Reducing Severe Diurnal Bruxism in a Severely Retarded Person

A. Daniel Gomez Fuentes

Western Michigan University

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REDUCING SEVERE DIURNAL BRUXISM IN A SEVERELY RETARDED PERSON

by

A. Daniel Gomez Fuentes

A Thesis
Submitted to the Faculty of The Graduate College in partial fulfillment of the requirements for the Degree of Master of Arts Department of Psychology

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REDDUCING SEVERE DIURNAL BRUXISM IN A SEVERELY RETARDED PERSON

A. Daniel Gomez Fuentes, M.A.
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Bruxism, the nonfunctional grinding, clenching or clicking of the teeth, has been viewed as a psychophysiological disorder. The literature on the incidence and effects of bruxism indicates that bruxism may affect a significant portion of both normal and retarded population. In the current study a multiple baseline, combining with an ABA design within sessions was conducted. During the generalization step, an ABAB design was used. The present study was designed to evaluate the effectiveness of an operant weakening (ice) and operant strengthening (tokens and praises) procedures to reduce the rate and duration of an audible teeth grinding sound in a 42 year old severely retarded male. The results of the study indicate that the use of aversive stimuli, icing or positive stimuli, tokens and praises are equally effective in the treatment of diurnal bruxism. However, the positive control tended to demonstrate greater generalization across time periods and response topographies.
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A. Daniel Gomez Fuentes
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CHAPTER I

INTRODUCTION

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). The purpose of this study is to determine the effectiveness of two response weakening procedures on this behavior.

There are three variations of the bruxistic habit. The first is the grinding habit, which is the resultant contact of opposing tooth surfaces in a rotating motion. The second is clenching, in which pressures are brought on the periodontal structures by the repeated clamping of the teeth. The third is clicking, which is usually a rapid, repeated and rhythmic tapping of the teeth (Blount, Drabman, Wilson & Stewart, 1982; Nadler, 1960). Except for contact during mastication, occasional light contact during speech, and possible contact at the completion of swallowing, sneezing, coughing and yawning, all other forms of pressure contact may be considered acts of bruxism.

Estimates of incidence rates vary considerably. This could be due, in part, to the fact that bruxism is performed on a reflex level and is, therefore, in most instances unrecognized by the patient unless a second party calls it to the patient's attention. In general, adult population estimates range from a low of 5.1 percent (Reding, Rubrigth & Zimmerman, 1966) to a high of 21 percent (Wigdorowicz-Makowerowas, Grodzki & Maslanka, 1972). Ramfjord and Ash (1983) indicate that
information gained from questionnaires, case histories, family members, and examinations indicate that the presence of bruxism is found in 60 to 90 percent of patients with periodontal disease and in 78 percent of all children between two and five years old. Nadler (1957) believed the problem to be universal, and expects that most individuals will engage in bruxism during some stage of their lives. No data on the incidence of bruxism among institutionalized retarded persons could be found. However, in an informal survey (Blount, Drabman, Wilson, & Stewart, 1982) it was observed that 21.5 percent of a profoundly retarded group (N = 65) engaged in bruxism as defined by the production of audible diurnal grinding sounds.

Bruxism may have a significant influence on the periodontal tissues, teeth, masticatory and/or adjacent muscle, and temporomandibular joints. (Christensen, 1971; Gallagher, 1980; Nadler, 1960; Ramfjord & Ash, 1983; Scandrett & Ervin, 1973; Schulte, 1982). When the bruxistic habit occurs over a long period of time, the teeth often show excessive attrition of their biting surfaces. While it is not proven that bruxism inevitably leads to periodontal disease, it remains as a potential source of damage to the periodontium and to the temporomandibular joints (Gallagher, 1980; Ramfjord & Ash, 1983). Significant damage from bruxism is often greater to the crown of the teeth than to the periodontium. It may lead to pulpitis, pulp exposure, or pulp death. Sharp irritating enamel margins, fractured or split teeth or restorations, and even apical strangulation of the pulp are other possible dental sequelae of bruxism (Ramfjord & Ash, 1983). Furthermore, bruxism has been identified as a possible factor in chronic facial pain and headaches.
Theories of Bruxism

Nadler (1957) has classified the known etiological factors of bruxism into four hypothetical categories: (a) local; (b) systemic; (c) psychological; and (d) occupational factors. The research undertaken since Nadler's review has concentrated primarily on the first three factors, with the occupational factor generally subsumed under the psychological theories (Glaros & Rao, 1977).

Local Factors

Recent theories have held that bruxism might result from occlusal abnormalities (Scandrett & Ervin, 1973; Schulte, 1982; Ramfjord & Ash, 1983). A disharmony between the teeth and joints becomes evident in the central nervous system (CNS) through the proprioceptive receptors in the supportive structures of the teeth. These receptors establish a program for the CNS so the teeth can avoid disharmony with the joints. If the feedback mechanism is no longer able to cope with disharmony between the teeth and joints, the patient may try to negate a disharmony by grinding or clenching his or her teeth (Scandrett & Ervin, 1973). Individuals who come in contact with acids, sand, granite, gravel, and other abrasive materials which may enter the oral cavity and produce etching or abrasion of the teeth which resembles the effects of bruxism (Nadler, 1960).

Various explanations have been proposed that indicate bruxism is precipitated by a combination of psychological and occlusal factors and consequently, is more apt to be present at certain times in a person's
life than at others. If the etiology is functional, occlusal therapy is very effective if done properly (Ramfjord & Ash, 1983; Schulte, 1982). The psychological factors will be discussed later.

**Systemic Factors**

A variety of systemic factors may be pertinent. Gastrointestinal disturbances, nutritional deficiencies, nephritis, allergies, sinusitis, vesical irritabilities, neurological and neuromuscular disturbances, endocrine disorder and hereditary factors should be considered. Epilepsy, meningitis, chorea, cerebral spastic infantile paralysis and cerebral palsy may also be causative factors (Nadler, 1960). However, one cannot assure that bruxism is the result of systemic or neurological dysfunctions (Reding, Zepeling, Robinson, Zimmerman & Smith, 1968).

The most promising systemic research has concentrated on the role of the cerebral and autonomic nervous systems in grinding and clenching the teeth. The evidence that has accumulated over the last several years to support these theories has been derived from research that has employed one of the following basic designs: (a) observation of animals who have either specific cortical or subcortical regions - either stimulated or ablated; (b) observation of humans in all-night studies using a combination of electroencephalogram (EEG), electromyogram (EMG), electrooculogram (EOG), electrocardiogram (EKG) and respiration and sound recording; (c) observation of humans who suffer bruxism as a side-effect of drug therapy (Gloros & Rao, 1977).
Psychological Factors

Glaros and Rao (1977) found that the psychological data, although not unanimous, tend to suggest that at least a significant number of bruxists are under stress, either from intrapersonal psychological sources or from situational sources. However, given the lack of methodological and the theoretical sophistication present in the majority of the studies reviewed by Glaros and Rao (1977), the results of the analysis must be regarded as only tentative hypotheses. The occupation of the patient may also be significant. Bruxism may be a compensatory device to the stress of working and living.

