-based problem that simulates a future clinical experience. The application of the knowledge to develop the psychomotor skills is facilitated by discussion sections in which students learn from all the experiences of their peers, in the same manner used by physicians in residency. The active participation of faculty experts to assist students in the development of their clinical skills is also facilitated by the discussion during which faculty can learn the strengths and weaknesses of their students. The creation of an atmosphere of supportive discussions and constructive critique begins to model the professional behaviors so critical for the success of the new graduate. Problem-based learning provides a mechanism for learning in a manner that most closely simulates the future practice environment and encourages the students to adopt professional behaviors and approaches to patient care that model the very best in the profession.7

Ivan Joyce, Jr., Part I

Ivan Joyce is a 22-year-old real estate salesman from San Marino who has completed all the required past medical history and personal information forms. He arrives in the office as a new patient with complaints of sensitivity of several posterior teeth following exposure to either cold drinks or sweets. There was no history of any sensitivity to either hot food or drink. On further questioning, the sensitivity seems particularly localized in the region of the mandibular left first molar.

Interestingly, Mr. Joyce reports that he has never previously sought the care of a dentist and that he eats a lot of candy and drinks several Cokes each day. His parents were born and raised in the panhandle region of Texas, where his father was an open-pit metal miner. Neither of his parents ever experienced any decay, although their teeth were mottled in appearance with some stains. Mr. Joyce says that his parents commented that, "it was something in the water back home," that affected their teeth. Ivan was born and raised in Los Angeles and has always been complimented by his parents for his white, straight teeth, which look much better than theirs.

A hard- and soft-tissue head and neck exam was completed and periapical radiographs of teeth 18-21 were completed to help diagnose the chief complaint.

Figure 2. Ivan Joyce, Jr., Part I

Figure 3. Radiographs for Ivan Joyce, Jr.

Ivan Joyce is a 22-year-old real estate salesman from San Marino who has completed all the required past medical history and personal information forms. He arrives in the office as a new patient with complaints of sensitivity of several posterior teeth following exposure to either cold drinks or sweets. There was no history of any sensitivity to either hot food or drink. On further questioning, the sensitivity seems particularly localized in the region of the mandibular left first molar.

Interestingly, Mr. Joyce reports that he has never previously sought the care of a dentist and that he eats a lot of candy and drinks several Cokes each day. His parents were born and raised in the panhandle region of Texas, where his father was an open-pit metal miner. Neither of his parents ever experienced any decay, although their teeth were mottled in appearance with some stains. Mr. Joyce says that his parents commented that, "it was something in the water back home," that affected their teeth. Ivan was born and raised in Los Angeles and has always been complimented by his parents for his white, straight teeth, which look much better than theirs.

A hard- and soft-tissue head and neck exam was completed and periapical radiographs of teeth 18-21 were completed to help diagnose the chief complaint.

Mr. Joyce was advised of the diagnosis of tooth #19 and the etiology for the cause of his signs and symptoms. He was advised that a comprehensive dental examination and complete mouth radiographs were necessary for a thorough evaluation, diagnosis, and consideration on needed therapy. The radiographs and intraoral caries and periodontal charting were completed during the appointment.

A fascination with the lack of cavities in Mr. Joyce's parents lead you to encourage them to visit the office for an

Ivan Joyce, Jr., Part II

Mr. Joyce was advised of the diagnosis of tooth #19 and the etiology for the cause of his signs and symptoms. He was advised that a comprehensive dental examination and complete mouth radiographs were necessary for a thorough evaluation, diagnosis, and consideration on needed therapy. The radiographs and intraoral caries and periodontal charting were completed during the appointment.

A fascination with the lack of cavities in Mr. Joyce's parents lead you to encourage them to visit the office for an evaluation of their dental status.

