Alcohol Abuse and Perceptual-Motor Dysfunction: The Occupational Therapist’s Role

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A review of the literature on perceptual-motor deficits in alcoholic patients is presented. Studies show that there is a relationship between perceptual-motor dysfunction and alcoholism. Because occupational therapists treat perceptual-motor deficits in other kinds of patients, they may have a role in treating these deficits in alcoholic patients as well. To assume such a role, however, occupational therapists must document a relationship between dysfunction in activities of daily living and perceptual-motor dysfunction in the alcoholic patient. Unless such a relationship is established, treatment of perceptual-motor dysfunction in alcoholic patients would not fall within the scope of occupational therapy.

For this paper, perceptual-motor dysfunction is defined as deficits in “abilities for interpreting sensory information and for manipulating self and objects” (Kielhofner, 1985, p. 33). Alcohol abuse is defined as the improper use of alcohol.

There is widespread abuse of this drug in the United States. Hennecke and Gitlow (1983) reported that 19% to 95% of children and adolescents in grades 7 through college use or abuse alcohol. Nineteen percent were classified as problem drinkers; however, when a person is below the legal drinking age, any use becomes abuse.

Criteria for alcohol abuse in studies of adults varied from behavioral definitions to formal medical diagnoses. Incidence figures of alcohol abuse for adults varied from 4% to 15.7% because of differences in the definition of abuse and geographic location and other variables. One study of the elderly showed incidence of 8.3% (Hilton, 1987; Robins et al., 1984). According to Moore (1986), alcoholism is the third largest public health problem in the United States. In 1986, Eckardt and Martin reported evidence of brain dysfunction in 50% to 70% of detoxified alcoholics (these figures exclude alcoholics who have organic brain syndrome).

Although the American Occupational Therapy Association supports the role of occupational thera-
pists in treating alcoholic patients (AOTA, 1986), few occupational therapists working in the substance abuse area have contributed to the professional literature. Noteworthy exceptions are Lindsay (1983) and Gangle (1987).

Lindsay (1983) described how occupational therapy would help the alcoholic patient. Occupational therapy was directed toward helping the patient practice new behaviors to achieve a long-term recovery. Appropriate emotional expression, healthy interpersonal relations, and the use of leisure time were emphasized. Although therapy to improve memory, teach problem solving, and enhance fine eye-hand coordination is mentioned, little attention is given to visuospatial or tactile-perceptual dysfunction.

Gangle (1987) studied the effects of occupational therapy on adolescents, many of whom were alcohol abusers. Treatments emphasized prework skill and relationship skill development. Intensive involvement in occupational therapy was significantly related to positive change in relationship skills on 7 of the 18 variables defining these skills. Like Lindsay's study, Gangle's study did not specifically address perceptual-motor dysfunction.

Neuropsychological Tests

Most researchers dealing with perceptual-motor dysfunction and alcohol abuse have used one or more of the following tests: the Block Design, Object Assembly, or Digit Symbol subtests of the Wechsler Adult Intelligence Scale (Wechsler, 1974); the Luria-Nebraska Neuropsychological Battery (Golden, Hammek, & Purisch, 1980); the Category, Tactile Performance, and Trail Making tests of the Halstead-Reitan Battery; the Raven Progressive Matrices (Raven, 1960); the Wisconsin Card Sorting Test; the Bender-Gestalt Test; the Witkin Embedded Figures; the Rod and Frame Test; and several of the Arthur Benton Tests. Most of these tests have a motor-skill component. The Bender and embedded figures tests measure the subject's ability to separate the foreground from the background. The Rod and Frame Test, which has also been used to measure this ability, is now in question as a figure-ground perception test (Donovan, Queisser, & O'Leary, 1976; Goldstein & Shelly, 1971; Lafferty & Kahn, 1986). The above-mentioned tests primarily assess visual-spatial functions, with the exception of the Tactual Performance test of the Halstead-Reitan Battery, which also measures spatial memory, and the Tactile scale of the Luria-Nebraska. The tests involving visual-spatial perception vary as to which higher cognitive functions are also measured: memory, sequencing, abstraction, or ideational flexibility (Eckardt & Martin, 1986; Horton & Wedding, 1984; Page & Cleveland, 1987).