Thaller (1960) administered the Cornell Medical Index to 50 female patients at New York University College of Dentistry. Thaller found a definite correlation between anxiety and the bruxistic habit. The results showed that periodontal patients with the bruxistic habit have a higher score on the Cornell Medical Index than patients who are not bruxistic.

Yemm (1969a, 1969b) found an increase in masseter muscle activity when human subjects were asked to perform a task which was designed to induce emotional stress. When a human subject is under stress, the activity of both the masseter and temporal muscles tends to increase (Yemm, 1971).

Hutchinson et al. (1972) presented a brief summary of the empirical evidence that several types of environmental conditions produce aggressive behavior in infra-human species. They concluded that the causes of aggression are of two principal classes: (1) the onset or occurrence of
noxious, aversive, painful or negatively reinforcing events, and (2) the offset or termination of pleasant, beneficial, or positively reinforcing events.

Hutchinson et al. (1977) undertook the measurement and functional analysis of jaw clenching in humans. The frequency, duration, and intensity of nonfunctional jaw contractions in humans were measured. Several experiments explored the environmental causes of jaw clenching. Jaw contractions were differentially increased by the delivery of noise, the cessation of cigarette smoking, or the termination or reduction of both response-dependent and response-independent money, and points convertible into money. In another experiment, progressive increase and decrease in amounts of response-independent money decreased and increased jaw clenching respectively. These studies suggest that masseter contractions in humans are a consistent component of human aggression.

As a result of the relationship between stress and bruxism, researchers have suggested relaxation-training techniques as treatment for reducing stress and subsequently bruxism (Cases, Beemsterboer & Clark, 1982; MacManus, 1981).

Treatment of Bruxism

Non-Behavioral Treatment

Dental

The dental approaches to the treatment of bruxism are an outgrowth of the local etiological theories discussed above. In general, dental
treatment attempts to eliminate trigger factors leading to bruxism and/or attempt to prevent further damage to the teeth and the supporting tissues.

Occlusal adjustment has been often recommended in the treatment of bruxism if the etiology is functional. (Ramfjord & Ash, 1983; Schulte, 1982). A second widely recommended technique involves the use of occlusal appliances, typically constructed from hard acrylic. The primary advantages of these devices (bite plates and occlusal splints) are (a) ease of fabrication and (b) prevention of further wear to the teeth and supporting structures (Ramfjord & Ash, 1983).

Behavioral Treatment

Since a large number of authors have conceptualized bruxism as a response to emotional dysfunction, psychotherapy or psychoanalysis has often been recommended to deal with the hypothesized underlying emotion problem (Nadler, 1973; Ramfjord & Ash, 1971). However, no data on the efficacy of psychotherapeutic techniques have been presented (Glaros & Rao, 1977).

A more promising approach to the psychological treatment of bruxism has conceptualized bruxism in terms of learning theory (Ayer & Hirschman, 1972).

Learning Methods

Classical or Avoidance Conditioning. Some of the classical and avoidance conditioning procedures currently implemented have involved normal individuals and have used aversive conditioning. Nocturnal
bruxism has been decreased using loud tones (DeRisi, 1970), sound blasts
(Heller & Strang, 1973), or negative practice - a combined effect of
punishment and extinction (Keith, 1976). Daytime bruxism has been
decreased using both negative stimuli and positive stimuli procedures;
both procedures are self-monitored and self-administered. The negative
stimuli procedure utilized lemon juice (Jenkins, 1978), while the other
procedure used positive stimuli as reinforcement if a reduction of 10
or more teeth grinding behaviors occurred. If such a reduction did not
occur, the subject practiced teeth grinding for a designated period
before falling asleep (Pawlicki & Galotti, 1978).

Massed Practice. Ayer and his associates (Ayer, 1976; Ayer &
Gale, 1969; Ayer & Levin, 1973) have proposed that massed practice
might be successful in the treatment of bruxism. In massed practice,
repeated evocation of the response elicits muscular pain and discomfort.
Cessation of response, therefore, is reinforced due to the decrease in
muscle fatigue.

Heller and Forgione (1975) assessed the efficacy of the massed
practice technique devised by Ayer and Levin (1973). Their conclusion
that massed practice was not effective in reducing bruxism contradicted
the results of the Ayer and Levin study (1973) who reported elimination
of bruxism in 11 of 14 patients. Additional study is necessary to
determine the treatment duration and intensity to reach maximum fatigue

Habit-Reversal Technique. Another behavioral treatment of bruxism
has been the habit-reversal technique developed by Azrin and Nunn (1973)
and implemented by Rosenbaum (1980) and Rosenbaum and Ayllon (1981). This procedure is designed to: (a) increase the client's awareness of the occurrence of the habitual movement; (b) interrupt the chain of behavior terminating in the habitual movement as early as possible in the chain; (c) teach the client a competing response opposite to the habitual movement but involving the same muscle groups as in that movement; and (d) eliminate social reinforcement for the habit or shift it to being contingent on appropriate behavior.

**Tension Reduction and Biofeedback Methods**

**Relaxation.** If bruxism is conceptualized as a response to generalized or environmental-specific stress, teaching a subject to relax may be an effective means of reducing or eliminating bruxism.

This technique incorporates practice relaxation exercises into the individual daily schedule several times during the day. These studies have used training tapes alone (Heller & Forgione, 1975), training tapes plus the use of EMG biofeedback of masseter muscle tension with skin temperature monitoring (MacManus, 1981), comprehensive behavioral stress-reduction counseling program (Casas, Beemsterboer & Clark, 1982) and relaxation and management techniques with subjects who had facial pain (Rosenbaum & Ayllon, 1981). Results of these studies have shown an effective reduction of incidence of bruxism during sleep. Furthermore, they lend support to the idea that stress is a factor contributing to nocturnal bruxism. In addition, the stress management technique was found effective in reducing pain associated with bruxism.
Bicfeedback. This line of investigation assumes that subjects given biofeedback training will better discriminate between high and low levels of muscle tension, thereby allowing subjects under high levels of tension to initiate responses (e.g. relaxation) that inhibit the tension.

