Unexpected dental behavior in five Alzheimer patients

Differences between cognitive and functional capacity, graphic performance, and dental behavior

Gunilla Nordenram, Eva Ryd-Kjellén, Kjerstin Ericsson and Bengt Winblad

Division of Geriatric Dentistry, Department of Oral Diagnostic Sciences, and Division of Geriatric Medicine, Department of Clinical Neuroscience and Family Medicine, Karolinska Institute and Gerontology Research Center, Stockholm, Sweden

Nordenram G, Ryd-Kjellén E, Ericsson K, Winblad B. Unexpected dental behavior in five Alzheimer patients. Differences between cognitive and functional capacity, graphic performance, and dental behavior. Acta Odontol Scand 1995;53:381–388. Oslo. ISSN 0001–6357.

The aim of the study was to analyze five patients with Alzheimer's disease in whom the degree of dementia assessed by cognitive and functional tests was at variance with the behavior in the dental setting and to relate these factors to the outcome of the graphic test. Possible reasons for the differences were discussed. The subjects were diagnosed as having Alzheimer's dementia on the basis of the DSM-III-R. Their cognitive and functional impairments were assessed with the Mini-Mental State Examination test and Katz's index of activities of daily living. Behavior in the dental office was registered in a structured form. The graphic function was assessed as Human Figure Drawing. Besides the stage of dementia, the patient's personality, social and medical background, and memories of previous dental care influence the demented patient's behavior in the dental office. To provide secure conditions for treating demented patients, the dentist must be able to interpret the patient's unique personality in the context of the dental situation.
☐ *Alzheimer's disease; cognition; geriatric dentistry*

Gunilla Nordenram, Geriatrisk Odontologi, Odontologiska fakulteten, Box 4064, S-141 04 Huddinge, Sweden

The proportion of elderly people in the Swedish population is increasing (1). Since the prevalence of dementia diseases increases in old age, this implies a rapidly growing medical, sociologic, and economic problem in Sweden, as in most other modern societies (2).

In comparison with earlier generations of elderly, most of whom were edentulous and used removable dentures (3), the elderly of today have better oral health and retain their natural dentitions into very high age (4). To maintain a lifelong good oral health, the elderly now need more regular dental care, including preventive care.

Dementia reduces the ability of the patient to accept conventional dental treatment (5–7). Some demented patients may require preoperative sedation for dental care, and some treatment must be carried out under general anesthesia. Attention to the patient's behavior in the dental clinic can give the dentist hints about the patient's stage of the dementia and capacity to cooperate. Such observations are of importance in the dentist's treatment decision and treatment planning.

The capacity to perform a free-hand Human Figure Drawing (HFD) has long been used to assess intellectual development in children (8). It has been shown to be reliable and valid for this purpose and has proved popular in clinical practice (9). The HFD is also said to be a portrait of the subject by a projection of body feelings and attitudes towards inter-personal relationships in general. The details drawn in the HFD are believed to represent the subject's awareness of and interest in primarily elemental aspects of everyday life (10). The absence of essential details in the HFD might indicate a start in cognitive deterioration; for example, the removal of arms or omitting the mouth or eyes makes communication impossible.

Mental status can be assessed by non-verbal measures like drawing and copying, usually performed in pediatrics (11, 12). The technique has potential for the assessment of regression of cognitive function in dementia (13, 14). The drawing function in impaired elderly subjects seems to mirror the developmental stages of childhood. In the drawing this corresponds to a decline from a stick figure, to a headfooter, to scribbles of different kinds (15, 16).

There has already been some work on applying the technique to assess cognitive function in the elderly (17), to assess psychomotor skills (18), and to evaluate patients with organic disorders (19). Earlier results also show that the capacity to copy is retained longer than the capacity to draw without a model (20).

In a study by Nordenram et al. (21) 31 of 36 patients showed good concordance between different forms of observations—cognitive function, dental behavior, and graphic skill—and the stage of dementia. In comparison, the Mini-Mental State Examination test (MMSE) (22), behavior in the dental setting, and graphic skill did not indicate the same stage of dementia in five patients.

