Self-Focused and Somatic Attention in Patients with Tinnitus

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Abstract

Self-focused and somatic attention were examined in a sample of 51 patients with tinnitus using the Self-Focus Sentence Completion Test, Private Self-Consciousness Subscale of the Self-Consciousness Scale, Modified Somatic Perception Questionnaire, and the Somatization Subscale of the Symptoms Checklist-90-Revised. Two subgroups of patients emerged following a cluster analysis of the attentional tasks. One group scored lower on both self-attention and somatic attention measures ("low self-attenders"), whereas a second group was more internally directed and scored higher on the attention measures ("high self-attenders"). Between-group comparisons showed that the high self-attenders were, on average, more depressed, had greater emotional distress due to tinnitus, and had greater perceived tinnitus handicap. In contrast, no differences were observed for pitch and loudness measures using either psychophysical or rating scale techniques. Results of this investigation support the belief that attentional mechanisms play an important role in patients' perception of tinnitus and should be considered when planning management strategies.

Key Words: Self-focused attention, somatic awareness, tinnitus

Abbreviations: BDI = Beck Depression Inventory, MSPQ = Modified Somatic Perception Questionnaire, PSC = Private Self-Consciousness Subscale, SCL-90-R = Symptoms Checklist-90-Revised, SFSC = Self-Focus Sentence Completion Test, SOM = Somatization Subscale, THQ = Tinnitus Handicap Questionnaire, TRQ = Tinnitus Reaction Questionnaire

There is a common clinical observation that patients with equivalent tinnitus pitch and loudness experiences demonstrate a broad spectrum of response to the perceived tinnitus sensation(s). In fact, several investigators (Meikle et al, 1984; Jakes et al, 1985, 1986; Hallam, 1986; Kuk et al, 1990; Dennis, 1993; Newman et al, 1994; Hazell, 1995; Henry and Wilson, 1995) have reported low correlations between psychophysical measures of pitch and loudness, sensation level or intensity measures, minimum masking level, hearing loss, and the degree of perceived disability/handicap quantified using self-report instruments or subjective rating scales.

Based on the aforementioned observations, cognitive factors, rather than the psychoacoustic attributes of the tinnitus sensation, may play an important role in the perceived severity of the phantom sounds (House, 1981). In this connection, Kirsch et al (1989) reported that self-perceived tinnitus handicap was related to their subjects' ability to cope with distress. Further, Hallam et al (Hallam et al, 1984; Hallam and Jakes, 1987) have suggested that attentional mechanisms are underlying cognitive variables relating to tinnitus annoyance and distress. That is, tinnitus noises become troublesome because the patient focuses attention on the tinnitus (Hallam et al, 1988). Further, Leader (1986) demonstrated that tinnitus intensity is increased significantly when attention is directed toward the tinnitus, suggesting that attention may serve to potentiate the magnitude of tinnitus. These latter findings are consistent with previous investigations showing that pain intensity can be modulated by attention (Kanfer and
Goldfoot, 1966; Blitz and Dinnerstein, 1977; Pennebaker and Skelton, 1978). Moreover, Leader (1986) suggested that tinnitus may be a greater problem for individuals who are unable to direct their attention away from the tinnitus sensation(s).

It is our general hypothesis that attentional mechanisms may be an underlying mediating factor subserving the differential response to similar auditory sensations observed in patients with tinnitus. Two attentional mechanisms were investigated in the present study, namely, somatic and self-focused attention. The concept of somatic attention relates to an individual's awareness of bodily sensations. Research in the area of somatic attention (Kahneman, 1973; Navone and Gopher, 1979) has indicated that decreases in the intensity of external stimuli often result in internal information becoming more salient to the individual. This principle may help explain why a patient reports that his or her tinnitus becomes “louder” at night when the surroundings are quiet. That is, for patients who listen to tinnitus, as the external environment becomes quiet (i.e., “background noise”), previously ignored tinnitus (i.e., “signal”) becomes more intrusive (i.e., the “signal”-to-“noise” ratio favors the tinnitus) and thus the tinnitus becomes more noticeable, resulting in increased reports of physical and/or psychological distress.