This technique utilizes a muscle biofeedback unit which delivers an audible "warning" tone if the patient clenches or grinds his/her teeth. This procedure involves training sessions in which the individual learns to reduce electromyogram (EMG) muscle activity. In addition to monitoring EMG levels, self-reports of muscle fatigue and pain, and clinical evaluations of dentition and jaw disturbances are obtained. Results of these studies have shown a positive relationship between decreasing EMG levels and the reduction of reported symptoms. These studies have evaluated daytime biofeedback (Stein, 1976; Solberg & Rugh, 1972) and the effects of daytime biofeedback training upon EMG activity and nocturnal bruxistic response (Cornellier, 1981; Cornellier, Keenan, Wisser, 1982; MacManus, 1981; Clark, 1981).

Studies with Retardates

Although bruxism presents a severe problem for a large percentage of retarded individuals, there have been no treatment studies targeting bruxism in this population except the studies of Kramer (1981) and Blount, Drabman, Wilson and Stewart (1982).

Kramer (1981) used a single subject design (AB) to assess the effectiveness of a contingent verbal "No", accompanied by the teacher's
finger pressing on the eight year old mentally retarded child's jaw. During the baseline, the teacher recorded the occurrence and duration of each incident of bruxism as well as whether the subject was involved in individual or group activities. Audible grinding noises were used as the dependent measure at all points of the study. The results showed that the aversive contingency was effective in reducing the level of teeth grinding. However, the nature of the design, (single subject) limits the generalization of the results, as does the absence of an attempt to reverse the treatment effect or to apply the treatment in other settings.

Blount, et al. (1982) used a multiple baseline across subject design with mentally retarded adults to assess the effectiveness of contingent "icing" procedure in which a brief contingent tactile application of ice to the cheek area was used as a treatment for bruxism. Assessments took place during three 15-minute treatment periods and two-minute generalization periods, five days per week. One subject displayed a 95 percent reduction in the percentages of intervals during which bruxism occurred during treatment periods, and a 67 percent reduction during generalization periods. The other subject displayed a 94 percent reduction in the percentage of intervals during which bruxism occurred during treatment and a 53 percent reduction during generalization periods.

The study was designed to evaluate the effectiveness of:

(a) an operant weakening procedure: the application of an aversive stimulus, "a cube of ice" to the jaw/cheek area for five seconds, contingent upon the occurrence of the bruxistic response; and
(b) an operant strengthening procedure: the delivery of tokens and praises contingent upon non-occurrence of the bruxistic response for a period of 10 seconds.

A Differential Reinforcement of Other Responses (DRO) schedule was used. Operant weakening and operant strengthening were used because they retain the sense of behaviors operating on the environment and permit the use of the simple descriptive terms for the effects of the environmental changes on behavior (Michael, 1969).

The sound of teeth-grinding was adopted as the criterion for the validation of the dependent variable, because, when present, the sound is a reliable indicator of bruxism.

The decision to intervene with an aversive procedure was made after consideration of the following: the frequency of the behavior and resultant health problems indicated the need for quick, effective intervention. "Icing", a brief contingent ice application to the cheeks or the chin, is a procedure that has been used successfully to reduce severe diurnal bruxism in profoundly retarded individuals (Blount, Drabman, Wilson, & Stewart, 1982).

A conditioned positive stimulus (tokens and praises) associated with an unconditioned stimulus (food) were used, because they have been used successfully to reduce the severity of other behavioral problems found in the retarded (Ayllon & Azrin, 1965; Ayllon & Azrin, 1968; Bijou, Birnbrauer, Kiddar & Tague, 1967). In addition to being effective, the tokens and praises take on the properties of a generalized reinforcer. This eliminates many of the problems which are associated with temporary
satiation and deprivation (Sulzer & Mayer, 1972). The Differential Reinforcement of Other Responses (DRO) schedule used approach the goal of behavioral reduction in a positive manner. DRO enables the individual to be rewarded for a wide variety of behaviors, with the one specified exception. (e.g., bruxistic response).

The hypothesis of this study predicted that both procedures, negative and positive techniques, could be successful in reducing severe diurnal bruxism in a severely retarded individual.
CHAPTER II

METHOD

Subject

The subject was a 42 year old severely retarded male client who attended a day training program affiliated with a local university. He had a history of nocturnal seizures and was under daily medication (Atarax, Phenobarbital, Dilatin). His bruxism was characterized by a sharp sound which usually continued from 15 to 30 seconds per occurrence, but sometimes lasted 60 seconds or more.

He was selected for the study because of the severity of his bruxism, and the sounds produced, by the repeated grinding of teeth were annoying and distracting to this therapist and parents. There was also concern that the bruxism would adversely affect his oral health.

Experimental Setting

The subject was undergoing a personal therapeutic program. He attended five therapeutic modules each of 45 minutes, along with 10 to 15 other clients at the center. He engaged in a variety of training and activities in the following areas: communication, recreation, prevocational, daily living skills, socialization and community living.

The study was completed while the subject was attending the therapeutic modules. The experimenter personally conducted the study during the third, fourth and fifth therapeutic modules. These corresponded...
with three settings. In the first, the subject was trained in basic prerequisites necessary for enhanced development of self-help and self-management skills, i.e., discrimination training, academic skills, time usage, and handling money. In the second, the subject was being trained in functional communication, basic verbal behavior, sentence length, sentence structure (grammar and syntax), articulation and modulation of his voice level and a decrease in inappropriate verbal behavior. In the third setting, the subject was being trained in daily living skills which facilitate the acquisition of self-care and independent living behaviors.

During these three settings the subject was engaged in activities of assembling nuts and bolts, coloring and buttoning buttons. These activities were selected to provide consistency across the study. In the first setting, the subject was working at the same table with his peers but engaged in an individual activity: screwing together nuts and bolts. In the second and third setting, the subject worked by himself, coloring and buttoning buttons. A 30-minute session of observation and treatment was held in each of three settings. Each 30 minute session was divided into three 10 minute periods.

During the generalization step of the study, the observation and treatment periods extended to encompass the subject's entire day at the Center and included his lunch and coffee break. Aid in conducting the study was obtained from therapists and students at the Center during this step.
Apparatus

A portable tape recorded (Panasonic, Rq-337) with a tie clip microphone (Realistic, cat. no 33-1058) was used to record the teeth grinding noises made by the subject.

Procedure

Audible teeth grinding sound served as the dependent variable, because, when present the sound has been demonstrated to be a reliable indicator of bruxism.

The two procedures to alter bruxism responses were: an operant weakening procedure, in which "a cube of ice" wrapped in fabric was applied to the jaw/cheek area for five seconds, contingent upon the occurrence of the bruxistic response; and an operant strengthening procedure with the delivery of a token and praise contingent upon non-occurrence of the bruxistic response for a period of 10 seconds. A Differential Reinforcement of Other Responses was employed (Fixed Interval 10 seconds). For this second procedure, if the teeth grinding response was not audible during the entire 10 second interval, the other responses emitted by the subject were reinforced. If the teeth grinding response was audible at any time during the ten second interval, the stopwatch was reset, and the time interval started again. During the generalization step the DRO was faded from an interval (variable) of 1 minute to an interval (variable) of 5 minutes.
Response of Interest

Three 10 minute machine observation periods were held for each session. An acute sound emitted by a pocket watch signalled the end of each period within each session. There were five sessions a week. These occurred between 10:50-11:20 a.m., 11:35-12:05 p.m. and 1:35-2:05 p.m. A portable tape recorder was employed, and a tie clip microphone was attached to the subject's collar so as to record the audible teeth grinding sound. The portable tape recorded was calibrated, heads cleaned, and the batteries changed every two weeks throughout the course of the study.