Aims of the present study

The aims of the present study were to analyze further the five patients with Alzheimer's dementia in whom the MMSE test and behavior in the dental setting diverge with regard to degree of dementia and to relate these values to the outcome of the graphic test.

The study will discuss possible explanations for the differences.

Materials and methods

The five patients in the study lived in a nursing home in Stockholm and participated in a more extensive study (21). Contrary to the main results of that study, there was no unanimous information about these five patients' stage of dementia as assessed with MMSE test, observed behavior in the dental setting, and their graphic skill.

The patients fulfilled the criteria for Alzheimer's disease on the basis of the DSM-III-R (23). Their social and medical background and the cognitive tests were registered by E. Ryd-Kjellén. Because low scores in the MMSE test can be inaccurate (24–26), the investigations were supplemented with the Hierarchic Dementia Scale (HDS) (27) when the MMSE scores were below 10/30.

An assessment in accordance with Katz's index of independence in activities of daily living (ADL) (28, 29) was available for each patient (Appendix 1). ADL is of importance because cognitive losses and functional impairments are two distinct aspects of dementia severity (30), and both might influence dental behavior. The ADL ratings were registered by E. Ryd-Kjellén and also confirmed by the ward nurses. This information was not available to the dentist until after the oral assessment in the dental clinic.

During the oral assessment the patient's behavior was observed and registered in a structured form (Appendix 2). The observations were made independently by the dentist and the dental nurse while the patient was in the dental clinic. Immediately after the patient had left the clinic the dentist and the nurse discussed their impressions, the form was evaluated in consensus, and the formula was filled in by the dentist (G. Nordenram). The total score of 5 dental items was 20.

The graphic functioning level was measured separately by K. Ericsson, who at that time had neither information about the identity of the patients nor the results of the other examinations. The graphic analysis included writing sentences and signatures, copying simple and complex geometric patterns, and free-hand figure drawing (Appendix 3) (13).

The assessment indices were calculated as percentage deficiency. This was done to obtain easily comparable results, as the figures from the different assessments do not have an absolute value.

The study was approved by the Ethical Committee of Huddinge University Hospital.

Results

Patient A, an 86-year-old woman

Medical background, social behavior and cognitive rating. Patient A has a progressive dementia diagnosed late in 1989. She underwent surgery for her second petrochanteric femur fracture in the spring of 1991. When she arrived at the nursing home postoperatively her general health was poor, and she was malnourished. Obviously, the home-care situation had been failing over a long period. In the winter of 1991 Patient A underwent surgery for a cataract. Despite her weak eyes she does not want to wear glasses.

Patient A understands requests and is always positive and willing to comply. She wants to be co-operative, but she is not open-minded and remains passive. In the MMSE test she gives in easily. She frequently emphasizes that she has a competent sister but she herself is not so clever. Her MMSE test score was 6/30, and the HDS test score, 107/200.

Katz's ADL. She washes the front of the upper part of her body herself, seated in front of the wash basin. She understands requests about cleaning the lower part of her body but needs help. She needs much help in personal hygiene and some help in toothbrushing. While dressing she needs support because she often puts her clothes on in the wrong order and in the wrong direction. She cannot find her way to the bathroom, but during the day she usually tells a nurse when she needs to go to the lavatory. She uses a walker and can eat by herself. ADL score, 6/12.

The dental care setting. Patient A behaves adequately, is familiar with the dental surroundings, and co-operates very well. She recognizes a toothbrush without any problem. She briefly brushes her front teeth only, and when she is finished, she rinses correctly. Dental evaluation, 19/20.

Graphically. Patient A can write her signature and a given sentence. She refuses to draw, and this is noted as an active refusal. Her poor eyesight and her dislike of wearing glasses may influence the outcome of her graphic capacity.

Analysis. Patient A might experience the cognitive examinations as a school test, and as this is a stress situation, she fails to do her best because of poor self-confidence. In the dental assessment the patient does not feel any demands for school knowledge or skills and might therefore feel confident enough to cope with the situation. She seems to have a certain awareness of her failures in parts of the cognitive tests, implying an insight that a person of MMSE = 6 should not have.

In comparison with her graphic presentation she ought to score about 10–12 on the MMSE, which also is indicated by her HDS score of more than 100. Most probably, she has moderate dementia.