Figure 4. Ivan Joyce Jr. Part II

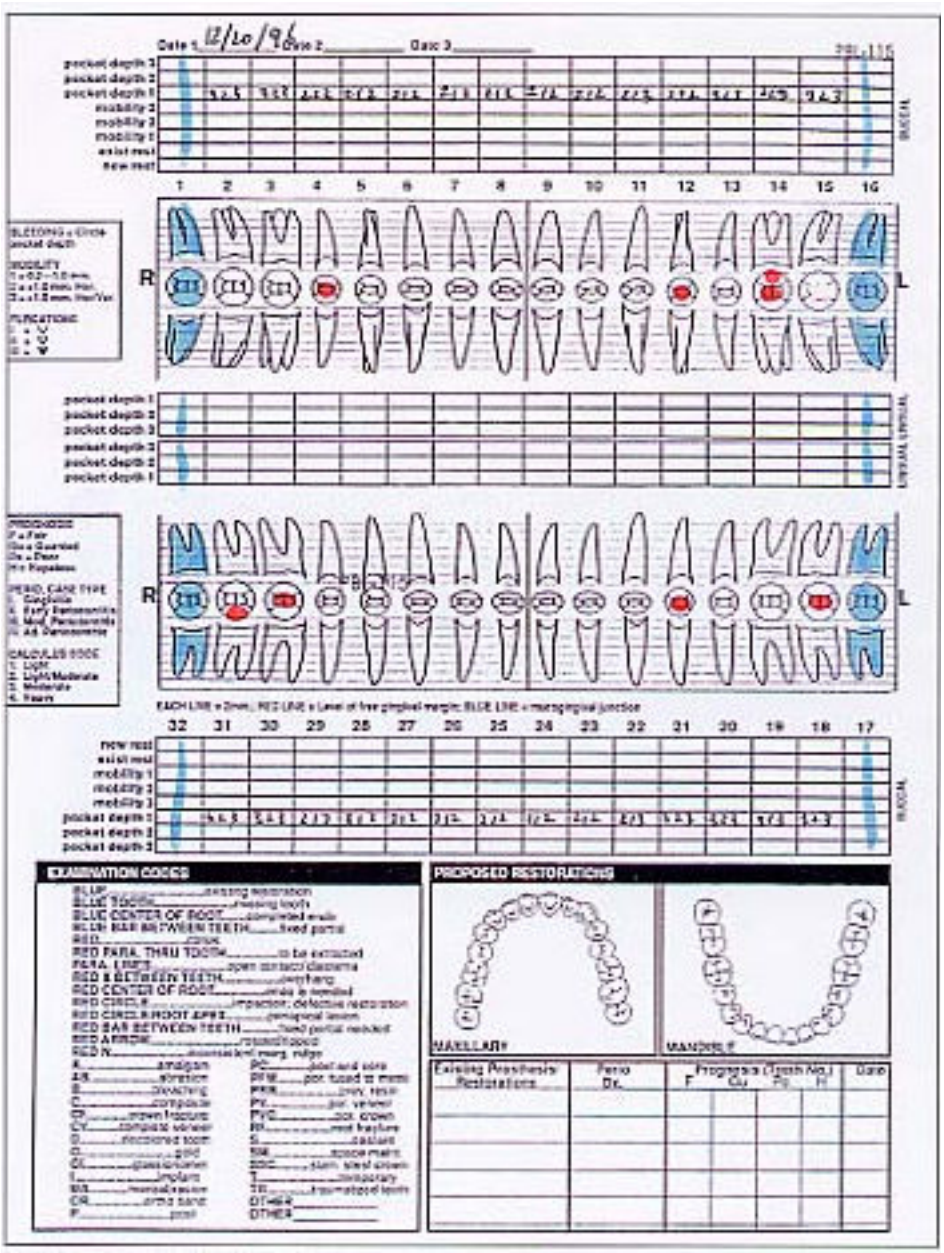

Figure 5. Chart for Ivan Joyce Jr.

Figure 6. Photo of affected area.

evaluation of their dental status.

Ivan returns to your office for a discussion of your examination findings. You discuss with him the teeth that are affected by dental caries and the status of his periodontal health. During the review of your findings, Ivan becomes rather depressed and blames himself for the incidence of his caries. Mr. Joyce remains confused by the cause of dental caries and how his teeth have been affected. In particular he doesn't understand the difference between his parents' experience with dental decay and his own. You present a detailed account of the etiology of dental caries and the pathology that has affected his teeth with emphasis on the different experience of his parents.

Mr. Joyce returns to your office to discuss the restoration of his teeth that have dental caries. He has had no change in his chief complaint and you review his medical history to compare the findings with those of the initial examination. The intraoral and radiographic findings are presented to the patient. Following your review of the clinical findings, you explain to him the teeth that require restoration and the types of restorations that are required. You discuss with him the various alternative materials and approaches to completing intracoronal dental restorations.

Acknowledgments

Many faculty colleagues at the USC Center for Craniofacial Molecular Biology and the USC School of Dentistry have been instrumental in the development of the Problem Based

Learning Program at the University of Southern California. I want to thank all of them for their many contributions to the development of a program that has attracted worldwide attention for a creative new approach to dental education.

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Ivan Joyce, Jr., Part III

Ivan returns to your office for a discussion of your examination findings. You discuss with him the teeth that are affected by dental caries and the status of his periodontal health. During the review of your findings, Ivan becomes rather depressed and blames himself for the incidence of his caries. Mr. Joyce remains confused by the cause of dental caries and how his teeth have been affected. In particular he doesn't understand the difference between his parents' experience with dental decay and his own. You present a detailed account of the etiology of dental caries and the pathology that has affected his teeth with emphasis on the different experience of his parents.

Figure 7. Ivan Joyce Jr. Part III

Table 1.

Sequence of Learning Basic Principles and Clinical Application

Trimester II					
Week 12	**Monday a.m.** Ivan Joyce, Jr. PBL sessions	**Tuesday a.m.**	**Wednesday a.m.** Ivan Joyce, Jr. PBL sessions	**Thursday a.m.**	**Friday a.m.** Ivan Joyce, Jr. PBL sessions
Week 13	**Monday a.m.** Ivan Joyce, Jr. PBL sessions	**Tuesday a.m.**	**Wednesday a.m.** Ivan Joyce, Jr. PBL sessions	**Thursday a.m.**	**Friday a.m.** Ivan Joyce, Jr. PBL sessions
Trimester III					
Week 1	**Monday a.m.** Ivan Joyce, Jr., Returns PBL sessions	**Tuesday a.m.**	**Wednesday a.m.** Ivan Joyce, Jr., Returns PBL sessions	**Thursday a.m.**	**Friday a.m.** Ivan Joyce, Jr., Returns PBL sessions
Week 2	**Monday a.m.** Ivan Joyce, Jr., Returns PBL sessions	**Tuesday a.m.**	**Wednesday a.m.** Ivan Joyce, Jr., Returns PBL sessions	**Thursday a.m.**	**Friday a.m.** Ivan Joyce, Jr., Returns PBL sessions
Weeks 3 – 16				**Thursday a.m.** Treatment of Ivan Joyce, Jr. Simulation Laboratory	**Friday a.m.** Treatment of Ivan Joyce, Jr. Simulation Laboratory

Ivan Joyce, Jr., Returns, Part I

Mr. Joyce returns to your office to discuss the restoration of his teeth that have dental caries. He has had no change in his chief complaint and you review his medical history to compare the findings with those of the initial examination. The intraoral and radiographic findings are presented to the patient. Following your review of the clinical findings, you explain to him the teeth that require restoration and the types of restorations that are required. You discuss with him the various alternative materials and approaches to completing intracoronal dental restorations.

