Brief Relaxation Versus Music Distraction in the Treatment of Dental Anxiety: A Randomized Controlled Clinical Trial

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Dental anxiety is a significant problem for patients and dental care providers. Patients who have dental anxiety tend to avoid necessary treatment, and once in the dental chair, they often are difficult to treat. Misdiagnosis may even result from a dentist-patient relationship that is dominated by severe anxiety.1

Avoidance of dental treatment owing to anxiety is common and appears to be associated strongly with significant deterioration of oral and dental health,2 leading to a vicious cycle of cumulative anxiety and increasing avoidance.3 Enkling and colleagues4 conducted a demographic survey and found that 11 percent of a German community sample experienced dental anxiety. While a survey of Norwegian subjects reported a prevalence of dental anxiety below 10 percent,5 other studies have reported that the prevalence of high levels of dental anxiety ranged between 4 percent6,7 and more than 20 percent.6,8 Dental anxiety levels tend to be higher in...
female patients\textsuperscript{9,10} and seem to decrease with age, although it is not yet clear if this effect is due to aging itself or to a cohort effect reflecting differences between age clusters surveyed in the trials.\textsuperscript{11}

Development of dental anxiety usually is associated with a traumatic experience in connection with dental treatment,\textsuperscript{12,13} but many additional causes also are known. The theory of model learning (that is, learning processes resulting from observing the behavior of role models such as family members) and stories told by people in everyday surroundings are considered to have an influence on the emergence and development of different degrees of dental anxiety.\textsuperscript{14}

Several studies support the hypothesis that pain or fear of pain is a primary source of anxiety, as well as a major obstacle to seeking dental care.\textsuperscript{15} In addition, highly anxious patients appear to be more sensitive to pain.\textsuperscript{16,17} Accordingly, Wardle\textsuperscript{18} found the dental injection to be most powerful as an anxiety-provoking stimulus, followed by the dental drill. However, beyond memories that subjects have regarding their dental experiences in childhood, the level of dental anxiety clearly is influenced by individual psychopathologic traits, as well as by the patterns of interpersonal attachments that affect patients’ therapeutic alliance to their dentist.\textsuperscript{14}

Effective treatment options include an explanation of the treatment procedure,\textsuperscript{19} pharmacological strategies involving the use of benzodiazepines and antidepressants,\textsuperscript{20} biofeedback,\textsuperscript{21} hypnosis\textsuperscript{22} and behavioral interventions.\textsuperscript{23} Behavioral management seems to be superior to anxiolytic drug therapy,\textsuperscript{24} and dentally anxious patients reported that they prefer nonpharmacological interventions.\textsuperscript{25} Most of the behaviorally oriented treatments include components based on systematic desensitization\textsuperscript{26} and use of relaxation to counteract and weaken the fear response during gradual exposure to treatment.

Berggren and colleagues\textsuperscript{26} conducted a study in which training in progressive muscular relaxation led to a greater reduction in anxiety among dentally anxious patients than did a cognitive approach. A possible explanation for this is that the perception of personal control as achieved with applied relaxation is a clinically important factor that influences patients’ level of acute pain, which is known to be a primary source of dental anxiety during stressful dental procedures.\textsuperscript{27}

Thus, the question arises whether interventions aimed at patients’ psychophysiological arousal, such as relaxation techniques, result in effects that are different from those achieved with approaches that involve more passive distraction from the anxiety-provoking stimuli.

The aim of our study was to test the hypothesis that an isolated short intervention involving the use of a brief relaxation (BR) technique is effective and superior to music distraction (MD), a supportive technique used commonly in dental practice\textsuperscript{28,29} for the treatment of dental anxiety. We compared BR with MD and with a control group (C), which did not receive any treatment for dental anxiety.

**SUBJECTS, MATERIALS AND METHODS**

**Sample and study procedure.** We recruited participants over a six-month period in a community dental clinic in a rural area of Germany. After an initial office visit, we included in the study regular clinic patients who needed dental treatment and acknowledged their dental anxiety. Exclusion criteria were age younger than 18 years, severe somatic or psychiatric disease, and use of any psychoactive medication (such as an antidepressant or a tranquilizer), as well as a foreseeable need for complex dental treatment requiring more than one treatment session.