In conclusion, she is able, but she has no self-confidence and does not dare.

Patient B, an 82-year-old woman

Medical background, social behavior, and cognitive rating. Patient B has been physically well, and the first signs of cognitive decline started about 5 years ago.

Patient B was brought up in a well-off family in a small town in Sweden. She was sent to a boarding school for girls in Switzerland. She was admired for her beauty, and she is still well aware of this herself. She was married but is now a widow without children. Her husband adored her and made every effort to please her. She seems to be accustomed to acting only in accordance with her own wishes. Her temper differs from time to time. Some days she is quite co-operative, and other days she is not. She seems to like the attention during the cognitive examinations and alternates between conversation in German and French and tries to sing Marlene Dietrich songs. Her MMSE test score was 18/30.

Katz's ADL. Patient B can manage most ADL if she wants to, but she is seldom in the mood and usually demands attention. She eats by herself. In personal hygiene and toothbrushing she requires attention and is therefore actually dependent. Her ADL score is 6/12.

The dental care setting. Patient B's co-operation in the dental clinic is very poor, and she says she recognizes neither the dental situation nor a toothbrush or how to use it. But when asked to rinse her mouth she does it quite adequately without hesitation. Her dental score was 8/20.

Graphically. Patient B has a neat, flowing handwriting style. Her free-hand drawing is correctly placed in the center of the paper, but she does not draw a person but something that she comments on as 'the hair of a man'.

Analysis. Patient B has a very demanding personality with great expectations with regard to service and attention. Her self-image seems to have been that of a strong, attractive, capable, active person. When mental and functional ability decreases, a person with such a self-image may feel more incompetent, changed, and dissatisfied.

At the time of the oral assessment Patient B most likely had a 'bad' day and was in a bad mood. She did not want to co-operate at all. She has made herself socially dependent, but in reality she is not very dependent physically and medically.

The drawing which she explained as 'the hair of a man' might be a psychologic symbol. Most probably, the MMSE score of 18 is adequate, but Patient B is special as a person.

In conclusion, she is able, but she does not want to.

Patient C, an 87-year-old woman

Medical background, social behavior, and cognitive rating. Patient C has dementia that has gradually developed since 1989. In the spring of 1992 she could no longer be cared for at home and was admitted to the nursing home. On admission she was oriented to person but neither in time nor space. During the autumn of 1992 Patient C's hemoglobin value dropped, and there were traces of blood in her feces. No intestinal obstructions were detected radiographically. She had no pain in her stomach but seemed to become weaker and weaker and died in the spring of 1993. The autopsy showed an ulcerating tumor in Bauhin's valve with obstructed lumen, enlargement of the ventricular system, frontal atrophy, and moderate atherosclerosis.

Patient C had been a talented shopkeeper. She had been married twice but had no children. She seemed to be used to organizing but hesitated to copy a model or draw a picture of her own. Her MMSE score was 15/30.

Katz's ADL. Patient C could walk but used a walker. She needed support in ADL functions and was incontinent at night. She ate by herself and could wash the upper part of the front of her body but needed help to dress. She needed much help in toothbrushing. Her ADL was 8/12.

The dental care setting. Patient C was co-operative but seemed confused in the dental setting and was somewhat restless during the dental assessment. She did not immediately recognize the toothbrush, and instead of brushing her teeth she brushed the spittoon. For rinsing she took a sip of water but without rinsing movements and did not spit it out. Her dental score was 10/20.

Graphically. Patient C made a poor drawing, equivalent to about MMSE 5–10. She wrote words rather than drew and wrote her maiden name. She tried to draw a quadrangle, with some success. She drew no person but a figure like a sun with sunbeams, and the paper was covered with sunbeams. She tried to write letters.

Analysis. Most probably, Patient C was assessed during the development of a somatic disease with progressive frontal atrophy, which explains her poor function in the dental setting: 'something is happening'. Her graphic presentation may indicate loss of coordination between visual perception and graphic action.

In conclusion, she is able, but she is too exhausted.