Figure 8. Ivan Joyce Jr. Returns Part I

Table 2. Major Learning Outcomes from PBL Case Ivan Joyce, Jr.
Dental caries -- microbiology, pathology, radiology
Intraoral caries and periodontal charting
Enamel fluorosis
Fluoridation of public water supplies -- natural/supplemented
Epidemiology of dental caries
Fluoride effects on dental caries
Radiographic interpretation -- full-mouth radiographs
USCSD record forms and data management

Table 3. Major Learning Outcomes from PBL Case Ivan Joyce, Jr., Returns
Class I amalgam restorations -- techniques
Class II amalgam restorations -- techniques
Class V amalgam restorations -- techniques
Dental materials -- amalgam, bases, liners
Strengths and weaknesses of amalgam restorations
Principles of intracoronal restorations
Treatment planning
Informed consent

Table 4. Structure of Learning in Simulator and Clinics
Pre-session -- discussion of clinical objectives and procedures
Treatment/application phase -- completion of procedures on typodont or patient
Post-session -- review of accomplishments and planning to increase skills and knowledge

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CDA JOURNAL, VOL 30, Nº6

Women Dentists: The Origins

John M. Hyson, Jr., DDS, MS, MA

ABSTRACT The pioneer women in dentistry are worthy of recognition and admiration. They broke the traditional barriers for their sex and set the standards for those who followed in their path as dental professionals. As medicine has its Elizabeth Blackwell, nursing its Florence Nightingale, so dentistry has its Lucy Taylor Hobbs and Henriette Hirschfeld. In 1884, Lucy Hobbs wrote: "People were amazed when they learned that a young girl had so far forgotten her womanhood as to want to study dentistry." Today, women represent almost 50 percent of the dental students in some dental schools. It is projected that by the year 2020, 20 percent of all dental practitioners in the United States will be women.1 This article details a timeline of women's place in dental history by highlighting prominent women dentists and various opinions on women in dentistry.

Author

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Reportedly, the first dental extraction forceps were made for Sen-Hopet, a beautiful Egyptian society matron, in 2000 B.C.2 In the year A.D. 300, Apollonia was canonized by the Church of Rome for refusing to renounce her Christian faith after being tortured by having her teeth extracted one by one. Since then, she has been the saint whose intercession has been sought for the relief of dental pain and suffering.3 As early as 1523, the earliest known dental engraving, by Lucas van Leyden in copper, depicts an itinerant dentist and his female assistant. While the dentist extracts the tooth, the assistant extracts the contents of the patient's pocket.4 Therefore, women have been associated with dentistry ever since its beginning. It is only fitting that women belong to this ancient profession. This paper will present a selective history of women in U.S. dental history.

Women have made up about 1 percent of dental students from the beginning of the profession; but in the late 1960s and 1970s, a significant number of women and minorities began entering the ranks of organized dentistry in the United States. By contrast, in Europe and South America, women dominate the field. There were two major reasons for this dramatic change in the United States. First, dental schools received federal financial incentives for each female and minority student matriculated. Secondly, the dental schools began to actively recruit these students. The federal plan was to address the

CDA JOURNAL, VOL 30, Nº6

imbalances in educational opportunities for women and minorities. By providing federal support, it was thought that the barriers of discrimination and lack of finances would get across the message that dentistry was available as a career to these students. Low-interest loans and scholarships were provided by the Health Professions Educational Assistance Program. Also during this period, the women's movement was becoming an active force for change in the role of women in the workplace. Two incomes were sometimes necessary to maintain the middle-class family lifestyle.5

One of the earliest references to the "lady dentist" occurred in 1821 when Levi S. Parmly published in London the second edition of his book, Natural History of the Teeth, in which he offers to instruct both ladies and gentlemen of "liberal education for dental practice." The ladies who availed themselves of this offer are unknown; however, in 1870 the U.S. census lists 24 women as "dentists" and in 1871, 116 women were listed in the British census when occupations were classified. Sixty-three of the English women were younger than 20.6

In 1847, Madame H. of Brussels, Belgium, had obtained a diploma to practice dentistry from the Medical Commission, but was refused permission to practice. She continued practicing and was prosecuted for "illegally exercising the art of healing." The court ruled that she could not be refused registration and that she had "complied with the forms required by law"; therefore, no punishment was due her and she was acquitted.7

Emeline Roberts Jones: 1859

The first woman to establish herself in a regular dental practice in the United States was Emeline Roberts Jones (**Figure 1**) of Connecticut. In 1854, at age 17, she married a dentist, Daniel Albion Jones, and became "intensely interested" in his work. After watching her husband work, she began filling extracted teeth. She filled a two-quart jar with her work and then showed her husband what she had done. Reluctantly, in May 1855, he agreed to allow her to practice with him in his Danielsonville office. Finally, in 1859, he took her in as his partner. She enjoyed a reputation as "a skillful dentist."8