Two observers were utilized, the experimenter and a reliability observer. The role of the observers was to listen to the tapes of the sessions through an amplifier and transduce the audible teeth grinding sound into two dimensional measures, frequency and duration. The first was measured by dividing the number of discrete bruxism responses by ten minutes (Rate). A two-second non-bruxism response was the criterion chosen to separate one discrete bruxism response from another. Duration was measured by adding the total duration of the bruxistic response during each ten minute period.

Both observers were trained while listening to two minute cassettes with the subject's bruxistic responses recorded one week before the study was started. The practice observations were concluded when a 95 percent reliability level between observers was reached. A calibration measure was taken at the end of the study to determine whether observers were still sensitive to the teeth grinding sound.
Reliability checks were made by the second observer while listening to 10 percent of the total number of sessions conducted during the study. The tapes were chosen at random and transduced into the two physical dimensions of the bruxistic response cited above.

Agreement between the observers or interobserver reliability refers here to the stability of the frequency and duration of the response. It was determined by comparing repeated, independently observed judgements, to each other of a series of the subject's audible teeth grinding sound, recorded by the tape recorder. The computation of the percentage of interobserver agreement equals 1 - [(Highest frequency or duration - lowest frequency or duration)/highest frequency or duration] was used (Kramer, 1981).

During the generalization step of the study, seven ten minute machine observation periods were held between 8:45 a.m.-2:15 p.m., five days a week. Each of the subject's therapeutic modules at the Center were divided in four 10 minute periods. The periods involved in treatment and observation were chosen randomly using random number tables. The coffee break and lunch activities were divided in two and three ten minute periods respectively. A random procedure was applied here also to select the periods for the treatment and observation.

**Design and Treatment**

A multiple baseline across settings combined with an ABA design within sessions was used.

In the first setting (10:50-11:20 a.m.) the baseline was continued, through the three consecutive ten minute periods for 15 days (one session
each day in this setting). After the 15th session, the treatment for this setting, which consisted of "icing," was applied in the second ten minute period. The first and third ten minute periods were held under baseline conditions throughout the study. The treatment continued until the twenty seventh session. The treatment consisted of the application of a cube of ice to the jaw/cheek area for five seconds contingent upon the occurrence of the bruxistic response (Blount, Drabman & Stewart, 1982). The cube of ice was wrapped in a piece of fabric.

During the second setting (11:35-12:05) the baseline was continued through the three consecutive ten minute periods for 21 days, one session each day. After the 21st session, treatment was started and administered only in the second ten minute period. The first and third ten minute periods were held under baseline conditions throughout the study. The treatment for this setting consisted of delivery of tokens and praises contingent upon non-occurrence of the bruxistic response for a period of 10 seconds. A Differential Reinforcement of Other Responses was scheduled (DRO FI 10 sec.). At the beginning of the second period during the treatment phase a tape cassette was played with the following instructions recorded by a therapist to the client: "(Name), don't make any noise with your mouth. Be nice and quiet. Daniel will give you chips, if you are quiet, and you can trade these for food at the end of the session". The chips were traded immediately after each third ten minute period for peanuts or dry fruit.

During the third setting (1:35-2:05) the baseline was continued through the study (27 sessions) for the three ten minute periods. This setting was used as a control, because no treatment was implemented.

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During the generalization step an ABAB design was implemented. Seven ten minute observation and treatment periods were held through the day, one of each session and activity. The baseline was continued for the seven ten minute periods for eight days. The treatment started for all seven ten minute periods on the ninth session using only the operant strengthening procedure, delivery of tokens and praises contingent upon non-occurrence of bruxistic response. The DRO schedule was applied as described above and it was faded through the treatment phase. Variable Interval (VI) 1' (110", 30", 20", 90", 40", 70", 100", 50", 80", 10") for the ninth session, VI 2' (120", 60", 90", 180", 150") for the tenth session, VI 3' (180", 120", 240") for the eleventh, twelfth and thirteenth session. A second baseline for all seven ten minute periods as established on the fourteenth session. No instructions, no tokens or food were delivered by the therapist. The treatment was reestablished on the seventeenth session. The DRO schedule was faded through the treatment phase, VI 3' (180", 120", 240") for the seventeenth and eighteenth session VI 5' (150", 450") for the rest of the phase (19th, 20th, 21st). With the intention of removing the stimulus associated with the tip clip microphone it was not used in recording the 20th and 21st sessions. The built-in microphone in the portable tape recorder, which has the same sensitivity, was used.

The microphone and the tape recorder unit were monitored by different staff and students at the Center, but usually by the therapist in charge at the time when the observation and treatment periods were held. The microphone was attached by the therapist in charge usually
ten minutes before the observation and treatment were scheduled and detached at the end of the session. The client spent his time working or doing his normal activities. At the beginning of the treatment phases the therapist in charge gave the instructions to the subject, using the same terms employed on the tape recorded instructions explained above.

The role of the experimenter was monitoring the schedule of the ten minute periods distributed across the day and monitoring the delivery of tokens by the therapist in accordance with the DRO schedule in effect. In addition, the researcher delivered at each session the microphone, tape recorder unit, cassettes, tokens and reinforcers to the therapist in charge. The tokens, praises and reinforcers were delivered by the therapist in charge contingent upon the non-occurrence of the bruxistic response.

The follow-up phase was conducted during seven ten minute periods per day, one day per week, the first and the second week after the study was finished.
CHAPTER III

RESULTS

The experiment was conducted using a multiple baseline, combining with an ABA design within sessions. During the generalization step, an ABAB design was used. In reporting the results, there will be a progression from the specific to the general.

Figure 1, Setting I shows the rate of subject's bruxism responses per minute in each of the three ten minute periods for each session, during baseline and treatment. Treatment was applied for the second ten minute period, using the aversive stimulus, contingent upon the occurrence of the bruxistic response.

Table 1 summarized an analysis across periods within sessions in the first setting and shows that the mean for the first 15 sessions, which corresponds to baseline were 1.38 for the first period, .49 for the second period, and .35 for the third period. The treatment phase was conducted from the 16th to the 27th session, only in the second period. The mean was 1.12 for the first period, .57 for the second, and .15 for the third period. This analysis shows a gradual decrease from the first to the third, in both groups of sessions (1-15 and 16-27).

