



The Pathophysiology, Medical Management and Dental Implications of Fragile X, Rett, and Prader-Willi Syndromes

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A B S T R A C T

Fragile X, Rett, and Prader-Willi syndromes are a group of inherited disorders that often present with varying degrees of mental retardation and challenging behaviors. Dentists caring for individuals with these disorders must be familiar with the manifestations of these diseases and their associated features so they can garner the maximum level of cooperation from the patient. They must also be familiar with the medications (anticonvulsants, antihypertensives, antidepressants, antipsychotics, and central nervous system stimulants) used to treat the associated behaviors, because many of these pharmaceuticals cause clinically evident orofacial and systemic reactions, and may precipitate adverse interactions with dental therapeutic agents.

Global developmental delay is used to describe children younger than 5 years of age who on clinical presentation appear to lag significantly behind their chronological peers in demonstrating gross and fine motor skills, speech and language abilities, cognition, social and personal skills, and the ability to perform activities of daily living. The term “mental retardation” is synonymous with global developmental delay but reserved for individuals old enough to have the diagnosis validated by intelligence quotient tests.¹ Mental retardation affects approximately 1 percent to 2 percent

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Fragile X



of the general population.² The severity of mental retardation is defined by a combination of the intensity of support needed by the individual to cope with common life demands, by how well the person meets the expected age-based standard of personal independence (level of adaptive functioning), and by the results of IQ tests (Table 1).^{3,4} The prevalence of mild mental retardation is seven to 10 times greater than severe, but in half of all cases its etiology remains illusive. The causes of severe and profound mental retardation, however, can be identified in 60 percent to 70 percent of cases and in most instances are related to a genetic abnormality that alters brain development and function, giving rise to aberrant cognitive, behavioral, and physical features.^{5,6} Down syndrome, a non-inherited chromosomal disorder, is the leading cause of mental retardation in the United States. The commonly encountered mental retardation disorders reviewed here include Fragile X, Rett, and Prader-Willi syndromes.

Fragile X Syndrome

Fragile X syndrome is the most common form of inherited mental retardation, with an estimated prevalence of 1 in 4,000 males and 1 in 8,000 females.⁷ Currently, there are more than 50,000 people affected with the disorder in the United States.⁸ Males are more severely affected than females. Males usually exhibit severe intellectual impairment, speech and language delay, parrot-like repetition of overheard words (echolalia), and social and behavioral difficulties, including problems with attention, hyperactivity, impulsivity, irritability, anxiety (shyness), and frequent tantrums. Also commonly noted are repetitive motor behaviors (preservation), enhanced sensitivity to visual, auditory or tactile stimuli (e.g.,

pulling away on being touched), elevated mouthing/smelling of objects, avoidance of eye contact, hand flapping, hand biting, and incontinence.

Females with fragile X syndrome are generally less cognitively impaired than males with the disorder and demonstrate a broader range of functional capabilities. Approximately 25 percent are found to be mentally retarded using standard IQ tests, 28 percent are borderline, and slightly more

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than half score in the low-normal range. Many of these high functioning females, however, still present with learning disabilities, such as the inability to plan and organize or shift attention from one concept to another (e.g., switching from sorting objects based on their shape to sorting them by color/executive function), problems with arithmetic and abstract reasoning, and difficulty in considering another person's perspective. Also commonly seen are deficits in social skills, such as avoiding eye contact, difficulty in initiating and maintaining conversation, shyness, depression, and aggressivity.^{9,10}

The difference in clinical outcome between boys and girls with fragile X syndrome occurs because males have an X and Y chromosome in each cell whereas females have two X chromosomes. In the male, when there is a mutation in the *FMR1* gene located on the X chromosome that is passed from mother to child, there is a genetic inability to produce fragile X mental retardation protein, which is required for the normal maturation of neurons and synapses in the brain. In the female, the production of the protein is maintained to varying degrees by the presence of the unaffected X chromosome, and therefore there is less impairment of brain development.^{11,12}

In addition to the behavioral and intellectual deficits, the syndrome is also associated with physical defects that become more easily discernible after puberty. A long, narrow face, prominent ears, prominent forehead, prognathic mandible, and high-arched/narrow palate; hyperextensibility of finger joints; decrease in adult stature; and macro-orchidism. The underlying cause of these physical defects, and their relevance to deficits in fragile X retardation protein, still remains to be uncovered.¹³

The diagnosis of fragile X syndrome is made by clinical observation and developmental testing of the child's behavior, noting delays in reaching such developmental milestones as walking alone, sitting up, and speaking single words; it is confirmed by chromosomal analysis and fragile X DNA testing.¹⁴ Prompt diagnosis enables children to receive early intervention services and families to receive genetic counseling. Although there are no proven remedies for fragile X syndrome, current efforts involve the input of many professionals, including psychologists, speech and language therapists, occupational and physical therapists, and special education teachers.