Alcohol Abuse and Fine Motor Skills

Typically, the studies on alcohol abuse do not make a distinction between fine motor control and perceptual-motor function. Of the Halstead-Reitan Battery frequently used in this type of research, the Finger Tapping test, a speed measure, probably best addresses motor control (Horton & Wedding, 1984). The Trail Making test (also of the Halstead-Reitan), which requires subjects to manipulate a pencil to connect symbols on a piece of paper, measures motor skill, but also rather large components of visual-spatial perception and figure-ground perception (Fabian & Parsons, 1983; Goldstein & Shelly, 1971; Lafferty & Kahn, 1986; Silberstein & Parsons, 1981). The Block Design subtest of the Wechsler also requires some degree of manual dexterity for appropriate manipulation of the blocks (Horton & Wedding). A relationship between alcohol abuse and poor performance on these three subtests has been substantiated (Fabian & Parsons; Goldstein & Shelly; Hillbom & Holm, 1986; Hochla & Parsons, 1982; Leberg, 1980; McCrady & Smith, 1986; Tarbox, Connors, & McLaughlin, 1986). Studies with other tests have shown similar results (Burger, Botwinick, & Storandt, 1987; Kleinknecht & Goldstein, 1972).

Some researchers have found that the motor components of their test batteries do not discriminate alcohol abusers from control subjects (Altman, Tarter, Pastarulo, & Baughman, 1984; Chmielewski & Golden, 1980). Because few studies have compared the performances of alcoholic and nonalcoholic subjects on basic motor versus perceptual tasks, the relationship between alcohol abuse and fine motor skill remains unclear.

Alcohol Abuse and Tactile Perception

The Tactual Performance test of the Halstead-Reitan Battery involves the placement of blocks in a form board without the use of vision, and the immediate drawing of the board from memory with the use of vision. One of the skills required for success is the efficient integration of kinesthetic and tactile feedback (Horton & Wedding, 1984). Kleinknecht and Goldstein (1972), after reviewing the early research, concluded that this test elicits poor performances in alcoholics. Goldstein and Shelly (1971), using one of the first factor analyses in this area, found tactual performance among those perceptual-motor variables associated with alcohol abuse.

During the late 1970s and early 1980s, many researchers substantiated the earlier findings. It was documented that alcoholic subjects performed poorer than did nonalcoholics in tasks of tactile perceptual function, as measured by the Halstead-Reitan Battery (Claiborn & Greene, 1981; Hochla & Parsons, 1982;
Alcohol Abuse and Figure-Ground Perception

The relationship of alcohol abuse to figure-ground perceptual dysfunction has been examined since the 1950s. Kleinknecht and Goldstein (1972) cited two early studies that compared alcoholic with nonalcoholic subjects on the Bender-Gestalt test; no differences between the two groups were observed. A second review (Donovan et al., 1976) cited two studies that compared alcoholic and nonalcoholic subjects on the Embedded Figures test, and again no differences were observed. A more recent review (Lafferty & Kahn, 1986) cited two early studies that did show a significant difference in figure-ground perception between alcoholics and nonalcoholics, but in both studies the Embedded Figures test was combined with the Rod and Frame test so that the latter test could have accounted for the difference. This evidence suggests no relationship.

Alterman, Bridges, and Tarter (1986) used the Embedded Figures test to compare the performances of 14 alcohol abusers with the performance of 20 control subjects. The subjects were all college students and were defined as “problem drinkers” if they indicated becoming intoxicated more than once a month. The alcohol abusers had poorer performance scores than the nonabusers.

The Bender-Gestalt and Embedded Figures tests have been found to discriminate within the alcoholic population, for example, showing improved performances as duration of abstinence increased (Lafferty & Kahn, 1986; Tarbox et al., 1986).

Brandt, Butters, Ryan, and Bayog (1989) were able to discriminate between alcoholic and nonalcoholic subjects using their figure-ground perception test. However, these investigators used a timed embedded figures test tachistoscopically presented that apparently was more sensitive than the measures used by others. They also demonstrated that although the scores of alcoholic and nonalcoholic subjects declined with age, alcoholic subjects showed poorer performance than nonalcoholic subjects regardless of age.

Alcohol Abuse and Complex Visual-Spatial Functions

Most of the research involving alcohol abuse and perceptual-motor dysfunction includes a visual-spatial performance component. Early studies showed poor performance by alcoholic persons on space perception-dependent subtests of the Wechsler, the Halstead-Reitan Category and Trail Making tests, the Benton Revised Visual Retention Test, the Raven Progressive Matrices, and other, similar tests (see, for example, Goldstein & Shelly, 1971; Jones & Parsons, 1971; and Kleinknecht & Goldstein, 1972). Among the early cross-cultural studies demonstrating that this relationship was not unique to the United States were the 1977 study by Berglund, Leijonquist, and Hörnlén (conducted with Swedish subjects) and the 1975 study by Clarke and Haughton (conducted with Irish subjects). Although alcohol abusers repeatedly performed poorly on visual-spatial tests, studies showed they performed within normal limits on verbal and general intellect tasks as measured by the Wechsler (Goldstein & Shelly; Kleinknecht & Goldstein).