In comparing the mean of the first 15 (1-15) sessions against the mean of the last 12 (16-27) sessions (Table 1) the following formula to compute the percentages 100 X([(Highest rate - lowest rate)/highest rate]) was used. A decrease was noted in the mean in the first ten minute period of 19% (1.38 - 1.12). In the second period was an increase
Fig. 1 Rate of subject's bruxism responses per minute in each of the three ten minute periods for each session, during baseline and treatment [only for the second period (0—0)] using aversive stimulus (ice), and positive stimuli (tokens and praises) under DRO schedule FI 10 seconds.
### TABLE 1

BRUXISM RESPONSES IN THE FIRST SETTING

<table>
<thead>
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<th>PHASES</th>
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<th>SESSIONS</th>
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<sup>a</sup>The letter P indicates the periods within sessions.

<sup>b</sup>an aversive stimulus (ice) was used as the independent variable during this setting.

<sup>c</sup>Partial analysis from the 16 to 27 sessions.
of 14% (.49 - .57). In the third minute period there was a decrease of 57% (.35 - .15). In this analysis a small increase from the baseline conditions to the treatment phase during the second period can be noted. However, a decrease was manifested in the first and third period during the last 12 sessions, even though those periods were under baseline conditions.

Figure 1, Setting II shows the rate of subject's bruxism responses per minute in each of the three ten minute periods for each session, during baseline and treatment. Treatment took place during the second ten minute period, using positive stimuli, contingent upon non-occurrence of the bruxistic response for a period of 10 seconds.

Using Table 2 an analysis across periods within sessions reveals the mean for the first 21 sessions which corresponds to baseline were .87 in the first period, .62 for the second period and .49 for the third period. The treatment phase was conducted from the 22nd to the 27th session, only in the second period. In the first period which was held under baseline conditions the mean was .48, in the second period the mean was .03, and in the third period which was held under baseline conditions, .0. This analysis shows a gradual decrease from the first period to the third in the first 21 sessions (baseline conditions for all periods). It was evident that a significant decrease occurred during the last six sessions (22-27). This can be noted using the formula to compute percentages cited above. In comparing the mean of the first period against the mean of the second period (.48 - .03) there was a decrease in the second period of 94%. In comparing the mean of the first period against the mean of the third period (.48 - .0) there was a decrease in the third period of 100%.
**TABLE 2**

**BRUXISM RESPONSES IN THE SECOND SETTING**

<table>
<thead>
<tr>
<th>PHASES</th>
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<th>SESSIONS</th>
<th>MEAN</th>
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<td>6</td>
</tr>
<tr>
<td>Baseline</td>
<td></td>
<td>22-27</td>
<td>6</td>
</tr>
</tbody>
</table>

²The letter P indicates the periods within sessions.

²Positive stimuli (Tokens and praises) were used as the independent variable during this setting.

²Partial analysis from the 1st to 21st session.
In comparing the mean of the first 20 (1-21) sessions against the mean of the last six (22-27) sessions (Table 2) the formula to compute percentages cited above was used. A decrease was noted in the mean of the first ten minute period of 45% (.87 - .48). In the second period there was a decrease of 95% (.62 - .03). In the third period there was a decrease of 100% (.49 - .0). This analysis shows a significant decrease for the three periods not only for the second period in which treatment was applied, but also for the first and third, which were under baseline conditions.

Figure 1, Setting III shows the rate of subject's bruxism responses per minute during the three ten minute periods for each session, during baseline generalization condition.

Using Table 3, an analysis across periods within sessions, which was conducted under baseline conditions from the first to the last session (1-27) reveals that the mean for the 25 sessions recorded were .24 for the first period, .20 for the second period and .22 for the third ten minute period.

A partial analysis shows that the mean for the first 14 sessions, which was conducted under baseline conditions at the same time that the first and second setting were being held in baseline, were .34 for the first period, .27 for the second period, and .35 for the third period. The mean for the next five sessions (16th - 21st) for the first period was .14, .02 for the second ten minute period and .08 for the third. The mean for the following six sessions (22nd - 27th) for the first period was .12, .18 for the second ten minute period and .05 for the third.
### TABLE 3
BRUXISM RESPONSES IN THE THIRD SETTING

| PHASES     |  | SESSIONS |          | MEAN          |          |
|------------|---------------|----------|-------------|-------------|
|            | Session       | Range    | Total       | Rate/Min    | Duration (Minutes) |
| BASELINE   | 1             | 1-27     | 25          | .24         | .29          |
| BASELINE   | 2             | 1-27     | 25          | .20         | .32          |
| BASELINE   | 3             | 1-27     | 25          | .22         | .28          |
| BASELINEa  | 1             | 1-15     | 14          | .34         | .43          |
| BASELINEa  | 2             | 1-15     | 14          | .27         | .52          |
| BASELINEa  | 3             | 1-15     | 14          | .35         | .48          |
| BASELINEa  | 4             | 16-21    | 5           | .14         | .16          |
| BASELINEb  | 1             | 16-21    | 5           | .02         | .006         |
| BASELINEb  | 2             | 16-21    | 5           | .08         | .01          |
| BASELINEb  | 3             | 22-27    | 6           | .12         | .09          |
| BASELINEb  | 4             | 22-27    | 6           | .18         | .12          |

aThe letter P indicates the periods within sessions.

bPartial analysis of the baseline.
In comparing the mean of the groups of sessions (Table 3) the formula to compute percentages cited above was used. In comparing the first 14 sessions against the next five (16-21), the first period shows a decrease of 59% (.34 - .14), 93% for the second period (.27 - .02), and 77% for the third period (.35 - .08). These five sessions, were held in baseline conditions while icing was introduced in the first setting. In comparing the first 14 sessions against the last six sessions (22-27), the first period shows a decrease of 65% (.34 - .12), 33% for the second period (.27 - .18), and 86% for the third period (.35 - .05). It demonstrates the probable effect of generalization when the aversive and positive stimuli were introduced, even though the effect of the time of day could also be attributed. In comparing the 16th to 21st sessions against the 22nd to the 27th sessions, the first period shows a decrease of 14% (.14 - .12), the second period shows an increase of 89% (.02 - .18), and the third period shows a decrease of 37% (.08 - .05). Even though the rate of responses during the second period increased, a decrease of at least 33% was noted when the procedures were applied (.27 - .18) in Settings I and II.

Figure 1 (Settings I, II and III) also was used to analyze the rate of bruxism responses per minute across settings for each one of the three ten minute periods held for each session during the three different settings.

The means for the first 15 sessions (1-15), which correspond to baseline reveal that there was a progressive decrease from Setting I to Setting III in the first ten minute period. However, the pattern is
different for the second and third ten minute period, where the means for Setting II are higher than that of the other two settings.