Owing to the naturalistic design of the study and our use of self-reported dental anxiety as an inclusion criterion, this study did not fulfill the diagnostic criteria for dental phobia as a specific phobia according to the Diagnostic and Statistical Manual of Mental Disorders, 4th edition\textsuperscript{30} (DSM-IV). Therefore, we did not define a cutoff point for the psychometric measurements or require a typical behavioral pattern of a patient with a dental phobia (that is, delaying, canceling or failing to appear at dental appointments).

The dentist (R.S.) asked potential subjects to participate in this clinical trial, and he explained that they would be randomized into one of two treatment groups (BR or MD) or into the C group. Of the 92 patients asked, 90 agreed to participate; three of these subjects were lost to follow-up.

owing to missing questionnaires. We obtained written informed consent from all subjects. We randomized participants in a 1:1:1 ratio to the BR, MD or C groups. A study nurse carried out the randomization confidentially. We concealed the allocation by using randomized numbers generated by an electronic spreadsheet created before the study.

The duration of the trial was identical for all three conditions. During the first appointment, subjects underwent regular dental diagnostic procedures, and the dentist (R.S.) informed them of necessary treatment steps. Because of the study design, all subjects had simple caries that was not in an advanced stage. Classification as simple caries implied that we could expect restorative treatment to be completed in a single session, which was the case for all participants.

At the second appointment (which took place within 14 days of the first appointment) subjects completed two questionnaires (State-Trait Anxiety Inventory [STAI], Hierarchical Anxiety Questionnaire [HAQ]). The dentist then explained BR and MD. While we used MD as a passive relaxation technique during dental treatment, we introduced BR to subjects in a 10-minute training session, accompanied by brief written instructions, before administering it during treatment (Box). Immediately after the completion of dental treatment and before the final consultation with the dentist, subjects again completed the STAI.

The same dentist (R.S.) treated all participants. Because of the obvious characteristics of MD and BR, blinding of participants was not possible. We completed the study according to plan and followed intention-to-treat principles (meaning that our analysis was based on the initial treatment intent, not on the treatment eventually administered).

**Treatment. BR.** We used the method of functional relaxation, because this technique is effective not only as a regular treatment for various psychosomatic disorders, but studies have proven its effectiveness as a brief, single intervention.

Functional relaxation is used commonly in Germany, Austria and Switzerland for the treatment of a variety of psychosomatic disorders through positive stimulation of the autonomic nervous system and the discovery of proprioception. Patients perform minute movements of small joints during relaxed expiration while focusing on perceived changes in bodily feelings triggered by the movements. In this way, subjects place importance on their relationship to the floor or to some other external foundation (that is, outer support), to the bony skeleton (referred to in functional relaxation as “the frame”) (inner support) and to the interior regions of the body and skin (the latter being the outer border separating the body from one’s environment).

The dentist provided subjects in the BR group with short written instructions regarding BR in the waiting room before dental treatment. In addition, immediately before administering dental treatment, he explained the method to patients in the BR group. If necessary, the dentist

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**Thematic structure of brief relaxation therapy (functional relaxation).**

The awareness that you will have to take your place in the dentist’s chair in a few minutes quite possibly provokes an unpleasant feeling over your body, leading to a hardening of your muscles. This tension may be relieved by the technique of functional relaxation.

For this exercise, please try to feel your body more intensely.

Please perform and repeat each sequence of movements as described for two to three seconds. Pause for a moment to register your body’s perception of changes from one sequence of movements to another.

Try to assume a comfortable position in your seat and perform only small, almost imperceptible, movements.

**How might this technique be applied?**

- Let your lower jaw fall loosely and move it easily from right to left for three to five seconds.
- Move the joints of your head and neck smoothly so that your head nods slightly from one shoulder to the other for three to five seconds. Let gravity do the work. Do you notice a change in awareness of your neck?
- For three to five seconds, move your relaxed shoulders in a circular motion in their joints in such a manner that another person would barely see your movements. Let gravity work for you.
- Pay attention to your awareness of your body. Do you notice any variation?
- Beginning with your backbone, move like a snake, loosely from side to side and from back to front for three to five seconds. Imagine that your chest is suspended from many flexible small joints. Let your ribs fall with gravity. Feel the flexibility of your chest. Notice the sensation inside your chest.
- Keep in touch with your body and be aware of your bodily experiences. Notice your flexibility.
- You do not need to worry about doing something wrong.

Thank you for your cooperation.

* Adapted with permission of S. Karger AG from Loew and colleagues.
explained the process further during treatment. To minimize any effects other than those resulting from BR, we urged the dentist to avoid talking continuously with the patient during the appointment.