Patient D, an 87-year-old woman

Medical background, social behavior, and cognitive rating. Patient D has poor eyesight due to age-related macula degeneration and diabetes type II. Her mental decline began about 10 years ago.

She has been employed in the handicraft business with weaving and designing. She is married and lives at home in her husband's good care, with short periods in the nursing home when her husband needs rest and recuperation.

Patient D constantly walks back and forth in the corridor with her walker. She sings some songs monotonously and politely asks the same questions again and again. She perpetually repeats the same sentences,

Table 1. Deficiency of cognition (MMSE), function in daily living (ADL), function in the dental setting (Dent.), and drawing (HFD), in percentage of full capacity

Patient	MMSE def.	ADL def.	Dent. def.	HFD def.	Dent. behavior	Graphic skill
A	80	50	5	*	Better	Better
B	40	50	60	50	Poorer	Adequate for person
C	50	67	50	63	Poorer	Poorer
D	73	33	5	38	Better	Better
E	53	83	70	†	Poorer	Adequate for person

*Refuses to draw but writes a proper signature.
†Active refusal.

saying that everything is nice, she is so pleased, and her husband is so kind.

In the cognitive examinations she recognizes objects and can name them but cannot remember them through repetition. She understands requests to a certain extent but cannot fulfill them if they are complicated. Her MMSE test is 8/30, and her HDS 118/200.

Katz's ADL. Patient D eats by herself but is dependent in personal hygiene. She needs help in showering, washing herself, brushing her teeth, and dressing. She can usually find her way to the bathroom, but for safety's sake the nurses guide her. Her ADL is 4/12.

The dental care setting. Patient D seems to recognize the dental care setting and acts spontaneously and adequately. On the request 'will you rinse your mouth please', she acts intensely and correctly, but the action must be started and then stopped by the dentist. Her dental score is 19/20.

Graphically. Patient D likes to write and draw but her handwriting is hardly legible, and her drawings are incomplete. She does not follow the lines on the paper (poor eyesight?). The free-hand figure is not a person but looks like a 'walking rhombus'. She writes a complete sentence.

Analysis. Patient D has a supportive home situation and is admitted to the nursing home for short periods when her husband needs rest and recuperation. The nursing home environment was unfamiliar to her, and the change in domicile may have been disturbing. She might be depressed because she was homesick and felt strange in the nursing home environment.

In the dental clinic she seemed to be familiar with the environment, and this may support her behavior. She has had regular dental appointments during her adult life. The oral assessment seemed to be familiar to her, and she acted adequately but repeatedly. Her graphic characteristics are like an MMSE score of about 15, which also is indicated by her HDS score of more than 100. Most probably, she has moderate dementia with elements of depression. She is familiar with dental treatment.

In conclusion, she is able, but only if the situation is well known to her.

Patient E, an 81-year-old woman

Medical background, social behavior, and cognitive rating. As a child Patient E had tubercular osteitis, lived in a hospital for physically handicapped children, and became lame in one leg because of impaired growth. On her first admittance to the nursing home Patient E was 73 years old. Three years later her stay was permanent, and she has now been in the nursing home for 6 years. From the beginning she was able to walk. A suppurating ulcer in one leg healed slowly, but later she became totally confined to a wheelchair.

Patient E is very anxious. She was her parents' only child. After the death of her mother Patient E became the daughter living at home caring for her father. A friend from her childhood said that she was a very good-looking young woman, but she was ashamed of her handicap. She was engaged, but her father did not allow her to marry. Her father was very dominating and might even have been abusive towards his wife and daughter. Now Patient E sometimes calls her father's name in a frightened voice.

She was very unsure in the cognitive examination, but as she knows the investigator (E. Ryd-Kjellén) well, she tried to do her best. Her MMSE score was 14/30.

Katz's ADL. Patient E eats by herself but is dependent in the other activities, including toothbrushing. Her ADL is 10/12.

The dental care setting. Patient E totally refuses oral assessment. She identifies a toothbrush but does not want to use it or rinse her mouth. Her dental score is 6/20.

Graphically. Patient E does not want to write her signature or a sentence, draw geometric patterns, or make a free-hand drawing.