Table 1

Severity of Mental Retardation, Prevalence and Associated Degrees of Intellectual and Adaptive Function¹

Severity of MR and corresponding IQ	Prevalence of severity among those with MR	Degree of intellectual function	Academic skill level	Degree of adaptive function
Mild IQ 50-70	85%	Develop social and communication skills during preschool years. Have minimal impairment in sensory motor areas.	Sixth grade	Can achieve social and vocational skills adequate for minimum self-support. Can live successfully in community either independently or in supervised setting.
Moderate IQ 35-49	10%	Acquire communication skills during early childhood years. Can attend to own personal care needs. Can master some vocational training.	Second grade	May have difficulties in recognizing social conventions, which can interfere with peer relationships. Can perform unskilled or semiskilled work with supervision. Can live in community in supervised setting.
Severe IQ 20-34	3%-4%	During early childhood are unable to acquire communicative speech. During school-age period may learn to talk. Can be trained in elementary self-care skills.	May learn alphabet and simple counting.	May be able to perform simple tasks in closely supervised setting. Can adapt well to life in community in group homes or with their families.
Profound IQ <20	1%-2%	Usually have diagnosed neurological condition causing mental retardation. During early childhood display considerable impairment in sensory motor functioning.	Motor development, self-care and communication skills may develop if appropriate training is provided in a highly structured environment with constant aid and supervision.	Require close supervision and sheltered setting.

Infants and toddlers with fragile X syndrome are provided early intervention programs that have language, social skills, and motor components. Sensory-integration occupational therapy using physical calming techniques decrease the incidence of tantrums and other behavioral problems in these children. School-age children are referred to a therapist who has experience with individuals having cognitive deficits or hyperactivity. These counselors use the per-

son's existing capabilities, particularly their visual and imitation skills, to master such tasks as feeding, dressing, and toileting. Adolescents and young adults are afforded vocational training in the community where appropriate activities and behaviors are modeled by a mentor or teacher.

The challenging behaviors of individuals with fragile X syndrome often necessitate the administration of psychoactive medications.^{15,16} Agents used to calm hyperactivity in preschool chil-

dren include use of the antihypertensive drug clonidine, the central nervous system stimulant methylphenidate, and the anticonvulsant carbamazepine. In approximately 60 percent of school-aged children with fragile X syndrome, methylphenidate is used to enhance attention and concentration, and clonidine is used to prevent hyperarousal. Clonidine is also helpful for the sleep disturbances that are common in these children. In adolescence, mood lability often increases; and, for about 30 per-



Table 2

Adverse Orofacial Reactions to Drugs Used to Treat Mental Retardation^{17,18}

Drug (trade name)	Xerostomia	Sialorrhea	Dysphagia	Sialadenitis	Dysgeusia	Stomatitis	Gingivitis	Glossitis	Tongue edema
Cabamazepine (Tegretol)	yes	no	no	no	no	yes	no	yes	no
Clonidine (Catapres)	yes	no	yes	yes	no	no	no	no	no
Fluoxetine (Prozac)	yes	no	no	yes	yes	yes	yes	yes	no
Lamotrigine (Lamictal)	yes	yes	no	no	yes	yes	yes	yes	yes
Lithium (Eskalith)	yes	no	no	yes	yes	yes	no	no	no
Methylphenidate (Ritalin)	yes	no	no	no	no	no	no	no	no
Risperidone (Risperdal)	yes	yes	yes	no	yes	yes	yes	no	yes
Sertraline (Zoloft)	yes	no	yes	no	yes	yes	no	yes	yes
Valproate/valproic acid (Depacon/Depakene)	yes	no	no	no	yes	no	no	yes	no

cent of the males, aggressive behavior is common. The aggression is often treated with antidepressants from the selective serotonin reuptake inhibitor family, such as fluoxetine or sertraline. Other medications used to treat aggression include carbamazepine, valproate, lithium, and risperidone.