Studies on visual-spatial dysfunction associated with alcohol abuse continued into the 1980s. Cross-cultural studies from Scotland, Norway, and Canada verified this relationship (Guthrie & Elliott, 1980; Löberg, 1980; Wilkinson & Carlén, 1980). Studies emphasized the interrelationships of other variables such as sex, age, education, drinking history, and drinking style, for example, binge drinking and daily drinking (Brandt et al., 1983; Burger et al., 1987; Fabian & Parsons, 1983; Gorenstein, 1987; Page & Cleveland, 1987; Tarbox et al., 1986). Regardless of these variables, the relationship between alcohol abuse and visual-spatial dysfunction typically re-
mained significant. However, some variation in the degree of the dysfunction has been reported. Younger alcoholics have shown a lesser degree of dysfunction than have older abusers (Brandt et al.; Ryan, 1982; Tarbox et al.). Also, evidence has been inconsistent regarding the effect of drinking style on perceptual-motor dysfunction (Gorenstein; Page & Cleveland; Tarbox et al.).

The introduction of the Luria-Nebraska battery into alcoholism research did nothing to alter the observation of the relationship between visual-spatial perception and alcohol abuse (Burger et al., 1987; Chmielewski & Golden, 1980). The visual-spatial perception deficit in alcoholics did not vary across tests.

Etiology and Recovery
Because researchers now agree that a relationship exists between perceptual-motor dysfunction and alcohol abuse, recent research has focused on why this relationship exists and whether or not perceptual-motor dysfunction is reversible.

Explanations for Perceptual-Motor Dysfunction in Alcoholics
Researchers have suggested various explanations for the relationship between perceptual-motor dysfunction and alcohol abuse, but none have been verified or universally accepted. Among the explanations for perceptual-motor dysfunction that are being considered by researchers are those pertaining to area(s) of cerebral damage: A frontal system deficit, a right-hemisphere problem, and diffuse brain damage have all been suggested. Researchers have proposed that a cerebral deficit causes, amplifies, or merely coexists with a perceptual deficit. Another possibility is that perceptual-motor dysfunction could lead to, rather than result from, brain damage (Alterman, Bridges, & Tarter, 1986; Cala & Mastaglia, 1981; Gorenstein, 1987; Jones & Parsons, 1971; Parsons & Leber, 1981; Porjesz & Begleiter, 1981; Wilkinson & Carlen, 1980). Studies of alcohol abusers have shown bilateral cerebral damage occurring in both cortical and subcortical sites (Cala & Mastaglia; Porjesz & Begleiter). Although of utmost importance, a review of these studies is beyond the scope of this paper.

The fact that many other body systems (besides the brain) are affected by alcohol abuse complicates the etiology of visual-spatial deficits, even from a strictly medical point of view. Liver or vascular disease and head trauma also affect perception (Eckardt & Martin, 1986; Hillbom & Holm, 1986; Tarter, Hegedus, Van Thiel, Gavaler, & Schade, 1986).

Further complicating the situation is the fact that perceptual-motor deficits observed with alcohol abuse resemble the deficits occurring with normal aging. Again, there is controversy. Some investigators consider the resemblance a matter of premature aging in alcoholic persons, with earlier damage of those brain structures and/or functions typically not deteriorating until older ages are reached. Others suggest an effect of alcohol toxicity on the aging central nervous system processes. As a third possibility, the effects of alcohol could be added to those of normal aging (Burger et al., 1987; Grant et al., 1984; Noonberg, Goldstein, & Page, 1985; Ryan, 1982).

Recovery of Perceptual-Motor Skill
Perceptual-motor performance may improve in recovering alcoholics. Research on this topic has used both longitudinal and cross-sectional designs. Alcoholics who have abstained for as long as 7 years have been studied (Brandt et al., 1983; Cala & Mastaglia, 1981; Ellenberg, Rosenbaum, Goldman, & Whitman, 1980; Fabian & Parsons, 1983; Goldman, 1983, 1986; Guthrie & Elliott, 1980; Lafferty & Kahn, 1986; Parsons & Leber, 1981; Yohman, Parsons, & Leber, 1985).

From their review of the early research, Kleinkneeht and Goldstein (1972) concluded that although many cognitive functions were restored within the first 2 or 3 weeks of abstinence, evidence of reversibility of perceptual-motor dysfunction remained inconsistent. If impaired test performances were still observed one month after the patient stopped drinking, the poor performance of perceptual-motor tasks was one of them (Claiborn & Greene, 1981; Goldman, 1983, 1986; Lafferty & Kahn, 1986; Parsons & Leber, 1981).

One study concluded that older alcoholic subjects regained perceptual-motor functions less readily than did younger subjects (Ellenberg et al., 1980). These results were supported by computerized tomography (CT) scans of alcoholic subjects (Cala & Mastaglia, 1981). Few CT scans have been performed for this purpose; those that have been performed show the best recovery in the younger patients. Because of the evidence that perceptual-motor deficits after several weeks of abstinence were retained at least by older recovering alcoholic persons, a number of studies investigated recovery over long time periods. Although some inconsistencies were reported, perceptual-motor dysfunction was still observed in alcoholic subjects who had been abstinent for months and even for years (Brandt et al., 1983; Fabian & Parsons, 1983; Goldman, 1986; Grant et al., 1984; Guthrie & Elliott, 1980; Parsons & Leber, 1981; Yohman et al., 1985).