In 1864, Daniel Jones died, leaving Emeline with two children, a 3 1/2-year-old son and a 6-year-old daughter. Bravely, she carried on independently to support her family. In 1876, she moved to New Haven, Conn., and established one of the largest and most lucrative practices in the state. At the time, "a woman in business or professional ranks was almost a curiosity." She continued to work until her 78th year. Emeline Jones was recognized by her peers in 1896 as "the pioneer woman dentist" of the United States, if not the world. Although there may have been other women who worked in dental offices prior to 1855, she was the first woman to open her own office independently and offer her services to the public "as a competent dentist."9

In 1893, Dr. Jones served on the Woman's Advisory Council of the World's Columbian Dental Congress. Dr. Jones was elected to an honorary membership in the Connecticut State Dental Society in 1912 and, in 1914, to a complimentary membership in the National Dental Association. Dr. Jones died in 1916 at age 80.10

Lucy Beaman Hobbs Taylor: 1866

Lucy Beaman Hobbs (**Figure 2**) was the first woman in the world to graduate from a recognized dental college. Lucy was born in Ellenberg, N.Y., on March 14, 1833, the seventh of 10 children. Orphaned at age 12, she worked as a seamstress to support herself through school and taught school for 10 years before starting her dental career. Teaching was one of the few "honorable careers" available to women in 1849. Originally, she wanted to study medicine at the Electric Medical College in Cincinnati, Ohio, but was informed that "women were not admitted as students." Therefore, she turned to dentistry. In 1859, she unsuccessfully tried to get an apprenticeship in a Cincinnati dental office before applying to dental college (a requirement at the time). Fortunately, Dr. Jonathan Taft, dean of the Ohio College of Dental Surgery, allowed her to study and work in his office while she looked for a preceptor.11

Finally, Dr. Samuel Wardle, who had just graduated in February 1859 from the Ohio college, took her on as an apprentice in his office. Later, she credited Dr. Wardle with "the honor of making it possible for women to enter the profession." She was still forced to work at night with needle and thread in her tiny attic room earning a few pennies for the morning meal. Many months later in March 1861, she made application to the Ohio College of Dental Surgery but was rejected. Dr. Wardle advised her to begin practice without a diploma, since the majority of her male colleagues were not graduates of a dental college.12

Dr. Hobbs opened an office in a room in a little building on Fourth Street in Cincinnati and was not left with much after the rent was paid, "only 25 cents per week at times kept her from starvation." In April 1861, the Civil War broke out, and her meager business was ruined. She borrowed some money from a friend and moved to Bellevue, Iowa, seeking a better location. She opened an office and the first year made enough money to buy a new dental chair. She then moved to

McGregor, Iowa, and people were curious to see the "woman who pulled teeth." Dr. Hobbs' reputation grew throughout Iowa. In July 1865, the Iowa State Dental Society invited her to attend their meeting in Dubuque; and she was elected to active membership, the first woman to be so honored. Its historian called the admission of a woman to the society a "chivalrous" act.13

Dr. Hobbs attended the American Dental Convention meeting in Chicago with the Iowa delegation and met some of the dental school faculty professors. The Iowa dentists made a formal appeal for her admission to dental college and threatened to boycott any college that refused her admission. Finally, the Ohio College of Dental Surgery relented and allowed her to matriculate. She closed her office in McGregor; entered the college in November 1865; and, because of her practice experience, graduated on Feb. 21, 1866, after only one session. She was the first woman to receive the DDS degree. Following graduation, Lucy opened an office in Chicago and in April 1867 married James M. Taylor, a Civil War veteran. The same year, the couple moved to Lawrence, Kan., where her husband began to study dentistry under her guidance.14

In July 1866, Dr. Hobbs read a paper, "The Use of the Mallet," before the Iowa State Dental Society and became the first woman to address the members of a state dental society. Her paper was published in the Dental Register, which was edited by her old friend, Dr. Taft.15 On Jan. 7, 1868, Dr. Hobbs advertised in the Kansas Daily Tribune:

"To the Citizens of Lawrence!' Those wishing anything done in the Dental line will find the parlor comfortable and the Operating Room always pure, and well provided with every instrument and article necessary to the successful practice of the Art, together with all useful modern improvements known to the profession."16

In 1893, Dr. Hobbs served on the Woman's Advisory Committee for the World's Columbian Congress held in Chicago. She died at her home in Lawrence on Oct. 3, 1910, at age 78. In 1993, the American Association of Women Dentists established the Lucy Hobbs Taylor Award to recognize "significant service to dentistry and contribution to society." In 1998, Dr. Hobbs was honored with a New York State historic marker.17

Dr. George Barker: The Opposition

Dr. George T. Barker, one of the editors of Dental Times, in July 1865, perhaps in response to Lucy Hobbs' election to active membership in the Iowa State Dental Society, published an article, "Dental Surgery: Should Females Practice It, " in opposition to the emergence of women in the dental profession. He wrote that women did not have the "mental and physical equipment" to practice dentistry. The "very form and structure of woman unfit her for its duties." He also cited pregnancy and family neglect. In rebuttal, the editor of the Dental Register commented: "Filling a tooth requires less effort of mind and body than getting up a dinner; and the whole of dental practice is mere play, both of mind and body, when compared with housekeeping."18