A psychosomatic specialist (T.L.) trained the dentist in the functional relaxation technique in a 10-session course. The dentist’s proficiency was ensured via supervised treatment sessions conducted with patients who were not part of this study. Moreover, we ensured adherence to the technique via continuous supervision during the trial (by videotaping the treatment sessions).

**MD.** MD is a noninvasive technique in which the user listens to pleasant music during a stressful procedure. It is based on a widely held perception that in a dental setting, music can reduce pain and anxiety, which are linked closely and lead to mutual amplification. MD is successful not only among pediatric but also in other medical settings, such as intensive care and oncology. Patients themselves have evaluated the utility of supportive MD highly. The effect of MD is believed to be a combination of relaxation and distraction.

We gave participants a list of various music styles from which to choose. During dental treatment, they listened to the music through headphones, with volume control at their discretion. The dentist ensured a pleasurable experience by periodically asking participants if they would like to change the music. Consequently, the nonspecific effect of the dentist’s conversing with the patient during treatment was similar to that with BR.

**Questionnaires.** Subjects in this study completed the STAI and HAQ, both of which were self-administered tests. The primary outcome parameter was the state subscale (STAI-S), because it was the only questionnaire administered before and after treatment. Participants completed the questionnaires independently, and a study nurse checked the data for completeness.

**STAI.** The STAI is a well-known and widely used instrument for detecting different types of anxiety. The instrument consists of two scales, each with 20 questions (total scores range from 20 to 80, with higher scores indicating higher levels of anxiety). The STAI-S measures the subject’s current level of anxiety, while the trait scale (STAI-T) assesses his or her general tendency to experience anxiety. The internal consistency of the STAI-S and STAI-T (Cronbach $\alpha$) is $r = .77$ and $r = .90$, respectively. According to Moore and colleagues, the state subscale is a useful measure for detecting fluctuating dental anxiety.

**HAQ.** We used the HAQ to stratify the intensity of dental anxiety. The questionnaire addresses six anxiety-provoking situations associated with dental treatment. It consists of 11 questions assessed on a five-point scale ranging from “nonanxious” to “completely anxious.” On the basis of an overall score ranging from 11 to 55, we can categorize respondents into “low anxious” (up to 30), “moderately anxious” (31 to 38) and “highly anxious” (above 38) groups. The HAQ is validated sufficiently and exhibits a high correlation with Corah’s dental anxiety scale. Because the HAQ was developed to measure dental anxiety as a consistent characteristic, we administered it only once (before the intervention).

**Ethical considerations.** We planned and conducted this study in accordance with the Declaration of Helsinki and ethical laws pertaining to the medical profession. The ethics committee of the University of Regensburg Medical School, Germany, approved the trial design, and we obtained written informed consent from subjects. We conducted the study independently of any institutional influence, and it was not funded.

**Statistical analysis.** Because the data were not normally distributed, we used the Mann-Whitney test as an appropriate nonparametric method to compare each treatment group with the C group and the BR and MD treatment groups with each other. We used standard deviations and probability to report treatment results according to the principles of an explorative data analysis. Owing to the explorative approach, we did not carry out a post hoc Bonferroni correction of the level of significance despite the multiple testing. We analyzed the data using statistical software (SPSS, version 12.0, SPSS, Chicago).

**RESULTS**

We randomly assigned 90 subjects to one of three groups; three subjects were lost to follow-up owing to incomplete questionnaires, resulting in a study sample of 87 patients. Table 1 presents the patients’ sociodemographic data. We found no statistically significant differences between the groups, except for significantly older age in the C group than in the MD group. Further statistical analysis revealed no significant correlation between age and the outcome parameters, either in the entire sample or in any subgroup. The

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**Table 1:** Sociodemographic data

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C</strong></td>
<td>38.5</td>
<td>Female</td>
<td>30</td>
</tr>
<tr>
<td><strong>BR</strong></td>
<td>39.2</td>
<td>Male</td>
<td>30</td>
</tr>
<tr>
<td><strong>MD</strong></td>
<td>40.1</td>
<td>Female</td>
<td>30</td>
</tr>
</tbody>
</table>

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*Note: The difference in age was statistically significant.*
noticeably higher proportion of male subjects in the C group did not reach the level of statistical significance.