Self-focused attention refers to attention directed internally toward one's own thoughts and feelings as opposed to attention directed externally toward the environment (Ingram et al., 1988; Ingram, 1990). Carver (1979) indicated that self-focused attention may take the form of focus on internal perceptual events, particularly when sensory receptors react to changes in bodily activity. Current hypotheses surrounding tinnitus perception suggest that, for some individuals, adaptive changes may occur centrally (e.g., at subcortical and/or cortical levels) that help “preserve” the tinnitus for those patients who attend to it. These adaptive processes may be potentiated by the patient's emotional response to the perceived threat represented by the tinnitus (Hazell, 1995). In turn, the perceived threat of tinnitus would have a predictable influence over the level of attention directed by the patient toward the tinnitus (i.e., attention toward this warning stimulus would increase). Therefore, it is not only “attention” but the negative beliefs that are associated with the attention that increases the magnitude of the tinnitus.

The purpose of the present investigation was to determine if a group of patients with tinnitus differed in their propensity to be self-focused and aware of somatic sensation. More specifically, the present study was undertaken to determine whether a heterogeneous clinical sample of patients with tinnitus could be clustered into subgroups based on measures of self-focused and somatic attention. If the heterogeneous group of patients could be clustered into subgroups based on the outcome of the attention measures, differences between subgroups would be explored across a number of dimensions, including the psychoacoustic attributes of tinnitus (pitch and loudness), depression, psychological distress, and perceived tinnitus handicap.

METHOD

Subjects

Fifty-one subjects (35 males and 16 females) ranging in age from 18 to 58 years (mean = 46.2; SD = 8.9) participated. All subjects were drawn from a population of outpatients being seen in the Division of Audiology at Henry Ford Hospital. All subjects reported gradual-onset bilateral tinnitus, which was either their primary complaint or secondary to hearing loss, at the time of the audiologic examination. All subjects had normal hearing sensitivity through 1500 Hz (hearing thresholds <=20 dB HL) with a sloping high-frequency sensorineural loss. All patients were otologically normal as determined by an otoscopic examination conducted by an otolaryngologist. None of the subjects had a known history of neurologic disease as determined by case history and medical chart review.

Materials, Instrumentation, and Procedures

A battery of tests was administered to evaluate self-focused and somatic attention, perceived tinnitus handicap, depression, and tinnitus pitch and loudness. The attentional mechanism scales were selected in consultation with a neuropsychologist. The entire battery took approximately 2 hours to complete per subject (1½ hours for completion of the questionnaires and ½ hour for the psychophysical tinnitus measures). Each questionnaire was administered using a paper and pencil format.
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Attentional Mechanism Scales

Self-Focused Attention. The Self-Focus Sentence Completion (SFSC) Test (Exner, 1973) is comprised of 30 sentence stems that are completed by the subject. Each of the 30 completions were assigned by two of the investigators (CWN and JAW) to one of four categories (self-focus response, external world response, ambivalence response, and neutral responses). The self-focus score consists of the total number of sentence completions assigned to each of the self-reference categories.

The Private Self-Consciousness (PSC) Subscale of the Self-Consciousness Scale (SCS) is comprised of 10 items using a 5-point Likert scale. Although the SCS contains three subcales, the present investigation employed only the PSC Subscale, which can be used as an independent measure of internal thoughts, sensations, and feelings to the relative exclusion of environmental events (Fenigstein et al, 1975).

Somatic Attention. The Modified Somatic Perception Questionnaire (MSPQ) (Main, 1983) is a 13-item scale designed to measure somatic and autonomic perception. The scale was originally standardized on a sample of 102 chronic back pain patients; however, the developer of the scale suggested that it is appropriate for use with other chronic problems. The response to each of the 13 somatic items is assessed by a 0 to 3 scale.

The Somatization (SOM) Subscale of the Symptoms Checklist-90-Revised (SCL-90-R) (Derogatis, 1977) is a 12-item scale designed to measure symptomatic psychological distress as it relates specifically to somatic awareness. Each item represents somatic attention using a discrete 5-point scale.