Dr. James Truman: An Advocate

Dr. James Truman in his March 1866 valedictory address to the graduating class of the Pennsylvania College of Dental Surgery declared:"Talent is of no sex, color or clime; but it is an inheritance from the Creator, given to be fully cultivated in the direction that it leads."19

On Aug. 6, 1869, Dr. Truman proposed a resolution at the American Dental Association meeting at Saratoga, N.Y., that, as the "National Delegated Body," the organization should ensure the rights of "any woman duly qualified" as full members of organized dentistry. The resolution was "laid on the table" and not acted on, a major setback for the admission of women to the profession.20

Dr. Truman believed that to say to "one-half of the human family, stitch, stitch, darn stockings, make shoes for a shilling, stand behind counters for two or three dollars a week, do anything, but don't enter the sacred precinct that we have marked out for our particular benefit," was morally wrong and needed change. He was the "first to begin the contest" for the admission of women to dentistry."21

Henriette Hirschfeld: 1869

Henriette Pagelsen Hirschfeld (**Figure 3**) was born in 1836 at Sylt, a small island on the West Coast of Schleswig-Holstein, Germany. At 19, she married but was separated before she was 30 because of her husband's mental condition. He was committed to an asylum and her marriage annulled. While in Berlin, she was impressed with the great need of German children for dental care. However, there were no dental schools in Germany at the time, and therefore all dental training was through preceptorships. This approach did not satisfy her desires. Her only recourse was to come to the United States.22

Dr. Hirschfeld arrived in Philadelphia in 1867 alone and unknown for the purpose of studying dentistry at the Pennsylvania College of Dental Surgery. However, the dean refused to admit her. One anatomy professor stated that he "would not teach anatomy to a woman." The faculty rejected her by "a majority vote, but two voting in her

favor." Fortunately for Dr. Hirschfeld, Dr. James Truman interceded and arrangements were made to have her study anatomy at the Woman's Medical College of Philadelphia. On her first visit to the dental college, she was greeted "with a storm of hisses" from the male students.23

Dr. Hirschfeld had received a written promise from the Prussian government before she left that she would be allowed to practice in Germany if she obtained a diploma from an accredited American dental college. She graduated on Feb. 27, 1869, after taking the entire course of instruction (the first woman to do so as Lucy Hobbs had received credit for her practice time), and returned to Berlin and opened her office. Society matrons first sent their servants, then their children, and finally themselves as patients. When the crown princess engaged Dr. Hirschfeld for her nursery, Dr. Hirschfeld's success was assured.24

Dr. Hirschfeld noted:"I don't think many of my professional brethren like it much that the females have crept into their privileges, but I can't help the poor fellows, they will have to get used to it." Mothers were delighted to have her treat their children as "they place their little ones with confidence under my charge." In 1872, Henriette remarried and had two children. In 1874, she took in Dr. Louise Jacobi, an 1874 graduate of the Baltimore College of Dental Surgery, as a partner in her busy practice. In 1893, she returned to the United States to attend the World's Columbian Congress as one of the 41 women dentists to serve on the Woman's Advisory Council with Emeline R. Jones and Lucy B. Hobbs Taylor. After establishing a woman's clinic and hospital, Dr. Hirschfeld retired in 1899. She died on Aug. 24, 1911, at age 77.25

Emilie Foeking: 1873

Emilie Foeking (**Figure 4**) of Prussia was the first woman to receive a degree in medicine or dentistry in Baltimore when she graduated from the Baltimore College of Dental Surgery in 1873, after attending two full courses of lectures and demonstrations and passing the final examination. She had forst been refused admission to the Pennsylvania College of Dental Surgery, but was taken to Baltimore to meet Dr. Ferdinand J.S. Gorgas, the dean of the Baltimore College of Dental Surgery, by the aforementioned Dr. James Truman, who seemed to be the primary advocate for women in the dental profession. Dr. Foeking's thesis was appropriately titled, "Is Woman adapted to the Dental profession?" Her paper was published in the American Journal of Dental Science in April 1873. The Missouri Dental Journal commented on her article that women were "by nature much better fitted" for "cooking, tailoring, etc." and would be unable to achieve the "highest honors as professionals." After graduation, Dr. Foeking returned to Berlin, Germany to practice.26

Annie Ramburger: 1874

Annie D. Ramburger of Philadelphia was the second American woman and the first American woman to graduate from the Pennsylvania College of Dental Surgery on Feb. 28, 1874. Her thesis was titled, "Teeth, their Diseases and Treatment." After graduation she opened her office treating only women and children. The Dental Register commented that she had some "prejudice" to meet, which she overcame. Furthermore, the editor surmised, "Three-fourths of all operations upon the natural teeth of ladies and children, could be just as well done, and in a great many cases far better, by lady operators, than by men."27

Dr. Ramburger stated in 1884, that she had not missed a day because of illness in her 10 years of practice at her Philadelphia office. She felt that dentistry had given her the freedom from the "humiliating restraints" that many female occupations imposed on women.28

Nellie E. Pooler Chapman: 1870s

Nellie E. Pooler Chapman, born in 1847, was the first woman to practice dentistry in California. Her husband, Dr. Allen Chapman, trained her as an apprentice in his office at Nevada City, Calif., before he left in 1861 to join the Nevada silver rush. This arrangement covered his office while he was away on trips to the Comstock Lode. She died in 1906. Their two sons followed them into dentistry.29