In comparing the mean of each of the three periods across settings and grouping the sessions into the first 15, the 16-21 and the 22nd to 27th (Figure I, Tables 1, 2, and 3) the formula to compute percentages cited above was used. In comparing the first 15th sessions against the next six (16-21) a decrease was noted in the first ten minute period of 33% during Setting I, Table 1 (1.38 - .92), 98% during Setting II, Table 2 (1.23 - .03), and .59% during Setting III, Table 3 (.34 - .14). A decrease was noted in the second ten minute period of 25% during Setting I, Table 1 (.49 - .37), 100% during Setting II, Table 2 (.89 - .01), 93% during Setting III, Table 3 (.27 - .02). A decrease was noted in the third ten minute period of 100% during Setting I, Table 1 (.35 - .0), 100% during Setting II, Table 2 (.70 - .0), and 77% during the Setting III, Table 3 (.35 - .08). These data show the effectiveness of ice in reducing bruxism and the probable effect of generalization from Setting I, second period, in which "icing" was applied to Settings II and III which were being held under baseline conditions.

In comparing the 16th to 21st sessions against the 22nd to 27th sessions an increase was noted in the first ten minute period of 31% during Setting I, Table 1 (.92 - 1.33), 94% during Setting II, Table 2 (.03 - .48), and a decrease of 14% during Setting III, Table 3 (.14 - .12). An increase was noted in the second ten minute period of 53% during Setting I, Table 1 (.37 - .78), 100% during Setting II, Table 2 (.0 - .03), 89% during Setting III, Table 3 (.02 - .18). An increase was noted in the third ten minute period of 100% during Setting I,
Table 1 (.0 - .30), the level was held to zero during Setting II, Table 2 (.0 - .0), and a decrease of 37% was noted during Setting III, Table 3 (.08 - .05). Although followed by an initial reduction in the bruxistic behavior (session 16 to 21), the individual increased the rate of bruxistic responses during the last sessions (22-27). The effect of the negative and positive stimuli can be noted during the last six sessions although there is a small increase in the rate of bruxistic responses from the previous six sessions.

Figure 2 shows the total minutes of bruxism responses during three ten minute periods for each session, throughout baseline and treatment which was applied [only for the second period (0--0)] using aversive stimulus (ice), and positive stimuli (tokens and praises), under a DRO schedule FI 10 seconds.

The comparison between means was made using the following formula to compute percentages: 100 x [(Highest duration - lowest duration)/ highest duration].

Using Figure 2, Setting I, Table 1 an analysis across periods within sessions in the first setting shows that the mean for the first 15 sessions, which corresponds to baseline were 2.42 for the first period, .87 for the second period, and .61 for the third period. The treatment phase was conducted from the 16th to the 27th session, only in the second period. The mean was 2.77 for the first period, .17 for the second, and .58 for the third period. In comparing the mean of the first period against the mean of the other two ten minute periods in the first 15 (1-15) sessions, a decrease was noted of 64% (2.42 - .87) in the
Fig. 2  Total minute duration of bruxism responses during three ten minute periods for each session, throughout baseline and treatment which was applied [only for the second period (0——0)] using aversive stimulus (ice), and positive stimuli (tokens and praises), under a DRO schedule FI 10 seconds.
second period. In the third minute period there was a decrease of 75% (2.42 - .61). In comparing the mean for the first ten minute period against the mean of the other two ten minute periods in the last 12 sessions (16-27), a decrease was noted of 94% (2.77 - .17) in the second ten minute period. In the third ten minute period there was a decrease of 79% (2.77 - .58). This analysis shows the effectiveness of the aversive stimulus (ice) upon the reduction of the bruxistic response. This is evident from the 94% reduction in bruxism during the second period in which treatment was applied.

In comparing the mean of the first 15 (1-15) sessions against the mean of the last 12 (16-27) sessions (Figure 2, Setting I, Table 1) the formula to compute percentages cited above was used. An increase was noted in the mean in the first ten minute period of 13% (2.42 - 2.77). In the second period there was a decrease of 80% (.87 - .17). In the third period there was a decrease of 5% (.61 - .58). This analysis shows 80% reduction in bruxism in the second period during treatment phase, in which the ice was applied. The other two periods were held under baseline conditions.

Figure 2, Setting II, and Table 2 show an analysis across periods. The mean for the first 21 sessions, which corresponds to baseline, was .88 in the first period, .72 for the second period and .51 for the third period. The treatment phase was conducted from the 22nd to the 27th session, only in the second period. In the first period which was held under baseline conditions the mean was .96, in the second period the mean was .02, and in the third period .0, which was held under baseline conditions. This analysis shows a gradual decrease from the
first period to the third in the first 21 sessions (baseline conditions for all periods). A significant decrease occurred during the last six sessions (22-27). This can be noted using the formula to compute percentages cited above. In comparing the mean of the first period against the mean of the second period (.96 - .02) there was a decrease in the second period of .98%. In comparing the mean of the first period against the mean of the third period (.96 - .0) there was a decrease in the third period of 100%.

In comparing the mean of the first 20 (1-21) sessions against the mean of the last six (22-27) sessions (Figure 2, Setting II, Table 2) the formula to compute percentages cited above was used. An increase was noted in the mean of the first ten minute period of 8% (.88 - .96). In the second period there was a decrease of 97% (.72 - .02). In the third period there was a decrease of 100% (.51 - .0). This analysis shows a significant decrease for the second period (under treatment conditions) and for the third ten minute period (under baseline conditions).

Figure 2, Setting III, and Table 3 show the total duration of subject's bruxism responses in each of the three ten minute periods for each session, during baseline conditions.

An analysis across periods within sessions, which was conducted under baseline conditions from the first to the last session (1-27) reveals that the mean for the 25 sessions recorded was .29 for the first period, .32 for the second period and .28 for the third ten minute period.

A partial analysis shows that the mean for the first 14 sessions, which were conducted under baseline conditions at the same time that
the first and second setting were under baseline, was .43 for the first period, .52 for the second, and .48 for the third period. The mean for the next five sessions (16-21) for the first period was .16, .006 for the second ten minute period and .01 for the third. The mean for the following six sessions (22-27) for the first period was .09, .12 for the first period was .09, .12 for the second ten minute period and .008 for the third.