Self-Perceived Tinnitus Handicap Assessment

The Tinnitus Handicap Questionnaire (THQ) (Kuk et al, 1990) is a 27-item self-assessment inventory comprised of three subscales or factors. Factor 1 (15 items) assesses the physical health, emotional status, and social consequences of tinnitus. Factor 2 (8 items) evaluates hearing difficulty related to tinnitus, and Factor 3 (4 items) addresses the patient’s personal viewpoint of tinnitus. Each item is rated by the subject using a 0- to 100-point scale, indicating how much they agree or disagree with each item.

The Tinnitus Reaction Questionnaire (TRQ) (Wilson et al, 1991) is a 26-item scale focusing solely on the psychological distress associated with tinnitus. Ratings for each item are made on a 5-point scale.

Depression. The Beck Depression Inventory (BDI) (Beck et al, 1961) is a 21-item scale designed to evaluate specific behavioral manifestations of depression and provides a quantitative assessment of the intensity of depression. The inventory consists of a graded series of four to five self-evaluative statements.

Psychophysical Tinnitus Measurement. Psychoacoustic pitch and loudness matches were made for each subject. A clinical audiometer (Grason-Stadler Model 10) and a sweep-frequency pure-tone generator (Wavetek Model 180) produced the signals necessary for the loudness- and pitch-matching tasks. Accuracy of the pure-tone signals produced by the oscillator was monitored using a digital frequency counter. The output signals of the audiometer were fed to Telephonics TDH-50 earphones encased in MX-41/AR cushions. All tinnitus pitch and loudness judgments were made inside a double-walled sound-treated booth.

Pitch matching was conducted using a method of adjustment. Each subject was instructed to adjust the frequency of a pure tone (presented at a comfortable listening) to match the pitch of his or her tinnitus. Subjects with multiple tinnitus sounds were instructed to respond to the most predominant pitch perceived. The tone was presented to either the ear contralateral to the side with the predominant tinnitus sensation or selected randomly (if the patient reported equal tinnitus sensations between ears). Three replications were obtained and the median value recorded.

Each subject matched the loudness of his or her tinnitus to the pitch-matched frequency. An adaptive psychophysical method employing a bracketing approach with 1-dB increments was used. Three replications were obtained and the median value noted.

In addition to the psychoacoustic measures, each subject made subjective judgments of pitch and loudness using a 5-point scale. The anchors for the pitch scale were “1,” indicating “very low pitch,” and “5,” representing “very high pitch.” For the loudness scale, a “1” response represented “no tinnitus” and a “5” meant “extremely loud tinnitus.”
RESULTS

Cluster Analysis

Cluster analysis methods were used to determine possible groupings of the 51 patients with tinnitus. Scores from the self-focused attention indices (PSC, SFSC) and from the somatic attention measures (MSPQ, SOM-SCL-90-R) were used to generate potential clusters. A cluster analysis is an exploratory technique in which many different clustering algorithms and plots were employed, with the aim of achieving “clinically sensible” clusters (Johnson and Wichern, 1988). That is, four possible groupings of the data, each one having a different number of clusters, were generated. Each of the groupings was examined to determine which was most intuitively appealing clinically. Before the clustering analysis was conducted, the data from the attention measures were standardized to have a mean of 0 and a standard deviation of 1. This transformation was performed because some of the scores had very large variances, which would have a greater effect on the resulting clusters than those with smaller variances. The clustering was achieved by an iterative algorithm that minimized the sum of the squared distances from the cluster means.

Based on the cluster analysis, a grouping was derived having two major clusters. The first cluster was composed of 32 subjects (mean age = 47.12 years; SD = 7.52) who scored lower on both the self-attention measures (PSC, SFSC) and somatic attention measures (MSPQ, SCL-SOM). The subjects comprising this cluster (25 males and 7 females) were classified as “low self-attenders.” In contrast, a second cluster included 19 subjects (mean age = 44.58 years; SD = 10.58) who scored higher on each of the attentional tasks. The latter cluster of subjects (10 males and 9 females) was categorized as “high self-attenders.” The mean length of time that the low self-attenders reported having tinnitus was 7.79 years (SD = 8.15), whereas the average time that patients were bothered by the tinnitus was 3.97 years (SD = 6.39). For the high self-attenders, the reported duration of tinnitus was 8.66 years (SD = 9.69), with it being bothersome for 3.08 years (SD = 2.78). The cluster analysis was used to create two groups of patients, which served as an independent variable for comparisons of psychological distress, tinnitus handicap, depression, and tinnitus pitch and loudness judgments.