Dental Considerations

Many of the medications used to treat fragile X syndrome have adverse orofacial side effects (Table 2),^{17,18} systemic reactions, and interactions with medications used in dentistry (Table 3).¹⁹⁻²⁸ A number of medical problems are seen more often in people with fragile X syndrome than in the general population, and these are also germane to the practice of dentistry. Approximately 50 percent of adults and a lesser percentage of children have mi-

tral valve prolapse.²⁹⁻³¹ When mitral valve prolapse is accompanied by a heart murmur, prophylactic antibiotics may need to be prescribed when performing invasive dental procedures.³²⁻³⁴ Recurrent otitis media is common in young children and recurrent sinusitis in older individuals. Distinguishing pain associated with these entities from that of dental origin is difficult for these mentally challenged individuals. Also of concern is gastroesophageal reflux disease and recurrent emesis, which exposes the dentition to gastric acid and may result in the erosion of tooth structure. Generalized or complex partial seizures occur in about 20 percent of children with fragile X syndrome. The seizures are usually treated with carbamazepine, which is often discontinued in early adolescence when the seizures spontaneously disappear.

Rett Syndrome

Rett syndrome, first described in only 1966, is now recognized as the leading cause of profound mental retardation in girls and women, with a prevalence rate of 1:10,000 to 1:13,000.^{35,36} (Males with the genetic defect underlying Rett syndrome typically do not survive past childbirth.) It is characterized by apparently normal development for the first six to 18 (and possibly 30) months of life. Thereafter, there is deceleration in the rate of cranial growth and an onset of extreme agitation accompanied by involuntary movements in all parts of the body, including the tongue. This episode is then followed by regression or loss of previously acquired cognitive and motor skills (e.g., reaching for objects, standing) over the ensuing days, weeks, and months.³⁷ Communication function is

Discolored tongue	Bruxism	Miscellaneous
no	no	Erythema multiforme, carbohydrate craving
no	no	Parotid gland swelling and pain
yes	yes	Jaw pain, buccal-glossal syndrome
no	no	Halitosis, gingival hyperplasia
no	no	Carbohydrate craving
no	no	Erythema multiforme
yes	no	Toothache, tongue paralysis, sinusitis
no	yes	Gingival hyperplasia
no	no	Periodontal abscess, sinusitis, neck pain

lost (i.e., loss of the ability to speak and understand single words/ phrases or nuanced babble that was initially learned), social skills (e.g., smiling) regress, eye contact is lost, and profound irritability develops.³⁸ Previously learned fine motor skills (e.g., passing toys from hand to hand) are replaced by repeated hand washing movements, interspersed with biting or rubbing the dorsum of the hand against the teeth and lips, and digit-hand sucking or licking.³⁹ Growth failure (especially noticeable are the small head and small, cold, blue-colored feet) is pervasive, with height and weight declining from near normal values at age 1 to below the fifth percentile for the normal population by age 7.⁴⁰ Approximately 25 percent of people with Rett syndrome never walk (secondary to spinal cord involvement) and are confined to a wheelchair, eventually

developing muscle wasting and skeletal deformities (i.e., scoliosis). Tests indicate a mental age at the 8- to 10-month level and motor function at the 12- to 18-month level. Adaptive skills such as feeding, dressing, and toileting are never effectively acquired.

The girls who develop and retain the ability to walk do so in an aimless fashion, with the first step often being backwards (retropulsion). For these girls, communication functions such as socialization and eye contact may improve. In fact, intense staring to obtain eye communication or express wishes is a prominent feature of Rett syndrome. Well-functioning Rett syndrome females even tend to develop a surprisingly effective “eye pointing” language as a substitute for their loss of speech and fine motor communication skills. However, they remain incapable of self care; over the next several decades, they slowly lose motor function such that ambulation and stereotypic hand movements diminish in speed and frequency. Survival to middle age is typical, with 70 percent of women living to age 35 and some living to older than 60. Death is usually sudden and unexpected and presumed to arise from breathing dysfunction or cardiac arrhythmias.