In comparing the mean of the groups of sessions (Figure 2, Setting III, Table 3) the formula to compute percentages cited above was used. In comparing the first 14 sessions against the five next (16-21), the first period shows a decrease of 63% (.43 - .16), 99% for the second period (.52 - .006), and 98% for the third period (.48 - .01). These five sessions, were held under baseline conditions while icing was introduced in the first setting. In comparing the first 14 sessions against the last six sessions (22-27), the first period shows a decrease of 79% (.43 - .09), 77% for the second period (.52 - .12), and 98% for the third period (.48 - .008). It demonstrated the probable effect of generalization when the aversive and positive stimuli were introduced, though the effect of the time of day could be attributed. In comparing the 16th to the 21st sessions against the 22nd to the 27th sessions, the first period shows a decrease of 44% (.16 - .09), the second period shows an increase of 95% (.006 - .12), and the third period shows a decrease of 20% (.01 - .008). Even though the duration of bruxistic responses during the second period had a small increase, the general analysis shows a decrease of at least 63% (.43 - .16) when the procedure was applied in the Setting I and II.
Figure 2, Settings I, II, III and Tables 1, 2, 3 are used to analyze the total duration of bruxism responses per minute across settings for each one of the three ten minute periods held for each session during the three different settings.

The mean for the first 15 sessions (1-15), which correspond to baseline reveals that there was a progressive decrease from Setting I to Setting III in the first ten minute period. However, the pattern is different from the second and third ten minute period, where the means of the Setting II are higher than the other two settings.

In comparing the mean of each of the three periods across settings, and grouping the sessions into the first 15, the 16-21 and the 22nd to 27th (Figure 2, Tables 1, 2, and 3) the formula to compute percentages cited above was used. In comparing the first 15th sessions against the next six (16-21) in the first ten minute period, a decrease was noted of 22% during Setting I, Table 1 (2.42 - 1.88), 90% during Setting II, Table 2 (1.21 - .12), and 63% during Setting III, Table 3 (.43 - .16). A decrease was noted in the second ten minute period of 77% during Setting I, Table 1 (.87 - .20), 100% during Setting II, Table 2 (1.03 -.0), and 99% during Setting III, Table 3 (.52 - .006). A decrease was noted in the third ten minute period of 100% during Setting I, Table 1 (.61 -.0), 100% during Setting II, Table 2 (.73 -.0), and 98% during Setting III, Table 3 (.48 -.01). These data show the immediate effect of ice in reducing bruxism and the probable effect of generalization from Setting I, second period, in which "icing" was applied to the first and second period in Setting I (under baseline conditions) and across the three ten minute periods in Setting II and III under baseline conditions.
In comparing the 16th to 21st sessions against the 22nd to 27th sessions an increase was noted in the first ten minute period of 49% during Setting I, Table 1 (1.88 - 3.67), 87% during Setting II, Table 2 (.12 - .96), and a decrease of 44% during Setting III, Table 3 (.16 -.09). A decrease was noted in the second ten minute period of 30% during Setting I, Table 1 (.20 - .14). An increase was noted of 100% during Setting II, Table 2 (.0 - .02), and an increase of 95% during Setting III, Table 3 (.006 - .12). An increase was noted in the third ten minute period of 100% during Setting I, Table 1 (.06 - 1.16), the level was held to zero during Setting II, Table 2 (.0 - .0), and a decrease of 20% was noted during Setting III, Table 3 (.01 - .008).

There is a correlation between the rate and duration of bruxism, and both manifest an increase in the level of bruxistic responses during the last six sessions (22-27). However, the reduction was significant during the sessions 16th to 21st and was held at low level during the next sessions (22-27) principally during the second period, which was under treatment conditions. The effectiveness of the positive stimuli was demonstrated by the reduction of at least 98% during the second period in the last sessions and its probable generalization effect upon the third minute period which had a reduction of 100%.

Figure 3 shows the average rate of bruxism response per minute for seven ten minute periods throughout the day, during baseline, treatment and follow-up phases, using positive stimuli (tokens and praises), under a DRO schedule VI: 1', 2', 3', and 5'.

The average rate was obtained adding the rate/minute of each of the seven ten minute periods held between 8:45 a.m. - 2:15 p.m. divided by seven.
The comparison between means was made using the following formula to compute percentages $100 \times \frac{(\text{Highest average rate} - \text{lowest average rate})}{\text{highest average rate}}$.

Using Figure 3, Table 4, an analysis across phases shows that the mean for the first eight sessions, which correspond to baseline was .35. The mean for the treatment phase conducted from the 9th to the 13th session, using positive stimuli (tokens and praises) under a DRO Schedule VI (Variable Interval): was .03. The mean for the baseline phase conducted from the 14th to the 16th session was .61. The mean for the treatment phase conducted again from the 17th to the 21st session using positive stimuli under a DRO schedule VI: 3', and 5' was .01. The follow-up phase was conducted during seven ten minute periods per day, one day per week, the first and second week after the study was finished. The mean was .12.

In comparing the mean of the baseline phases against the treatment phases a decrease was noted of 91% from the first baseline (1-8), and a 98% from the second baseline (14-16).

Figure 4 shows the average duration of the subject's bruxism responses for seven ten minute periods across the day, during baseline, treatment and follow-up phases, using positive stimuli (tokens and praises), under a DRO schedule VI: 1', 2, 3', and 5'.

The average duration of bruxism responses was obtained adding the total duration of bruxism responses for each ten minute period held between 8:45 a.m. - 2:45 p.m. and dividing by seven.

The comparison between means was made using the following formula to compute percentages $100 \times \frac{(\text{Highest average minutes} - \text{lowest average minutes})}{\text{highest average minutes}}$. 

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Fig. 3 Average rate of bruxism response per minute for seven ten minute periods throughout the day, during baseline, treatment and follow-up phases, using positive stimuli (tokens and praises), under a DRO schedule VI: 1', 2', 3', and 5'.

Fig. 4 Average duration of the subject's bruxism responses for seven ten minute periods across the day, during baseline, treatment and follow-up phases, using positive stimuli (tokens and praises), under a DRO schedule VI: 1', 2', 3', and 5'.
### TABLE 4

**BRUXISM RESPONSES IN THE GENERALIZATION STEP**

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<td>17-21</td>
<td>5</td>
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<td>FOLLOW-UP</td>
<td>22-23</td>
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<td>.12</td>
<td>.12</td>
</tr>
</tbody>
</table>

*a Tokens and praises were delivered under a DRO IV 1', 2', 3'.

*b Tokens and praises were delivered under a DRO IV 3', 5'.

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Using Figure 4, Table 4, an analysis across phases shows that the mean for the first 8th sessions, which correspond to baseline, was 1.22. The treatment phase conducted from the 9th to the 13th session, using positive stimuli (tokens and praises) under a DRO schedule VI: 1', 2' and 3' was .02. The baseline conducted from the 14th to the 16th was 1.06. The treatment phase conducted again from the 17th to the 21st session, using positive stimuli under a DRO schedule VI: 3' and 5' was .03. The follow-up phase was conducted during seven ten minute periods per day, one day per week, the first and the second week after the study was finished. The mean was .12.