Analysis. Patient E's dependency might be a result of her long stay in the nursing home, where she refuses mental stimulation and does not want to participate in social activities. Her reactions might be social inappropriateness and apathy correlated with Alzheimer's disease, but can also be influenced by her premorbid personality. Patient E's personality with general anxiety might also be combined with dental phobia. Her function during dental assessment is not equivalent to an

MMSE of 14 and might be an expression of fear aggravated by her dementia. She refused to write and draw, and this was an active choice.

In conclusion, she is able, but she is too frightened to act.

Cognition, dental behavior, and graphic skill

From the MMSE index, ADL index, dental index, and graphic index the capacity deficiency is calculated in percentage of full capacity (Table 1).

Three of the five patients had poorer function in the dental setting than the MMSE indicated, and two had better function. This was confirmed in the graphic test in three patients. Two patients were special as persons, and their graphic performances were considered to be adequate in reference to the personality.

Discussion

Cooper et al. (31) used MMSE scores in a study of the relationship between cognitive status and abnormal behavior in Alzheimer's disease and found that abnormal behavior is more likely to occur with decreasing cognitive function, but there was a great deal of variation among the patients. Anger/agitation was almost twice as likely in patients with severe cognitive impairment (MMSE < 10) as in those with mild impairment (MMSE > 20), but the correlation between MMSE score and anger/agitation was relatively low.

Premorbid personality traits may predispose to subsequent psychiatric symptoms in Alzheimer's disease but it is unknown to what extent. Premorbid personality may be accentuated, resulting in exaggeration of personality characteristics. Chatterjee et al. (32) found that people who are premorbidly more neurotic are pushed to further extremes and may be more likely to develop depressive features and to be more vulnerable and less extroverted. It may be that individuals with Alzheimer's disease change in stereotypic ways but with individual variability. Siegler et al. (33), on the other hand, found no relation between premorbid personality patterns and changes in conscientiousness and vulnerability, but premorbid intelligence may affect the manifestation and expression of personality changes in Alzheimer's disease. According to Petry et al. (34), the most profound changes include loss of energy and enthusiasm and increasing social inappropriateness, but these personality changes are not related to premorbid patterns. Burns et al. (35) reported that neither aggression nor apathy correlate with any measure of premorbid traits. Wang (36) suggested that anxiety and social and environmental factors affecting stress may contribute to individual behavior in dementia. The personality changes seen in patients with Alzheimer's disease may also be a function of the individual's coping with the strain of memory loss (33). The perception of capability is an important basis for self-esteem and the coping process (37, 38).

The personality of a demented person is probably important when the patient is confronted with a dental setting. An anxious personality with little self-confidence probably reacts less favorably in the dental office than the stage of dementia would imply. Dental treatment can be experienced in different ways by different persons. People react individually depending on personality, current form, and memories from earlier dental procedures. Feelings of unrest or anxiety might be more obvious in demented people who are unable to control their emotional reactions. The dental fear might have been mentally controlled before the onset of dementia. A refusal not in concordance with the outcome of the MMSE test might be a result of distressing memories of earlier dental care. Formerly, dentists were authoritarian, and there were no effective anesthetics. Unfortunately, there are no studies to indicate whether such memories may be buried in the unconscious mind of a demented person, and, if so, how it might influence present dental behavior.

If dental care has been an ordinary habit during life, adequate behavior in the dental situation may be retained longer, as in Patient D. She cannot take the initiative on her own, but with certain support she acts correctly.

The importance of earlier memories as support of recognition has been studied by Bäckman & Herlitz (39). It may be of importance that the dental clinic is traditionally furnished and equipped, that the staff wear white clinical gowns, and that the smell is typical of a dental office. Such factors may act as a support for the demented patient in recognizing and coping with the situation.

To plan and provide good dental care for demented patients, it is important that the dental staff is aware of the patient's stage of dementia. The dental staff must also be able to interpret the demented person's unique personality applied to the dental situation and be prepared to act accordingly.

Conclusions

The stage of dementia, the personality, and the memories of earlier dental care may influence the demented patient's behavior in the dental office. But since it is unknown to what extent these different factors influence the patient, there is a need for further research to better define and solve the problems of providing appropriate dentistry for Alzheimer's patients.

