

*REDUCING SEVERE DIURNAL BRUXISM IN
TWO PROFOUNDLY RETARDED FEMALES*

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Several diurnal audible teeth grinding (bruxism) was found to affect 21.5% of a profoundly retarded population. However, no previous research has treated bruxism in retarded individuals. In the current study a multiple baseline across subjects design was used to assess the effectiveness of contingent "icing," brief contingent tactile applications of ice, as a treatment for bruxism. Three 15-minute treatment periods and two 5-minute generalization periods were conducted 5 days per week. One resident displayed a 95% reduction in the percentage of intervals during which bruxism occurred during treatment periods and a 67% reduction during generalization periods. The other resident displayed a 94% reduction in the percentage of intervals during which bruxism occurred during treatment periods and a 53% reduction during generalization periods.

DESCRIPTORS: bruxism, punishment, generalization, icing

Bruxism has been defined as "a nonfunctional, voluntary or involuntary mandibular movement which may occur during the day or night, manifested by the occasional or habitual grinding, clenching or clicking of the teeth" (Nadler, 1960). Because there are three different behaviors that can occur during the day and/or at night included in the term bruxism, comparisons between studies are difficult. Further, in many instances, a satisfactory description of the problem was not presented by experimenters. This problem of multiple behaviors included in the term "bruxism" has also contributed to difficulties in determining incidence rates.

Estimates of incidence rates vary considerably in their range. In the general adult population,

estimates range from a low of 5% (Reding, Rubright, & Zimmerman, 1966) to a high of 21% (Wigdorowicz-Makowerowa, Grodzki, & Maslanka, 1972, cited in Glaros & Rao, 1977). Further, incidence rates appear to be unrelated to sex (Bober, 1958) or age (Lindqvist, 1971).

No data on the incidence of bruxism among institutionalized retarded persons could be found. However, in an informal survey which preceded the current study, it was found that 21.5% of a profoundly retarded group (N = 65) engaged in bruxism as defined by the production of audible, diurnal teeth grinding sounds. The use of this conservative definition suggests that the percentage of profoundly retarded persons who engage in bruxism would have been higher if the behaviors of nocturnal grinding as well as clenching and clicking had been included.

Ill effects caused or contributed to by bruxism include: lesions to the hard tissue of the teeth; damage to restorations; damage to supporting structures and soft tissues; thrombosis of the blood vessels of the periodontal membrane; necrosis of the periodontal fiber; resorption of the alveolar bone; dysfunction of the tempo-

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mandibular joint (Cannistraci, 1975); and headaches (Christensen, 1971).

In spite of this severe problem that may affect a large percentage of retarded individuals, there have been no treatment studies targeting bruxism in the retarded. Some of the reasons for this are that the procedures currently available for use with normal individuals, such as massed practice (Ayer & Levin, 1973; Heller & Forgione, 1975) and deep muscle relaxation (Heller & Forgione, 1975) require relatively high cognitive ability; whereas other procedures, such as biofeedback of masseter muscle tension (Carlsson & Gale, 1976; Solberg & Rugh, 1972) and a contingent aversive sound blast (Heller & Strang, 1973) require expensive equipment not usually found in institutional settings.

"Icing," a brief contingent ice application to the cheeks or chin, is a procedure that has been used to reduce the severity of another oral activity, self-biting, in a retarded child (Drabman, Ross, Lynd, & Cordua, 1978). In addition to being effective, it had the advantages of being innocuous, easily applied, and inexpensive. For these reasons, it was chosen for use in the current study. The effectiveness of icing as a technique for reducing severe diurnal bruxism in the profoundly retarded was evaluated. Further, checks for generalization of treatment effects were used.

METHOD

Residents

Velma was a 32-yr-old American Indian female. She was profoundly retarded as measured by both Slosson Intelligence Test I.Q. scores (Slosson, 1963) and Fairview Self-Help Scale scores (in Walls, Werner, & Bacon, 1976). Further, both her eyes were closed from birth and she was unable to hear. She was, however, able to ambulate using others as a guide and she assisted in feeding herself.