As shown in Table 2, state anxiety was high before dental treatment to a clinically relevant extent, scoring on average above 40. All three treatment modalities revealed a significant decrease in anxiety after treatment, with the most distinctive reduction occurring in the BR group. We noted a relatively small decrease in anxiety after dental treatment in the C group. While MD resulted in a significant reduction in state anxiety in comparison with no intervention (C) ($P < .05$), the anxiety reduction following BR was greater than that in the C ($P < .001$) and MD ($P < .001$) groups. Furthermore, only subjects in the BR group exhibited a clinically relevant standardized effect size of $d = 1.25$. Therefore, a sample size of at least $n = 28$ per group is sufficient in detecting effect sizes of $d = 0.34$ or more, assuming an $\alpha$ error of .05 and a power of .80.

Stratification according to the level of dental anxiety with the HAQ revealed that BR was effective in alleviating state anxiety throughout all

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**TABLE 1**

Sociodemographic data.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MEAN ± SD* AGE, YEARS</th>
<th>NO. (%) OF MEN/WOMEN</th>
<th>NO. (%) OF SUBJECTS MARRIED OR LIVING WITH SOMEONE</th>
<th>NO. (%) OF SUBJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Blue-Collar Worker</td>
<td>White-Collar Worker</td>
</tr>
<tr>
<td>BR†</td>
<td>(n = 29)</td>
<td>37.1 ± 10.1</td>
<td>10 (34.5)/19 (65.5)</td>
<td>24 (82.8)</td>
</tr>
<tr>
<td>MD‡</td>
<td>(n = 28)</td>
<td>32.7 ± 12.2</td>
<td>11 (39.3)/17 (60.7)</td>
<td>20 (71.4)</td>
</tr>
<tr>
<td>C§</td>
<td>(n = 30)</td>
<td>43.7 ± 13.0</td>
<td>18 (60)/12 (40)</td>
<td>26 (86.7)</td>
</tr>
</tbody>
</table>

* SD: Standard deviation. † BR: Brief relaxation. ‡ MD: Music distraction. §: Control.

**TABLE 2**

State anxiety (STAI-S*) at initial and final evaluation.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MEAN ± SD* INITIAL STAI-S SCORE</th>
<th>MEAN ± SD FINAL STAI-S SCORE</th>
<th>MEAN ± SD DIFFERENCE BETWEEN STAI-S SCORES</th>
<th>STANDARDIZED EFFECT SIZE (COHEN’S d)</th>
<th>$P$ VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BR§</td>
<td>(n = 29)</td>
<td>42.4 ± 10.4</td>
<td>29.4 ± 6.3</td>
<td>13.0 ± 9.5</td>
<td>1.25</td>
</tr>
<tr>
<td>MD¶</td>
<td>(n = 28)</td>
<td>41.3 ± 9.6</td>
<td>36.8 ± 9.8</td>
<td>4.4 ± 4.6</td>
<td>0.46</td>
</tr>
<tr>
<td>C#</td>
<td>(n = 30)</td>
<td>41.9 ± 11.5</td>
<td>40.5 ± 11.2</td>
<td>1.4 ± 4.4</td>
<td>0.12</td>
</tr>
</tbody>
</table>

* STAI-S: State-Trait Anxiety Inventory–State. † Source: Spielberger and Gorsuch.21 ‡ SD: Standard deviation. § BR: Brief relaxation. ¶ MD: Music distraction. #: C: Control.
levels of dental anxiety, demonstrating the largest effect in highly anxious subjects. MD also resulted in reduced anxiety, particularly in the moderately anxious subgroup (Table 3). Because the highly anxious subgroup consisted of only five subjects, we merged the moderately anxious and highly anxious clusters for purposes of statistical analysis.

We could find no relevant sex differences regarding the outcome parameters. No subjects reported any side effects of the interventions, nor did any subjects report difficulties with implementation of BR.

**DISCUSSION**

In this preliminary study, we investigated the effectiveness of two interventions—BR and MD—in reducing dental anxiety in comparison with no intervention (C). The results show that BR was more effective than MD. Although MD also proved to be beneficial in reducing state anxiety in comparison with no intervention (C), the effect sizes were moderate. While the effect of BR was greatest among highly anxious subjects, MD demonstrated its greatest effect among subjects with moderate anxiety. One study limitation we need to point out is that the influence of different levels of dental anxiety, as measured by the HAQ, remains slightly unclear because we merged the moderately anxious and highly anxious subjects for purposes of statistical analysis.