Journal Debate: 1873-76

From 1873 to 1876, various articles appeared in the dental press about the merits of women as dentists. The American Journal of Dental Science commented in 1873 that at the Baltimore College of Dental Surgery, "the experiment of receiving female students, inaugurated last session, has proven so successful, and the effect upon the male students is so beneficial, that faculty are perfectly satisfied with their action in this respect." It added that the male members of the class behaved like gentlemen. At the Pennsylvania College of Dental Surgery, apparently things did not run as smoothly in 1873. Three female 1872 students had been refused admission to the 1873 session on the basis that they were women and therefore, "not desirable students." A newspaper article, "Woman's True Rights," told of "a state of great internal commotion" and the "dissatisfaction of the male students." It contrasted this experience

with the Baltimore College experience and concluded that the Northern students were not the same "gentlemen" the Baltimore school had in its student body since its enrollment was primarily from the South. Finally, the Pennsylvania situation reached the board of trustees, who decided that "a faculty once receiving a student could not cast said student out without due cause, and, done, an action in court would be the proper remedy." Any expulsion because of sex would not be considered. Therefore, the faculty must "retain the women and fulfil the contract implied on matriculation"30

In 1874, a courageous Dr. J.S. Lattimer proposed a resolution at the First District Dental Society of New York that dental schools accept students "without regard to the sex" of the applicant. Some opposed him on the grounds that women could be "better taught in separate schools." The resolution was tabled indefinitely.31

Jennie D. Spurrier: 1876

Jennie D. Spurrier of Springfield, Ohio, opened her office in January 1876. She was the first female dentist in Illinois. Her first patient needed an extraction, for which she was paid 50 cents. She had it engraved with the date and "My First."32

The Debate Continues: 1883-87

On Nov. 7, 1883, Dr. Norman Kingsley of New York City, dean of the New York College of Dentistry, delivered a speech titled, "What is a woman? And what [are] her characteristics and capabilities?" before the American Academy of Dental Science in Boston. He referred to the "exceptional few" women who had graduated from dental college. He considered that there was "much in dentistry which is not within the scope of the average woman" and that women were not adapted "by nature" to the mental and physical aspects of the profession.33

However, he did believe that there was "a field in dentistry for women." They were doing well in school and their record was "equal to the best" male students at his college. In some cases, the clinic patients were requesting to be assigned to "one of the ladies to have their teeth treated or filled." In his opinion, women should enter the profession through the role of a dental assistant and then go for a degree if they liked it.34

In England in 1887, the editor of the Dental Record commented that only the "exceptional woman" would be capable of pursuing the "necessary curriculum" required for a dental degree. It was beyond the limit that the "higher education' of women, taken as a class, could safely go." However, the Dentists' Act of 1878 did not exclude women from registering.35

Jennie Kollock Hilton, DDS, of Fort Atkinson, Wis., stated in 1887 that it was "the work per se, not the work per sex," that was commanding the "attention of an educated and discriminating public." She pointed out that not all women nor men were qualified "by nature" or "by virtue of a diploma" to become dental practitioners. Then too, since the majority of dental patients were women and children, was it not fitting that "a skillful, sympathetic, and conscientious woman" dentist should treat them.36

Mrs. R.B. Ramsay, DDS, of Pittsburgh, Pa., in 1887, spoke of women having the "legal right to practice" in America mainly through "the efforts of a few men." The dental colleges were "open to them."37

The 1889 Controversy

Dr. Thomas B. Welch (1825-1903), the editor of the dental journals Items of Interest and later the Dental Brief and proprietor of the Welch Dental Mfg. Co., and discoverer of how to produce unfermented grape juice, became involved in the controversy toward the end of the 19th century. Welch's opinion, which he stressed to the point of some readers' distraction, was that women had "a legitimate place in dentistry."38

Dr. Kate C. Moody, at the banquet of the Illinois State Dental Society at Quincy, Ill., in May 1889 at the Newcomb House, responded to the toast, "Women in Dentistry," that the men "need not fear that the ladies will create a monopoly" in the profession and that there was no need of "legislation against them, crying for men's rights. There will be plenty of room for the stronger sex."39

In 1889, the Boston Herald reported that a woman graduated first in her class at the Boston Dental College out of between 30 and 40 students. The same year, Dr. Taft said that women were "always above the men in their classes" and that women would be "a means of elevating the profession." A woman dentist, Dr. C.W. McNaughton, the vice president of the Michigan Dental Society, called the female dentists "pioneers."40

In 1889, the problem for women in dentistry resurfaced when Dr. W.R. Spencer of West Point, Va., wrote to the editor of Items of Interest that there seemed to be "a growing tendency among women of the present day to undertake what may be called man's work." The dental profession had been "invaded" by women dentists. "Lord deliver me from one of these professional women." Spencer claimed that women placed a lower value on their labor and that women in the workplace "would compel men and women to live separately. None but the born rich' will dare to marry."41 Spencer could not accept the role of women in dentistry, thinking them "depraved." He argued that women took "no thought for

CDA JOURNAL, VOL 30, Nº6

the future" and made "no provision for a family"; therefore, they did not "charge enough," and they "depress fees."42