Acknowledgements.—This study was supported by the Foundation for the Aging Research, Stockholm. We thank the ward nurses in Stureby Hospital and, in particular, Madeleine Wretfors, dental nurse, for kind collaboration in the study and Joan Bevenius for revision of the manuscript.

References

1. Statistisk Årsbok 93. Kapitel 23: Befolkning. Stockholm: Nordstedts förlag, 1992.
2. Iqbal K. Prevalence in neurobiology of Alzheimer's disease. In: Iqbal K, Mc Lachlan DRC, Winblad B, Wisniewski HM, editors. Alzheimer's disease: basic mechanisms, diagnosis and therapeutic strategies. Chichester: John Wiley & Sons Ltd, 1991.
3. Nordenram G. Changes in oral status and dental treatment in long term hospital inmates in Stockholm from 1988 to 1990. Swed Dent J 1993;17:43–8.
4. Österberg T, Mellström D, Sundh V. Dental health and functional ageing. Community Dent Oral Epidemiol 1990;18:313–8.
5. Niessen LC, Jones JA. Professional dental care for patients with dementia. Gerodontology 1987;6:67–71.
6. Gordon SR. Dental treatment planning for patients with severe cognitive impairment. Gerodontics 1988;4:162–4.
7. Moody GH, Drummond JR, Newton JP. Alzheimer's disease. Br Dent J 1990;169:45–7.
8. Goodenough FL. The measurement of intelligence by drawings. New York: World Book Co. 1926.
9. Ericsson K. Is it possible to predict the future development of the child from the human figure drawing made at age 4? An evaluation of some aspects of the 4 year medical and psychological check-up [thesis]. Uppsala: University of Uppsala, 1985. Acta Univ. Ups. Studia Psychologica Upsaliensia 11.
10. Buck JN. The H-T-P-technique: a qualitative and quantitative scoring manual. J Clin Psychol 1948;4:317–96.
11. Sclan SG, Foster JR, Reisberg B, Franssen E, Welkowitz J. Application of piagetian measures of cognition in severe Alzheimer's disease. Psychiatr J Univ Ottawa 1990;15:223–8.
12. Reisberg B. Cognition related to functional, praxis and feeling changes in CNS aging and Alzheimer's disease and their development analogies. In: Beyreuter K, Schettler G, editors. Molecular mechanisms of aging. Berlin: Springer Verlag, 1990:18–40.
13. Ericsson K, Forsell L, Amberla K, Holmén K, Viitanen M, Winblad B. Graphic skill used as an instrument for detecting higher cortical dysfunction in old age. Hum Mov Sci 1991;10:335–49.
14. Ericsson K, Hilleråas P, Holmén K, Jorm A, Forssell LG, Almkvist O, et al. The short human-figure drawing scale for evaluation of suspect cognitive dysfunction in old age. Arch Gerontol Geriatr 1994;19:243–51.
15. Kellogg R. Analyzing children's art. Palo Alto; Mayfield, 1969.
16. Golomb C. Representation and reality: the origins and determinants of young children's drawings. Rev Res Visual Art Educ 1981;14:36–48.
17. Moore V, Wyke MA. Drawing disability in patients with senile dementia. Psychol Med 1984;14:97–105.
18. Liotard D. Dessin et psychomotoricité chez la personne âgée. Paris: Masson, 1991. Collection psychotherapies corporalles.
19. Gainotti G, Tiacci C. Patterns of drawing disability in right and left hemispheric patients. Neuropsychologia 1979;8:379–84.
20. Cox MV. Children's drawings of human figure. Hove: L. Erlbaum Associates Ltd, 1993.
21. Nordenram G, Ryd-Kjellén E, Ericsson K, Winblad B. Alzheimer patients in the dental environment. Gerodontology. In press.
22. Folstein MF, Folstein SE, McHugh PR. 'Mini-Mental State'. A practical method for grading cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189–98.
23. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 3rd ed., revised (DSM III-R). Washington (DC): American Psychiatric Association, 1987.
24. Anthony JC, LeResche L, Unaiza N, von Knörff MR, Folstein MF. Limits of the 'Mini-Mental State' as a screening test for dementia and delirium among hospital patients. Psychol Med 1982;12:397–408.
25. Rönnberg L, Ericsson K. Reliability and validity of the hierarchic dementia scale. Int Psychogeriatr 1994;6:87–94.
26. Grut M, Fratiglioni L, Viitanen M, Winblad B. Accuracy of the Mini-Mental Status Examination as a screening test for dementia in a Swedish elderly population. Acta Neurol Scand 1993;87:312–7.
27. Cole MG, Dastoor DP, Koszycki D. The hierarchic dementia scale. J Clin Exp Gerontol 1983;5:219–34.
28. Katz S, Akpom CA. A measure of primary sociobiological functions. Int J Health Serv 1976;6:493–508.
29. Hulter Åsberg K. Elderly patients in accute medical wards and home-care [thesis]. Uppsala: Uppsala University, 1986.
30. Bruce RR, Jagust WJ, Seab JP. Mental status as a predictor of daily function in progressive dementia. Gerontologist 1989;29:804–7.
31. Cooper JK, Mungas D, Weiler PG. Relation of cognitive status and abnormal behaviours in Alzheimer's disease. J Am Geriatr Soc 1990;38:867–70.
32. Chatterjee A, Strauss ME, Smyth KA, Whitehouse PJ. Personality changes in Alzheimer's disease. Arch Neurol 1992;49:486–91.
33. Siegler IC, Welsh KA, Dawson DV, Fillenbaum GG, Earl NL, Kaplan EB, et al. Ratings of personality change in patients being evaluated for memory disorders. Alzheimer Dis Assoc Disord 1991;5:240–50.
34. Petry S, Cummings JL, Hill MA, Shapira J. Personality alterations in dementia of the Alzheimer type: a three-year follow-up study. J Geriatr Psychiatry Neurol 1989;2:203–7.
35. Burns A, Folstein S, Brandt J, Folstein M. Clinical assessment of irritability, aggression, and apathy in Huntington and Alzheimer disease. J Nerv Ment Dis 1990;178:20–6.
36. Wang HS. Neuropsychiatric procedures for assessment of Alzheimer's disease, senile dementia, and related disorders. In: Miller NE, Cohen GD, editors. Clinical aspects of Alzheimer's disease and senile dementia. New York: Raven Press, 1981. Ageing, Vol. 15.
37. Thomasma D. Freedom, dependency and care of the very old. J Am Geriatr Soc 1984;32:902–14.
38. Nydevik I. Stroke in geriatric patients. Functional ability and need for care [thesis]. Stockholm; Karolinska Institute, 1994.
39. Bäckman L, Herlitz A. The relationship between prior knowledge and face recognition memory in normal aging and Alzheimers's disease. J Gerontol 1990;45:94–100.