The diagnosis of Rett syndrome is made by medical history and neurologic examination and is confirmed by a blood test that identifies a mutation in the *MECP2* gene. Recurrence within families is less than 1 percent; thus, Rett syndrome usually represents a new mutation. The mutated gene prevents adequate production of a protein normally found in the nucleus of many types of neurons. Loss of the protein results in arrested neuronal development, smaller neurons, a reduction in length and complexity of dendrites, impaired neuronal signaling, reduced brain weight, and reduced volume of the frontal cortex.⁴¹⁻⁴³

Dental Considerations

Many of the medications used to treat Rett syndrome cause orofacial and systemic side effects (Table 2), and evoke interactions with medications used in dentistry (Table 3). A number of orofacial and medical problems are seen more often in people with Rett syndrome than in the general population that are germane to the practice of dentistry. Severe bruxism, occurring more often while the patient is awake than during sleep and producing loud grating sounds, causes severe attrition of the primary teeth. Very common during early childhood, the bruxism is resistant to dental fabrication of biteplanes and medical management (administration of benzodiazepines or muscle relaxants).⁴⁴⁻⁴⁷ Accompanying the movement of the mandible are uncoordinated and repetitive movements of the tongue (often protrusion), bilateral masseter muscle hypertrophy, sialorrhea and drooling.^{48,49} Inadequate nutrition is often a problem because of involuntary movements of the tongue and mandible, movement of food around the mouth, poor mouth closure (secondary to an anterior open bite resulting from continuous tongue protrusion), aberrant swallowing pattern, and a lack of hand use. Gastroesophageal reflux is also common, with the potential for erosion of tooth structure on exposure to gastric acids.

Irregular breathing during wakefulness (especially when under emotional or physical stress) and consisting of hyperventilation or breath holding is common between the ages of 5 and 10 years. Breath holding may be prolonged and alarming, occasionally exceeding one minute. In older people, it becomes common for each expiration to be achieved only after a Valsalva maneuver (expiration against a closed upper airway, with severe alteration in heart rate and blood pressure due to

Table 3

Drugs Used to Treat Mental Retardation and Their Adverse Systemic Side Effects and Interactions with Dental Therapeutics¹⁹⁻²⁸

Drug (trade name)	Common usage	Illness	Indications	Side effects and interactions
Carbamazepine (Tegretol)	Anticonvulsant	Fragile X syndrome Rett syndrome Prader-Willi syndrome	Mood stabilization Antiaggression Anticonvulsant	Long-term use associated with decreased white blood cell and platelet counts. Erythromycin, clarithromycin, and propofene may inhibit the metabolism of carbamazepine and permit emergence of its side effects. Accelerates the metabolism of doxycycline.
Clonidine (Catapres)	Antihypertensive	Fragile X syndrome	Calm hyperactivity Regulate sleep	Increases sedation of other central nervous system depressants. May cause orthostatic hypotension.
Fluoxetine (Prozac)	Antidepressant	Fragile X syndrome Prader-Willi syndrome	Antiaggression Antianxiety Treat depression Prevent self-mutilation	Side effects include diarrhea, nausea, somnolence, dizziness, and sexual dysfunction. Occasionally causes an increase in bleeding time. Increases sedation of other central nervous system depressants. May inhibit the metabolism of codeine, some benzodiazepines. Erythromycin and clarithromycin may inhibit metabolism of fluoxetine.
Lamotrigine (Lamictal)	Anticonvulsant	Fragile X syndrome Rett syndrome	Anticonvulsant	May rarely cause thrombocytopenia, leukopenia, or leukocytosis. May cause skin disorders, including rash, Steven-Johnson syndrome, and angioedema. Increases sedation of other central nervous system depressants. Decreased effect with chronic, high-dose acetaminophen.
Lithium (Eskalith)	Antimanic	Fragile X syndrome	Antiaggression	Nonsteroidal anti-inflammatory drugs and metronidazole may decrease renal clearance of lithium. Increases sedation when used concurrently with benzodiazepines. Nausea, diarrhea, drowsiness, acne, hand tremor are common side effects. May cause electrocardiogram changes, weight gain, and hypothyroidism.
Methylphenidate (Ritalin)	Central nervous system stimulant	Fragile X syndrome Prader-Willi syndrome	Calm hyperactivity Enhance attention	May rarely cause thrombocytopenia, leukopenia, and anemia. Anorexia and reduced weight gain in children with long-term use. Use vasoconstrictors with caution, in low doses, and with careful aspiration.
Risperidone (Risperdal)	Antipsychotic	Fragile X syndrome Rett syndrome Prader-Willi syndrome	Antiaggression Antiagitation Rid delusions Rid hallucinations	May rarely cause thrombocytopenia. Increases sedation of other central nervous system depressants. May cause orthostatic hypotension. May induce motor disturbances (akathisia, etc.).
Sertraline (Zoloft)	Antidepressant	Fragile X syndrome Prader-Willi syndrome	Antiaggression Antianxiety Treat depression Prevent self-	Side effects include diarrhea, nausea, somnolence, dizziness, and sexual dysfunction. Occasionally causes an increase in bleeding time. Increases sedation depression of other central nervous system depressants. May inhibit the metabolism (and analgesic effect) of codeine. Erythromycin and clarithromycin may inhibit metabolism of sertraline.
Valproate/valproic acid (Depacon/Depakene)	Anticonvulsant	Fragile X syndrome Rett syndrome Prader-Willi syndrome	Mood stabilization Antiaggression Anticonvulsant	May cause leukopenia, thrombocytopenia, and decreased fibrinogen concentration. May cause liver function abnormalities and irreversible hepatic failure. Erythromycin and aspirin may inhibit the metabolism of valproate. Aspirin and nonsteroidal anti-inflammatory drugs increase bleeding tendency.