Velma had a full set of teeth on the mandibular dentition. On the maxillary row, however, she had only two teeth in the back on one side

and three in the back on the other. Her bruxism produced a low, hard, slow grinding sound. Bruxism was documented in her case record for at least 14 years. Though complete dental records were lacking, a recent dental consultation indicated that her tooth loss probably was caused by bruxism. Additionally, there was concern that continued bruxism would lead to further tooth loss.

Gerri was a 16-yr-old nonambulatory white female. She was profoundly retarded as measured by both I.Q. (Slosson Intelligence Test) and adaptive behavior scales (Fairview Self-Help Scale). Her bruxism produced a sharp sound that was usually short (2-3 sec), but sometimes continued for 10-15 sec per occurrence. Gerri's bruxism began shortly after her teeth erupted. She had not yet suffered any tooth loss; however, the biting surfaces of her teeth were severely worn.

Gerri was frequently very sociable in that she smiled often, made good eye contact, enjoyed being touched and tickled, and laughed while playing with others. However, both Gerri and Velma were reported by their teachers and observed by the experimenters to be more difficult to work with and to cry and tantrum more frequently during periods of high rates of bruxism. Dental consultation indicated that headaches and other unpleasant physical stimulation contributed to by bruxism were a probable facilitator for these negative behaviors. Also, with Gerri and to a lesser extent with Velma, being forced to engage in activities they were resisting frequently led to the onset of bruxism, crying, and tantrums. On some occasions this led to a termination of efforts by staff to engage them in activities, hence, potentially resulting in negative reinforcement (Carr, 1977) of bruxism.

For both Gerri and Velma, no occlusal abnormalities were observed other than severe wear on the biting surfaces and Velma's missing teeth. Vitamins were the only medication taken by Gerri. Velma took vitamins and a laxative.

Both residents were enrolled in a variety of activities during the day. These included training

in various self-help skills, physical therapy, and numerous recreational activities such as walks, bus rides, live entertainment, and television. Also, during less structured times of the day, toys were almost always available and direct care staff frequently interacted with both Gerri and Velma. However, for both Gerri and Velma, their irritating teeth grinding sounds and their lack of responsivity during periods of bruxism, decreased the willingness of teachers and direct care staff to work with them. Thus, bruxism was hindering their academic progress.

Setting

Both Gerri and Velma lived at a residential facility. For Gerri, treatment and observation periods were conducted in the area around her bed. At different times she was either on the bed, in a wheelchair around her bed, or more typically on the floor or on a bean bag near her bed. Until day 52, the observer was in clear view of the subject during the generalization checks. After that time, however, clandestine observations were initiated by obscuring the observer from view behind a curtain.

With Velma, treatment and observation periods were conducted at a table where she spent the majority of her waking hours. No attempt was made to obscure the observer from Velma since she was both blind and deaf.

Procedure

Recording. Three 15-min treatment periods were held with each resident individually, 5 days each week. These occurred between 10-10:30 a.m., 12:45-1:15 p.m., and 3-3:30 p.m. The periods were broken down into 90 intervals. The intervals consisted of 8 sec for observation and 2 sec for recording. A tape player signaled the beginning of each interval. There were also two 5-min periods per day for generalization checks throughout the study. They occurred between 12:30-12:45 p.m. and 3:30-3:45 p.m. The 5-min periods consisted of 30 intervals. As with treatment, the intervals consisted of 8 sec for observation and 2 sec for recording.

Reliability checks were made by two experimenters simultaneously and independently recording the occurrence or nonoccurrence of bruxism during each 8-sec interval. For Gerri, six checks were made during baseline and seven after intervention. For Velma, six checks were made during baseline and five after intervention.