Rehabilitation
Because the literature has documented the spontaneous return of some cognitive functions in alcoholic
patients although with certain perceptual-motor deficits remaining, it is logical to consider whether therapeutic procedures might enhance the recovery of these perceptual-motor processes. This “experience-dependent” recovery (i.e., recovery related to practice) has been studied by Goldman (1983, 1986). He showed that in both younger and older alcohol abusers, practice can improve perceptual-motor test scores beyond improvement caused by time alone. Goldman (1986) also demonstrated that improvement from a practice exercise was not limited to this exercise but was transferable to other visuospatial tasks. For example, some degree of learning transfer was shown on the Wechsler Digit Symbol subtest, on the Trail Making test, and on the Benton tests of visual retention and line orientation. There was no evidence of learning transfer on the Halstead-Reitan Tactual Perception test. Research also suggests that patients who are less cognitively impaired are more likely to be successful in alcohol rehabilitation programs (McCready & Smith, 1986).

However, remediation of perceptual-motor deficits is of specific interest to occupational therapists only if this improvement is associated with occupational functioning. Although no research substantiates this association, several authors have mentioned a potential relationship. Abbott and Gregson (1981) suggested that poor adjustment to daily living tasks is associated with the cortical deficits seen in alcoholic patients. Parsons and Leber (1981) suggested that cognitive deficits (including perceptual-motor deficits) may affect everyday functioning, thereby interfering with school or job activities. Finally, Goldman (1986) indicated that the rehabilitation of alcohol abusers in cognitive areas could help prepare them for future job responsibilities.

Role of Occupational Therapy

A relationship between alcohol abuse and perceptual-motor dysfunction in the visual-spatial area has been documented. When tactile perceptual performance shows impairment, it is probably in the spatial component of the task. There is little evidence to suggest that the motor skills of alcohol abusers are deficient apart from their perceptual aspects.

There is no consensus on the etiology of the perceptual-motor performance deficit shown by alcohol abusers. If perceptual-motor dysfunction in the alcohol abuser does improve, it is one of the last deficits to be corrected, but there is some evidence that rehabilitation can hasten recovery. The occupational therapy literature supports the role of occupational therapy in the treatment of perceptual-motor deficits of patients with head trauma and cerebrovascular accidents. The literature also shows that occupational therapists have been working with alcoholic patients in various capacities. Since alcohol abusers, particularly at the in-patient stage of rehabilitation, displayed poorer performance on tests of perceptual-motor skill than did nonalcoholic subjects, it follows that occupational therapy should be concerned with treatment in this area.

Although the literature has documented the relationship between activities of daily living and perceptual dysfunction in patients with head trauma and cerebrovascular accident, research is lacking in this area for alcohol abusers. Such research is necessary to support the role of occupational therapy in the treatment of alcoholic patients.

From the literature review, a number of concrete suggestions for occupational therapy research and practice have emerged. First, researchers need to document whether or not the perceptual-motor dysfunction observed in alcohol abusers is related to deficits in the performance of activities of daily living. This should be observed in adolescent, middle-aged, and elderly patients. Rather than addressing simple tasks such as dressing skills, measurement tools should address the more complex activities of daily living tasks, such as the management of one’s financial affairs and the maintenance of a healthy lifestyle in which a balance between recreation, work, and rest is maintained. The relationships with educational and prevocational tasks should be explored. Researchers should evaluate the relationship between perceptual-motor performance and early versus late stages of recovery. Occupational therapy may be able to hasten the regaining of normal functioning in activities of daily living in recovering alcohol abusers through early treatment of these patients’ perceptual-motor problems.

Occupational therapists should also research the area of perceptual-motor dysfunction. In order to treat these deficits, therapists need information on the underlying component deficits. Factor-analytic studies limited to clear-cut perceptual-motor test data could identify the deficits that relate specifically to alcohol abuse. The studies to date have included many complex cognitive tests, such that the scores of tests involving any kind of perceptual-motor skill were interrelated. We need to know specifically if motor skill or a problem with position in space or some other component is related to alcohol abuse.

Researchers from other disciplines are concerned with etiology and treatment related to freedom from substance abuse. Occupational therapists should study the association of activities of daily living with perceptual-motor deficits and the specific perceptual problems involved. Until such research is completed, occupational therapists in substance abuse settings might wish to observe alcoholic pa-
tients' functional activities from this perceptual-motor perspective as well as from within the more traditional psychosocial framework.

References