the pressure generated in the chest). This may lead to ejection of saliva, which may be mistaken for “spitting.” Among the most severely hypotonic people, inadequate, shallow breathing has been identified, which allows oxygen tensions to fall and carbon dioxide tension to rise.⁵⁰ Breath holding has also been reported during induction with 65 percent nitrous oxide and 35 percent oxygen for dentistry. Excessive somnolence after administration of oral midazolam or after emergence from general anesthesia has also been reported.⁵¹⁻⁵³

Self-abusive behavior, such as hitting the mouth and face, hair pulling, and biting of fingers or hands, is seen on occasion, especially when the patient is agitated. It must not be confused with parental or caretaker abuse. Individuals with Rett syndrome appear to have little or no control over these behaviors, and attempts to stop them by behavioral methods are ineffective. Aggressive behavior directed toward others may also be a problem and is often controlled with risperidone.⁵⁴ Some girls with Rett syndrome, mainly in their teens and older, periodically have attacks of violent screaming, which may last for hours. These screams are often attributed to body pains (including those in the oral cavity) by care givers. However, even after thorough clinical examination, somatic abnormalities are rarely identified.⁵⁵ Seizures often develop (in 60 percent to 90 percent of Rett syndrome patients) and are successfully controlled with carbamazepine, valproate, or lamotrigine.

Prader-Willi Syndrome

Prader-Willi syndrome is a genetic disorder caused by deletion of the paternal genetic information on chromosome 15 coding for proteins required

for general brain development, with particular emphasis on several regions in the hypothalamus. The disorder arises equally in both sexes, with an estimated prevalence of 1:10,000 births.⁵⁶ In utero, the fetus demonstrates decreased activity, and at birth the neonate has a weak cry, is unable to control movements (“floppy”) of the head and neck (muscular hypoto-

Irregular breathing during wakefulness (especially when under emotional or physical stress) and consisting of hyperventilation or breath holding is common between the ages of 5 and 10 years.

nia), has a poor suckling response, and may fail to thrive unless a feeding tube is placed. During this first year of life, the infant is friendly, easygoing, and affectionate. Toward the end of the first year of life, however, muscle tone and movements improve and developmental milestones (speech and motor skills) are achieved, although delayed. By 1 to 2 years of age, the child develops a voracious appetite (hyperphagia) and unless provided with food has a temper tantrum that often includes aggressive behavior and screaming.⁵⁷⁻⁶⁰ The severe overeating is thought to be due to a failure of the normal satiety response following food intake.⁶¹ Signs of mild-to-moderate mental retardation, physical inactivity, decreased

pain sensitivity, disturbed temperature perception, and speech difficulties begin to manifest. As these children get older, they begin to hoard and steal food, severely and persistently overeat, exhibit mood swings, become socially withdrawn, make poor eye contact, and display self-abusive behaviors such as continually picking at their skin and biting their nails. These individuals also often exhibit compulsive and obsessive behaviors (e.g., adherence to rituals, insistence on certain routines, ordering and arranging), repetitive speech, repetitive questioning, stubbornness, impulsivity, and argumentativeness (e.g., strong resistance to certain rules).