In rebuttal, Dr. Jennie Hilton in the 1890 Items hoped that when he was "filling his last cavity" it would be written on his tombstone, "Here lies the last obstruction to woman dentists."43

Dr. George W. Warren of Philadelphia, in an 1892 article in Items of Interest, said that "Education, social position, business responsibilities, or even professional duties do not unsex the woman; they rather give self-control and balance and breadth in the practical affairs of life." The same year, Dr. J. Holland stated that "it has been proved that a woman can become as good a dentist as a man." He praised the work of Dr. C.G. Turner, the only woman to pass the New Jersey State Board as "a skilful dentist" and "a remarkable woman."44

Ida Gray Rollins: 1890

Ida Gray Rollins (**Figure 5**) was the first African American woman to receive a dental degree in the United States. She was born sometime from 1865 to 1867 in Tennessee but grew up and attended school in Cincinnati, Ohio, graduating from high school in 1887. She matriculated at the University of Michigan Dental School in 1887 and graduated in 1890. She practiced in Cincinnati but married James S. Nelson, an accountant and attorney, in 1895 and moved to Chicago. Her husband, a Spanish-American and World War I veteran, died in 1926; and she remarried in 1929 to become Mrs. William A. Rollins, but was better known as Dr. Ida N. Rollins. She was still practicing in the 1930s and died on May 3, 1953. Her tombstone read: " Dr. Ida Gray Nelson Rollins, 1st Negro Woman Dentist in America."45

Theresa Hunt-Tyler: 1901

Dr. Theresa Hunt Tyler, born in 1878, was a 1901 graduate of the Western Dental College in Kansas City. She became the first resident dentist in the Oklahoma Territory. Dr. Tyler earned $18 her first day in practice. She also provided dental services to the residents of Eagle City, an overnight trip, where she used a barber's chair. Dr. Tyler also treated the Native Americans in the area's reservations. She retired in 1941 and died in 1972.46

The Women's Dental Association of the United States: 1892

In 1892, Dr. Mary Stillwell-Kuedsel founded the Women's Dental Association of the United States with 12 charter members. The secretary listed 32 members in her report of March 4, 1893, which stated, "The women interested in dentistry in Philadelphia met in March 1892 to organize a society by which they could strengthen themselves by trying to help one another."47 In 1921, the Federation of American Women Dentists was founded at the ADA meeting in Milwaukee, Wis. The name changed to American Association of Women Dentists. Dr. Evangeline Jordan was the AAWD's first president. By 1988, the roster had grown to 2,000 out of an estimated 9,000 women dentists in the United States.48

In 1870, there were 24 female dentists in the United States; in 1880, there were 61; in 1890, there were 337; and by 1900, there were 807 women dentists practicing in the United States.49 As late as 1905, of 25 dental schools surveyed by Dr. Edwin T. Darby of Philadelphia, 19 replied and only 12 of those took women students. Dr. Darby concluded from his study that there was "a place for women in dental practice."50

Other Accomplishments: 1911

In 1911, Jennie M. Taylor was the first person to go to a foreign land as a dental missionary. Dr. Uterpe Manta Thunis became the royal dentist for the Sultan of Turkey and received as a gift the island of Scio. By 1911, one-half of the dental students in Germany were women. By 1911, many women were dental school faculty members, such as Anna M. Thrane, operative dentistry, Buffalo Dental College; Mrs. W.T. Eckley, Northwestern University Dental School; Alice Stevens, oral surgery, Northwestern University Dental School; Mary J. Metzger, Columbian Dental College, Chicago; and Charlotte E. Benton, dental surgeon for the New York Institute for the Deaf and Dumb.51

M. Evangeline Jordon: Pioneer in Pediatric Dentistry

"There is an increasing need and demand for good dentistry for young Children; not children in groups in school clinics, or other public bureaus, but Children in private practice, where advantage of every device at hand should be taken to promote the highest welfare of the little children." -- M. Evangeline Jordon, 192752

Dr. M. Evangeline Jordon was born in Illinois in 1865. In 1885, her family moved to San Bernardino County, Calif., where she taught school. In 1897, after working as a dental assistant during her summer vacations, she decided to enter the School of Dentistry at the University of California. She graduated in 1898. She went into general practice, but soon began to limit her practice to children. She thus became the first pediatric dentist in the United States.53

In 1900, Dr. Jordon was selected by the dean of the University of Southern California's dental department to develop

a lecture course on children's dentistry. She also started a clinical program for the dental students at the Orphan's Home in Los Angeles. In 1923, Dr. Jordon began publishing her book on pediatric dentistry as articles in Dental Items of Interest. It was published in 1927. In her introduction, Dr. Jordon stated: "Dental caries is a preventable disease of childhood, due to incorrect diet and lack of hygiene." She predicted that caries could be eradicated in a generation.54

In 1921, Dr. Jordon was instrumental in the organization of the Federation of American Women Dentists (renamed the Association of Women Dentists in 1928) and was its first president. She also encouraged Dr. Samuel D. Harris to form a pediatric dental society, the American Society of Dentistry for Children, in 1927. Dr. Jordon retired in 1928 and died in 1952\.55