Between-Group Perceived Psychological Distress and Tinnitus Handicap Comparisons

Table 1 shows the means and standard deviations associated with each of the self-report tinnitus measures (TRQ and THQ) for the two groups identified in the cluster analysis. As can be seen, the total scores for both scales were lower (indicating less psychological distress due to tinnitus and perceived tinnitus handicap) for the low self-attender group. A t-test for independent samples demonstrated statistically significant differences between the low self-attender and high self-attender groups for the TRQ (t = 3.55; df = 22.7; p = .0017) and the THQ (t = -4.30; df = 25.6; p = .0002). These findings suggested that the low self-attenders perceived their tinnitus as less handicapping and causing less psychological distress in comparison to the high self-attender group.

Between-Group Depression Comparisons

The group means and standard deviations for the BDI are also shown in Table 1. An independent t-test yielded statistically significant differences between the two groups on the BDI (t = -3.85; df = 24.6; p = .0007), suggesting that the magnitude of depression was greater in the high self-attender group.

Between-Group Tinnitus Judgment Comparisons

Table 1 also summarizes the group means and standard deviations obtained for the pitch (in Hz) and loudness matching (in dB SL) tasks. No statistically significant differences were observed for either pitch (t = 0.77; df = 47; p = .44) or loudness (t = -0.82; df = 27.9; p = .42) between the two clusters. Table 2 displays individual subjective pitch and loudness rating judgments for the 5-point scales. Using Fisher Exact Tests for discrete variables, there were no statistically significant differences between clusters for either loudness (p = .28) or pitch (p = .11) ratings.

DISCUSSION

In recent years, increasing emphasis has been placed on the psychological and cognitive factors that might be important determinants of the perception of tinnitus disturbance. Emotional distress, intrusiveness of tinnitus, irritability, loss
of control, and depression have been identified as major problems of tinnitus sufferers (Tyler and Baker, 1983; Gerber et al., 1985; Jakes et al., 1985; Stephens and Hallam, 1985). The present study was undertaken to evaluate the extent of association between self-focused and somatic attentional factors and the wide range of individuals' tinnitus perception. Inasmuch as two distinct attentional subgroups could be identified in our heterogeneous clinical sample, the results of this investigation appear to support the hypothesis that attentional mechanisms play an important role in patients' perception of tinnitus.

Between-group comparisons for high self-attenders and low self-attenders revealed that tinnitus subjects maintaining a higher level of internally directed attention showed significantly greater perceived tinnitus handicap (THI), distress associated with tinnitus (TRQ), and depression (BDI). In contrast, no between-group differences were observed for psychophysical (i.e., pitch and loudness) judgments of tinnitus. These latter observations were anticipated in view of previous findings revealing a lack of predictable relationships between tinnitus pitch and loudness judgments, severity, and tinnitus disability/handicap (Meikle et al., 1984; Kuk et al., 1990; Newman et al., 1994; Hazell, 1995).

Our findings suggest that the psychophysical characteristics of tinnitus evaluated in the present study do not appear to play a significant role in the level of attention patients direct toward their own tinnitus. This question continues to be interesting because patients with tinnitus are quite adamant that it is the loudness, pitch, or quality of their tinnitus that makes it so disabling and handicapping. Thus, the plethora of descriptors of tinnitus may serve little more than a demographic function. It may be that the fear some individuals experience when presented with a chronic condition about which they know little and over which they feel they have little control serves to potentiate depression, emotional distress, and somatic awareness associated with tinnitus. Our findings appear to suggest that indices of attentional focus may be used to cluster meaningfully patients with tinnitus. There appears to be a significant association between the attention that is paid to tinnitus and the extent of negative response on measures of depression and tinnitus disability/handicap.