An occurrence of bruxism was defined as the audible sound produced by teeth grinding. Using a partial interval recording procedure (Cone & Foster, in press), a teeth grinding response was counted as having occurred if it either began in or occurred during the 8-sec interval. Even though several responses sometimes occurred during an observation, only one was recorded for that interval. This occurred more often in baseline than during treatment and, as such, the authors view the data as providing a conservative estimate of the magnitude of treatment effects. If bruxism began in one 8-sec interval and continued into another, a response was counted as having occurred in both intervals. If bruxism both began in and terminated before the end of the 2-sec period, no response was recorded.

Design and treatment. After institutional review and parental consent forms were received, a multiple baseline across subjects design was used. For Gerri, baseline was continued for 17 days and for Velma, 37 days. With both residents, treatment consisted of "icing," a brief contingent tactile application of ice (Drabman et al., 1978). In this case, a cube of ice was applied to the facial area contingent on a teeth grinding response. Originally, the lips were chosen as the area for icing; however, both subjects engaged in licking when ice was near their mouths. Because of some possible reinforcing effects from this behavior, the cheeks, chin, and under the chin were selected instead of the lips. In the initial phases of treatment when bruxism was occurring at high rates, the ice was moved from one area of the face to another in order to ease discomfort. Tactile contact was terminated 6-8 sec after the last bruxism incident.

Either the first, third, or fourth author applied the procedure.

The residents' reaction to icing varied. Initially, Gerri would occasionally cry after an ice application. However, physical contact and other forms of stimulation also tended to elicit crying readily when bruxism was occurring at high frequencies. Further, as treatment continued and bruxism occurred at lower frequencies, icing had little noticeable effect and sometimes even elicited laughter. For Velma, very little reaction was observed other than occasional grunts and some attempts to push the experimenter away.

RESULTS

In Figure 1, each point on the graph depicting treatment data represents the mean of at least two of the possible three 15-min periods. On some days either the resident's absence for one period or the experimenter's other duties interfered with treatment application. Each point on the graph depicting generalization data represents the mean for the two generalization periods for that day.

As can be seen in both Figure 1 and Table 1, intervention resulted in substantial reductions in bruxism for both residents during both treat-

ment and generalization periods. For Gerri, bruxism occurred during 63% of the treatment intervals during baseline and 8.4% after intervention. In the generalization periods, bruxism occurred during 67% of the intervals during baseline and 21.6% of the intervals after intervention. For Velma, bruxism occurred during 60.6% of the treatment intervals during baseline and 11.4% after intervention. In the generalization periods, bruxism occurred during 71.4% of the intervals during baseline and 32.6% of the intervals after intervention. As can be seen in Figure 1, initiation of clandestine generalization checks had no noticeable effect on Gerri's generalization data.

Reliability. The effective percent agreement (Gelfand & Hartmann, 1975) was computed separately for the occurrence and nonoccurrence of bruxism during each interval by dividing the number of agreements by the number of agreements plus disagreements $\times 100\%$. For Gerri, the mean of the checks for the occurrence of bruxism was 94.4% with a range from 78.5% to 100%. The mean of the checks for the nonoccurrence of bruxism was 97.7% with a range from 86.4% to 100%. For Velma, the mean of the checks for the occurrence of bruxism was 90.5% with a range from 36.4% to 100%. The