In comparing the mean of the baseline phases against the treatment phases a decrease was noted of 98% from the first baseline (1-8), and a 97% from the second baseline (14-16). (Figure 4, Table 4).

The generalization step of the study was extended to encompass the subject's entire day at the Center and included his lunch and coffee break.

The positive stimuli (tokens and praises) were applied by other staff members and students at the Center and not by the researcher, to know if the procedure could be effective in other settings throughout the day and to know if a significant reduction could be reached even if the procedure was applied by other people.

The aversive stimulus was not evaluated again, because the present study confirmed the effectiveness of "icing" to reduce bruxism, as had been earlier demonstrated by Blount et al. (1982).

The generalization step confirmed the effectiveness of positive stimuli (tokens and praises) under a DRO schedule in reducing the rate
and duration of bruxism in a retarded male individual. The results demonstrated the generalization of the positive approach across settings and its effectiveness when applied by a different therapist. The reduction in both rate and duration of bruxistic responses during the treatment phases from 91% to 98% confirms the assertion cited above.

Reliability

Reliability checks were made by the second human observer while listening to 10 percent of the total number of sessions conducted during the study. The agreement between observers was determined by comparing repeated, independently observed judgments to each other of a series of the subject's audible teeth grinding sounds, recorded by the tape recorder.

The computation of the percentages was obtained using the following formula: 1 - [(Highest frequency or duration - lowest frequency or duration)/highest frequency or duration] (Kramer, 1981).

The reliability checks made ranged from 80% to 100% with a mean of 96% for rate of the bruxistic response and from 83% to 100% with a mean of 97% for duration of the bruxistic response.
CHAPTER IV

DISCUSSION

The original hypothesis of the study was that both positive and negative procedures would reduce the rate and duration of diurnal bruxism in a severely retarded male. Although both procedures initially reduced the bruxism, it appeared that the aversive condition differentially decreased the duration of the response, rather than the frequency. Whereas, the positive condition tended to produce decreases in both rate and duration of bruxism, and resulted in greater within setting generalization.

There is a correlation between the rate and duration of bruxism, and both manifest an increase in the level of bruxistic responses during the last sessions (22-27) in Setting I, probably due to the use of an aversive stimulus of low intensity. However, the reduction was significant during the sessions 16th to 21st and was held at low level during the next sessions (22-27) principally during the second period, which was under treatment conditions. The effectiveness of the positive stimuli applied under a DRO schedule FI 10 seconds upon the nonoccurrence of the bruxistic response was demonstrated by the reduction of at least 98% during the second period in the last sessions and its probable generalization effect upon the third minute period which had a reduction of 100%.

The use of the audible grinding sound may be misleading since it did not give any indication of an inaudible movement of the jaw which
is also associated with bruxism, as been noted by Yemm (1969a, 1969b) and by Hutchinson et al. (1977). In the last six sessions an increase in the rate of bruxism was noted (Figure 1, Setting I). It may be speculated that this was due to the subject's desensitization to the low intensity aversive stimuli; or perhaps due to the application of the aversive stimulus after a grinding sound was manifested, subsequent to the muscle contraction. Thus, the initial responses in the bruxing chain (i.e., muscle contraction, and teeth contact) were not directly punished by the aversive stimulus. In future studies, it may prove more effective if the aversive stimulus is applied when the temporalis and masseter muscle start moving and prior to the emittance of sound.

The use of only one subject limited the possibility of testing the generalization of the positive approach across subjects. The positive approach also needs to be tested on different subjects, in a variety of settings including their homes and while they are engaged in their day-to-day activities. Additionally, using a tape recorder to record the data proved to be tedious because of the many hours necessary to transduce the data. It would be helpful if the data could be transduced by computer, using intensity as a criteria for determining the frequency and duration.

In earlier studies by Jenkins (1978), lemon juice was used to reduce bruxism in a normal adult. Kramer (1981) uses the spoken injunction "No" along with a pointed finger to reduce bruxism in a retarded, 8 year old child. Blount et al. (1982) used icing as treatment in reducing bruxism in a retarded individual.
The similarities of the above-mentioned studies with the present study were as follows. The subjects were mentally retarded; and negative stimuli were used to control diurnal bruxism. Blount et al. (1982) used icing as the independent variable and frequency as the unit of measurement. In this study the data on response frequency corresponds to the frequency of presenting the aversive stimuli. In Blount et al. (1982) significant reductions were apparent during treatment periods and were also obtained during the generalization periods. During the second half of the study, however, there was a slight increase in the percentage of intervals during the generalization periods in which bruxism occurred for both residents. In the current study a higher increase was noted during the first ten minute period than the third ten minute period (which was conducted under baseline conditions) during the last sessions (22-27) in the Setting I. This increase was primarily in the duration of bruxism response. Speculations as to possible reasons for this pattern in responding involves the timing of the treatment application and the predictibility of contingencies. It is probable that the time (as Blount et al. points out) came to serve as discriminative stimuli. In the present study the subject evidenced greater discrimination of the consequences during the last six sessions (Setting I) and this was more noted in the duration of the bruxistic response and during the first ten minute period.

Several differences between this and previous studies should be noted. The design of the present study used a multiple baseline, combining with an ABA design within sessions. The generalization
step of the study was extended to encompass the subject's entire day at the Center and included his lunch and coffee break in contrast to a single setting with/without control or generalization condition. Additionally, in the first part of this study, the subject engaged in three individual activities which he enjoyed. During the generalization step he was engaged in a variety of activities. In the present study the treatment was applied by several individuals to ensure greater generalization; rather than a single person and/or self-administered contingency. Duration and frequency were used to measure the bruxistic behavior employing a tape recorder. In earlier studies only frequency was employed and a human observer was used to measure the response. In this study a direct measure of rate and duration of the bruxistic behavior was used; rather than counting the number of presentations of stimulus condition. Positive reinforcement was used by Pawlicki (1978) but it was limited to a normal adult and was self-administered. Though the present study was started with the intention of using both positive and negative procedures, the results indicated that the positive procedure was most effective. Considering that the present study confirmed the effects of the aversive stimuli used by Blount et al. (1982), it was decided not to utilize this approach during the generalization step, and only the positive approach was employed. Finally, either a tape recorder or spoken instructions to the subject occurred immediately before the treatment period started, with a DRO schedule to deliver the tokens and praises using either a fixed or variable interval.
The practical implications of this study are that it should be possible to treat bruxism in retarded subjects using only positive stimuli. This has become extremely important, as it has become evident that the use of aversive stimuli on retarded subjects raises a host of ethical questions. In conclusion, the use of aversive stimuli (icing) or positive stimuli (tokens and praises) is initially effective in the treatment of bruxism. However, given the ethical considerations, the greater generalization effects across sessions, and less discrimination of response contingencies, the positive control procedures are recommended.


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