In a related study, we investigated whether selective auditory attention abilities differed between normal subjects and subjects with bothersome tinnitus (Jacobson et al., 1996). Using the negative difference wave (Nd) as an electrophysiologic index of selective attention, it was found that the Nd was of greater magnitude in the tinnitus patients. Further, the cortical N1 component of the evoked response occurred significantly later in the presence of selective attention in the tinnitus subjects. We interpreted the results as being supportive of the view that early selective attention in subjects with both-

| Table 1 Means and Standard Deviations Associated with Group 1 (Low Self-Attenders) and Group 2 (High Self-Attenders) for Measures of Emotional Distress (TRQ), Perceived Tinnitus Handicap (THQ), Depression (BDI), and Psychoacoustic Pitch and Loudness Matches |
|---------------------------------|---------------|---------------|---------------|
|                                  | Group 1 (n = 32) | Group 2 (n = 19) |
|                                  | Mean          | SD            | Mean          | SD          |
| TRQ*                            | 11.9          | 12.5          | 35.1          | 26.7        |
| THQ†                            | 19.3          | 14.0          | 45.1          | 23.8        |
| BDI‡                           | 5.3           | 4.4           | 13.0          | 8.0         |
| Pitch match (Hz)                | 6086          | 2614          | 5475          | 2756        |
| Loudness match (SL)             | 10.0          | 8.6           | 12.5          | 11.6        |

TRQ = Tinnitus Reaction Questionnaire; THQ = Tinnitus Handicap Questionnaire; BDI = Beck Depression Inventory.

Table 2 Individual Subject Judgments for the Loudness and Pitch Rating Scales (1- to 5-Point Equal Interval Scale) for Group 1 (Low Self-Attenders) and Group 2 (High Self-Attenders)

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Possible range of scores: *0-104, †0-100, ‡0-63.
ersome tinnitus differed from that of the normal controls. These electrophysiologic findings provide additional evidence that attentional mechanisms may have the capability of potentiating the annoying effects of tinnitus.

The present findings are in agreement with those of Henry and Wilson (1995), who reported that patients classified as “high distress” had BDI scores of 10.18 points, generally categorized as mildly depressed. In the current investigation, the BDI score for the high self-attenders was 13.0 points. Interestingly, the group mean TRQ scores in the present study were surprisingly similar to those reported by Henry and Wilson (1995). That is, the latter authors reported mean TRQ scores of 9.96 and 33.26 for the low- and high-distress groups, respectively. We observed mean TRQ scores of 11.9 and 35.1 points in our low and high self-attender groups, respectively.

Assessing the level of self-focused and somatic attention in patients with tinnitus may have important implications for intervention. Currently, no universally accepted rehabilitative tinnitus management approach exists. The major interventions used by audiologists include (1) patient education/counseling (Tyler et al, 1989; Stouffer et al, 1991); (2) cognitive therapy approaches where basic errors in logic are identified and intervention focuses on treating the patient’s reaction to tinnitus (Sweetow, 1986); and (3) instrumentation used for tinnitus masking (Vernon and Schleuning, 1978; Tyler and Bentler, 1987) and to facilitate habituation (Jastreboff and Hazell, 1993; Hazell, 1995). What remains to be determined is what endogenous factors lead some patients to be high self-attenders. It may be hypothesized from the present findings that tinnitus patients who are high self-attenders may benefit from therapeutic modalities, both medical (e.g., drug trial; Sullivan et al, 1989) and rehabilitative (e.g., cognitive-behavioral therapy approach; Sweetow, 1986), that are directed toward a reduction in depression and somatic awareness. These latter management modalities might be supplemented concurrently with instrumentation techniques, such as habituation therapy (Jastreboff and Hazell, 1993; Hazell, 1995) or conventional masking (Vernon et al, 1980). The low self-attender patient may benefit sufficiently from the provision of informational/educational counseling and instrumentalational approaches. This hypothesis may be tested by evaluating the quality of outcome (as quantified by tinnitus outcome measures, measures of depression, and general quality of life) of two samples of patients, one receiving standard tinnitus management techniques only and the other receiving customized treatment plans based upon classifying patients as high self-attenders and low self-attenders using attentional measures.

In conclusion, the present report highlights the importance attentional mechanisms play in an individual’s reaction to tinnitus. That is, patients with tinnitus who are more somatically aware and internally directed, on average, display elevated depressive symptomatology, tinnitus-related distress, and self-perceived tinnitus disability/handicap. Further, our findings support the belief that individual differences in a patient’s reaction to tinnitus are not a simple function of those psychoacoustic attributes of tinnitus studied herein.

Acknowledgment. This study was supported by the American Tinnitus Association.

REFERENCES