One potential explanation for the greater efficacy of BR, aside from the intended decrease in physiological arousal, lies in the subject’s experience of a typically anxiety-producing situation that otherwise is controlled almost exclusively by the dentist. To a certain extent, the subject is able to control his or her own perception of stress, thereby achieving reduced pain sensitivity. These factors do not apply to MD, which operates on a principle of overall distraction by masking fear-enhancing noises during treatment.

**Single interventions.** In contrast to more complex psychotherapeutic strategies, our study showed that both BR and MD were effective as single interventions without requiring prior training of participants. This is especially important for BR, which is an active technique that the user has to learn, in contrast to the passive MD intervention. The written instructions we gave subjects are similar to a manual used for a single BR intervention, which has proven to be effective in other somatic and psychosomatic conditions, such as asthma and tension headache. A 10-session intervention with BR also has been effec-

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**TABLE 3**

<table>
<thead>
<tr>
<th>ANXIETY LEVEL BEFORE TREATMENT (HAQ**†**)</th>
<th>MEAN ± SD DIFFERENCE IN BEFORE-AND-AFTER BR STAI-S†† SCORES</th>
<th>MEAN ± SD DIFFERENCE IN BEFORE-AND-AFTER MD** STAI-S SCORES</th>
<th>P VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (≤ 30)</td>
<td>9.7 ± 6.7 (n = 15)</td>
<td>3.3 ± 3.9 (n = 13)</td>
<td>0.8 ± 5.4 (n = 17)</td>
</tr>
<tr>
<td>Moderate (31-38)</td>
<td>12.3 ± 10.1 (n = 9)</td>
<td>7.1 ± 5.6 (n = 10)</td>
<td>2.9 ± 3.1 (n = 8)</td>
</tr>
<tr>
<td>High (&gt;38)</td>
<td>24.2 ± 8.7 (n = 5)</td>
<td>2.0 ± 1.3 (n = 5)</td>
<td>1.0 ± 1.4 (n = 5)</td>
</tr>
</tbody>
</table>

* HAQ: Hierarchical Anxiety Questionnaire.
† Source: Joehren.‡
‡ SD: Standard deviation.
§ STAI: State-Trait Anxiety Inventory–State.
¶ Source: Spielberger and Gorsuch.31
# BR: Brief relaxation.
** MD: Music distraction.
†† C: Control.
tive in somatoform heart disorders.37

With respect to our investigation, the study design itself might suggest that anxiety reduction can be brought about by termination of dental treatment as an anxiety-provoking stimulus. This might explain the decrease in state anxiety in the C group. However, a counterargument to this is the fact that we observed only marginal anxiety reduction in the C group in comparison with the BR and MD groups. This may be due to the highly elevated and thereby long-lasting state anxiety level before and during dental treatment, which does not subside rapidly on its own.

**Study limitations.** It is important to state that most of the participants in this study did not have a dental phobia, defined by DSM-IV as a specific phobia, because they visited the dentist regularly and came to the dental clinic voluntarily. Therefore, our inclusion criterion was neither avoidance behavior (the main criterion for a specific phobia in DSM-IV) nor a certain level of anxiety, according to the HAQ or STAI-S. Rather, subjects reported their subjective experience of dental anxiety spontaneously. Therefore, it is not surprising that the mean (± standard deviation) HAQ score of 28.7 (± 9.3) for our sample study is close to the level of dental anxiety (28.8 ± 10.1) reported in a German community sample.4 De Jongh and colleagues39 conducted a literature search, the results of which suggested that relaxation alone would not be the appropriate intervention for subjects with severe dental phobia. For these subjects, more comprehensive strategies, including exposure therapy or other cognitive-behavioral techniques, would be needed.

We also need to point out that we did not measure the dentist’s oral communication (a nonspecific therapeutic variable), which might have been slightly more intense with subjects in the BR group. However, because no subject reported difficulties implementing BR, there is no indication that more intense conversation between the dentist and the patient is needed with BR.

Despite a valid power calculation, the sample size was relatively small; thus, our findings are of a preliminary nature.

**CONCLUSION**

For the anxious patient who visits the dental practice voluntarily, BR can be a pragmatic, effective and cost-saving method of facilitating dental treatment. Additional research involving larger groups is needed to replicate the results of this preliminary study. It should include more complicated treatment procedures and patients with more severe dental fear to heighten the impact of different levels of general dental anxiety and to assess the long-term effects of BR on dental anxiety.

**Disclosure:** None of the authors reported any disclosures.

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