Helen E. Myers: 1951, The First Woman Army Dental Officer

Helen E. Myers of Lancaster, Pa., a 1941 graduate of Temple University, was commissioned as the Army Dental Corps' first woman dental officer in 1951. The exigencies of the Korean War made it necessary for the U.S. government to resort to this method of filling up the Army's medical staff to care for its casualties and expanded strength. Capt. Myers reported for duty to Fort Lee, Va., on March 21, 1951, the first of her sex to be so commissioned. She was a member of the AWD. Her War Department orders stated: "As officers on active duty, women dentists appointed in the Reserve will be given the same opportunities for clinical practice and advancement now available to male officers in comparable grades. The pay, allowances, and retirement benefits which accrue to male officers also apply to women dental reservists."56

Conclusion

On July 1, 1975, Dr. Jeanne C. Sinkford became the first woman dean of a dental school when she was appointed the dean of Howard University, School of Dentistry.57 In 1991, Dr. Geraldine T. Morrow became the first woman president of the American Dental Association.58 In 1997, Dr. Hazel J. Harper became president of the National Dental Association.59 Despite these achievements, women dentists' income ranges "from 58 percent to 75 percent of male dentists."60 Therefore, there is still room for progress for women in dentistry, and the future is now.

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CDA JOURNAL, VOL 30, Nº6

Monkeying With Medical Scheduling

Robert E. Horseman, DDS

An experimental brain implant the size of an M&M has allowed a monkey to control a computer cursor by thought alone, Brown University researchers announced Wednesday -- Los Angeles Times

Wouldn't you know it -- you finally get some sort of control over your mouse, knowing when to right click and how to scroll, then learn a monkey can do by thought alone what it took you six months to master and you still screw up.

We know what you're thinking -- this is another of the Times' staff writer's little pranks to liven up a slow news day. There is no such university called "Brown," right? Why not Harvard, or Yale, or Dartmouth? We could believe maybe Berkeley where the kids run their own classes, according to reports, and implanting M&Ms in monkey brains would be on a par with panty raids and swallowing goldfish, but Brown?

Well, pay attention -- Providence, R.I., is the home of Brown University. It was founded in 1764, currently boasts about 8,000 students who lay out $34,750 a year in tuition, and if Brown University says it has a monkey that controls computer cursors just by thinking about it, you have to stop that snickering and go along.

Senior researcher John Donoghue, Brown neuroscientist, explains: "We have substituted thought control for hand control." Obviously, there is a lot more to this, most of it involving tiny electrodes and neurons and the motor cortex section of the brain that is usually concerned with the necessary skills to separate Oreo cookies to get at the white stuff.

What's important here to ordinary people like yourself who have trouble understanding gravity, electricity and why each of the cast members of "Friends" should be paid $1 million per episode is this: If a monkey can be trained to operate a computer to the point of winning solitaire 3 out of 5 times, why can't medical personnel be trained to schedule appointments so that patients with official handwritten cards stating that they have an appointment at exactly 10:15 a.m. can actually be seen before 5:30 p.m.? How about THAT, Brown University?

In an effort to expedite some action on this vexing problem, we have been doing some research ourselves only to arrive at this pessimistic conclusion: More and more people are being seen by fewer and fewer health care providers until in the very near future, everybody will be seen by nobody. There is plenty of blame to go around, starting with the doctor.

- Doctor A's ego is fed by the belief that he is indispensable, the proof lying in the fact that his waiting room is overflowing. More patients = more billing = more money. His instructions to the front desk: Book 'em all, turn

nobody away, refer nobody out, we can handle it.

Doctor B is a wuss who can't say "no" and has no concept of his limitations. He is the Dr. Schweitzer of his town and will die at age 53 while contributing largely to the diminished life expectancy of anybody who works for him.

- Both Doctor A and Doctor B have a poorly developed sense of time. If asked what time was represented by "the little hand is on 3 and the big hand is on 11," they would be hard put for an answer. "Lunch time?" would be a typical response.
- Nurse A is in charge of scheduling. She routinely tells patients A, B, C and D to come in at 10, knowing the doctor sometimes doesn't return from rounds until 2, if then. "Have a magazine," she directs. "Doctor is running a little late." Not to put too fine a point on it, but "a little late" frequently means upwards of three days behind. There is a clause in the doctor's MD diploma that states, "Never, ever phone a patient and say, Stay home for God's sake, we're four hours behind schedule right now!'"
- The state medical board would perhaps consider suspending the license of a doctor who had signed 40 or more of his patients' death certificates in the past 10 days but would instantly revoke the ticket of any doctor caught actually apologizing for keeping a patient waiting in a drafty paper gown on a wax paper-covered table for as little as two hours.
- In way too many doctors' offices, not a single soul has any idea of how much time any given procedure will take, although they have been doing this for decades. "Five minutes" is their guess. If they have five treatment rooms with a patient in each one aging rapidly, the estimate is still five minutes. In medical math, this amounts to 60 patients per hour. In the waiting room the sound of "Baaaa, baaaa" is heard.
- Staff members, some of whom have been known to feel some degree of remorse for the gridlock, have been instructed to avoid eye contact with restive patients. If this should happen inadvertently, the guilty staffer is to announce in a loud voice that "Doctor has been delayed by an emergency and will be here shortly." This is calculated to make the ruffled patient ashamed to have put his ruptured spleen and broken pelvis on a higher priority than some poor devil's emergency.

Conclusion: When Brown University is through with the three monkeys they now have under training, they should immediately implement a crash course for them in medical scheduling. The need is great, the opportunities endless and if the primates can be taught to offer any kind of a caring apology, even if it's a banana, millions of frustrated patients will be forever grateful.