By adolescence, most people with Prader-Willi syndrome are severely obese (often with a body mass index that exceeds 33, where the normal for a male is 23 to 25 and for a female 20 to 22), of short stature (with small hands and feet), and with delayed sexual development (males: scrotal hypoplasia, undescended testes, small penis; females: hypoplasia of labia minora and/or clitoris; both sexes: decreased body hair, lack of voice change) because of inadequate function of the hypothalamus and its effects on the pituitary gland (i.e., lack of growth hormone).⁶² Characteristic orofacial features present since birth now become more readily apparent and include fair hair and skin, narrow face, almond-shaped palpebral fissures, strabismus, and a narrow nasal bridge. They also often have a small, retruded mandible, a small mouth with downturned corners that are crusted with thick, ropery saliva, and a thin upper lip. On intraoral exam, the oropharynx may be small and crowded with hypertrophied tonsils.⁶¹

During adolescence, violent and aggressive behavior becomes more

Fragile X



overt, as does stealing money to obtain food and lying about it. By the early 20s, between one-third and one-half of individuals with Prader-Willi syndrome develop definable psychiatric problems.⁶⁴ Major depressive disorder requiring administration of selective serotonin reuptake inhibitor antidepressants, bipolar affective disorder requiring treatment with carbamazepine, and episodes of agitation with delusions and auditory hallucinations necessitating administration of risperidone have been frequently reported.⁶⁵⁻⁶⁷ Physical problems also develop during adolescence, most of which are secondary to obesity, including scoliosis, diabetes mellitus, hypercholesterolemia, hypertension, obstructive sleep apnea (with loud snoring and daytime sleepiness), restrictive lung disease, and osteoporosis.⁶⁸ Death is likely to occur in the third and fourth decades from cardiovascular and respiratory disease.

Dental Considerations

Many of the medications used to treat Prader-Willi syndrome elicit adverse orofacial side effects (**Table 2**), systemic reactions, and drug interactions involving dental agents (**Table 3**). A number of orofacial and medical problems of interest to dentistry are also seen more often in people with Prader-Willi syndrome than in the general population.

Rampant dental decay has been frequently reported and arises from a combination of a preference for high carbohydrate food, poor oral hygiene, and reduced salivary flow.⁶⁹⁻⁷¹ Salivary flow in these individuals is only 20 percent of normal, and the decrease in salivary water contributes to the ropery, thick consistency.⁷² The aberrant saliva incapable of remineralizing enamel has recently been implicated in fomenting the excessive

tooth wear noted in many of these individuals.⁷³ Other dental abnormalities reported to occur in association with Prader-Willi syndrome include delayed tooth eruption, the presence of supernumerary teeth, and periodontal disease.⁷⁴

During adolescence, violent and aggressive behavior becomes more overt, as does stealing money to obtain food and lying about it.

Dental Treatment

Patients afflicted with the disorders described in this paper will exhibit a wide variation in their level of understanding and ability to cooperate. A preliminary office visit to assess their capabilities, obtain a medical history, and gauge the extent of dental disease should be arranged. Patients taking medications that adversely influence the hemopoietic system (e.g., carbamazepine, lamotrigine, methyl-phenidate, risperidone, valproate) will need a complete blood count to assess platelet status if surgical procedures are planned (**Table 2**). Patients with fragile X syndrome have a high prevalence of mitral valve prolapse, a subset of which has an accompanying murmur requiring prophylactic antibiotics to decrease the risk of endocarditis when invasive procedures are performed. Evaluation of these patients by a cardiologist is prudent.

Patients able to cooperate with care can have standard dental procedures performed using local anesthesia. Use of a dental mouth prop to assist patients in keeping the mouth open is very appropriate given their poor muscular control. Physical restraints, however, should be avoided, because they further agitate the child. Long-term care should consist of increasing oral hygiene frequency with the help of the parents and caregivers, daily application of topical fluoride gel or rinse, and frequent preventive recall appointments.

Management of the uncooperative patient is more complex. The degree of sedation and respiratory depression provided by oral sedative medications is difficult to control in healthy patients and is best avoided in this vulnerable population. Administration of intravenous sedative agents for short procedures in an office setting may be appropriate when the clinician is proficient in gaining venous access in obese individuals and emergently intubating patients whose airway may be altered because of obesity, scoliosis, small stature, and hypertrophic tonsils.^{75,76} Long and involved treatment procedures, however, are best performed in a surgical center or hospital setting.

Final Comment

Dentists treating patients with mental retardation must exhibit compassion as they provide care for the patient. They must also exhibit compassion for the family and caregivers when requesting their assistance in the preventive aspects of care. Expectations of the dental team must be tempered by the realization that the patient's preventive dental needs represent only a small component of their total need. Families of people with severe or profound mental retar-

dition are often occupied 24 hours each day, seven days a week, with feeding, toileting, diapering, bathing, and dressing.⁷⁷ **CDA**

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