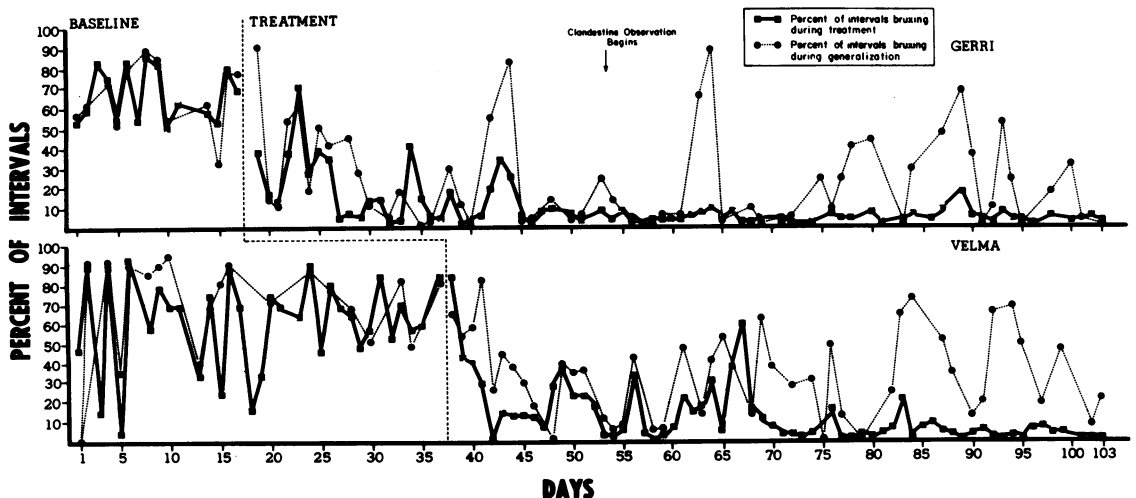


Fig. 1. Mean percentage of intervals per day in which Gerri and Velma engaged in bruxism during treatment and generalization periods.

Table 1
Percentage Reduction in Rate of Bruxism During Treatment and Generalization Periods

	<i>Baseline</i>		<i>Treatment</i>				
	<i>% of Bruxism Intervals</i>	<i>Overall Treatment</i>		<i>First half (till day 60)</i>		<i>Second half (from day 61)</i>	
		<i>% of Bruxism Intervals</i>	<i>% Decrease from Baseline</i>	<i>% of Intervals</i>	<i>% Decrease from Baseline</i>	<i>% of Bruxism Intervals</i>	<i>% Decrease from Baseline</i>
Gerri							
Overall Treatment	63	8.4	88	13	80	3.1	95.3
Overall Generalization	67	21.6	67.6	21	69	22.4	66.6
12:30-12:45 Generalization	59.1	21	64.5	15.9	73.1	25.7	56.5
3:30-3:45 Generalization	74.2	22.5	69.7	26.6	64.2	18.5	75.1
				(till day 67)			(from day 68)
Velma							
Overall Treatment	60.6	11.4	81.2	20.1	66.8	3.8	93.7
Overall Generalization	71.4	32.6	54.3	31.7	55.6	33.5	53.1
12:30-12:45 Generalization	83.5	47.9	43	43.2	48.3	52.6	37
3:30-3:45 Generalization	61.2	18.9	69	21.5	64.9	16.7	72.7

mean for the nonoccurrence of bruxism was 95.4% with a range from 81.3% to 100%.

DISCUSSION

In the current study, significant reductions in bruxism were apparent during treatment periods. Further, as can be seen in Figure 1, there was a downward trend in bruxism as treatment continued. Reductions were also obtained during the generalization periods. Because clandestine observations were in effect with Gerri and because Velma was both blind and deaf, it was assumed that changes in bruxism during generalization periods were due to the treatment procedures per se rather than to the experimenter's presence.

For both residents, in the first half of the treatment phase, concomitant reductions in bruxism occurred in the treatment and generalization periods. During the second half, however, there was a slight increase in the total percentage of

intervals during the generalization periods in which bruxism occurred for both residents. Closer examination reveals a reduction in bruxism during the 3:30-3:45 generalization period and an increase during the 12:30-12:45 period for both residents from the first to the second half of the treatment phase (See Table 1).

Speculation as to possible reasons for this pattern in responding involves the timing of treatment applications. The late generalization period always occurred 5-10 min after a treatment period, whereas the early generalization period occurred 2-2.5 h after a treatment period. It is probable that the length of time since consequences were administered for bruxism came to serve as discriminative stimuli (Catania, 1970) that it was safe to engage in bruxism again. This speculation is supported by the observation that after a couple of weeks of treatment for each resident, bruxism occurred almost exclusively during the first few 10-sec intervals of a treat-

ment session. After consequences were administered for a couple of responses, it was frequently observed that no more occurred during the remainder of a treatment period. Given these observations, a potentially beneficial treatment modification would be to have more numerous and random, though shorter, treatment periods throughout the day. This could help eliminate the predictability of contingencies (Stokes & Baer, 1977; Fowler & Baer, 1981) and therefore promote generalization to nontreatment times.

A number of benefits were realized due to decreases in the residents' rate of bruxism. First, Gerri was observed to laugh and play, both alone and with others when she was not engaging in high rates of bruxism. Her mother reported that her weekly visits with Gerri outside the institution were much more pleasant because Gerri was more sociable and because she was not constantly exposed to Gerri's irritating teeth grinding sounds. These reductions that her mother observed suggested that treatment effects generalized across setting and person as well as time. Teachers and direct care staff made similar comments after going on field trips with Gerri. Also, Gerri's teachers said she was more cooperative during class periods and learning progressed faster as a result. Further, staff reported being willing to spend extra time with Gerri when not exposed to her irritating teeth grinding sounds. A similar pattern of comments was obtained for Velma.

With both residents, environmental factors were observed to correlate with the onset of bruxism. With Gerri, and to a lesser extent with Velma, being forced to engage in activities they were resisting frequently led to the onset of bruxism, crying, and attempts to push staff away. Similarly, physical discomfort was anecdotally observed to precede the onset of bruxism. One example of this was Gerri's sitting in the hot sun at a picnic in July. Also, on days 44, 64, and 89 (29 calendar days separated days 44 and 64, whereas 38 calendar days separated days 64 and 89), Gerri had increases in the rate of bruxism during generalization periods that were associ-

ated with the presence of irritability and acne. On day 64 she had her first and only recorded menstruation during the study. Though the evidence is sparse, it does suggest the possibility that the rate of bruxism was influenced by the occurrence of menstruation (See Figure 1).

A consideration when using icing, or any other punishment procedure, is the availability of alternative ways of attaining the desired behavior change. In the current study, reinforcement for not engaging in bruxism or for incompatible behaviors such as keeping their mouths open were considered as potentially feasible approaches. However, these approaches were rejected for a number of reasons. First, there was some concern regarding the social desirability of the residents constantly keeping their mouths open. Second, omission training has been demonstrated to be difficult to attain (e.g., Schwartz & Gamzu, 1977), and because the residents were profoundly retarded, the authors doubted the residents would make the desired response-reinforcer association. Third, social and tactile stimuli were not considered to have sufficient potential as reinforcers. Fourth, edibles, another possible reinforcer, would have required the residents to chew and therefore engage in some of the same behaviors associated with bruxism. Also, edibles would have spuriously inflated the magnitude of treatment effects in that the residents could not grind their teeth while eating.

The above considerations as well as the destructive effects of bruxism justified the use of icing to reduce the behavior. However, as with any punishment procedure, medical consultation should be initiated if appropriate, staff training should be given, and frequent monitoring of treatment usage should be provided.

In the current study, audible teeth grinding sounds served as the dependent variable. Its use as a target behavior has been criticized because of the possibility that consequences would not be applied to inaudible grinding and clenching (Glaros & Rao, 1977). While admitting this difficulty, there are frequently economic restrictions in institutional settings that prohibit the

use of more sophisticated monitoring devices such as biofeedback of masseter muscle tension. Though it is possible that inaudible grinding and clenching still occurred during the treatment phase, reductions in audible grinding were associated with numerous social and academic improvements such as increased social play and compliance to teacher request. This suggests that targeting audible bruxism can be clinically efficacious as well as experimentally and economically desirable.

In summary, in this study of a behavioral intervention for bruxism in the retarded, substantial reductions in rate were attained during the treatment periods. Also, reductions were attained during the generalization periods. However, it appears that due to the predictability of the time of treatment, bruxism later increased during the generalization period. Future research should evaluate the effectiveness of random treatment periods as an aid for promoting generalization.

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