Received for publication 15 September 1994
Accepted 3 March 1995

Appendix 1.

Activities of daily living (ADL) index on the basis of Katz (Katz & Akpom 1976), modified Swedish version (Hulter-Åsberg 1986)

Score 0, independent	Score 1, partly dependent	Score 2, dependent
Bathing: sponge bath, tub bath, or shower		
Receives no assistance	Receives assistance in bathing only one part of the body (such as back or leg)	Receives assistance in more than one part of the body (or not bathed)
Dressing: getting clothes from closets and drawers, including underwear, outer garments, and fasteners (including braces if worn)		
Gets clothes and gets completely dressed without assistance	Gets clothes and gets dressed without assistance except for assistance in tying shoes	Receives assistance in getting clothes or in getting dressed or stays partly or completely undressed
Toileting: going to the 'toilet room' for bowel and urine elimination; cleaning self after elimination and arranging clothes		
Goes to 'toilet room', cleans self, arranges clothes without assistance (may use object for support such as cane, walker, or wheelchair and may manage night bedpan or commode, emptying this in morning)	Receives assistance in going to 'toilet room' or in cleansing self or in arranging clothes after elimination or in use of night bedpan or commode	Does not go to termed 'toilet' for elimination process
Transfer: moving in and out of bed and in and out of chair		
Moves in and out of bed and in and out of chair without assistance (may be using object for support such as cane or walker)	Moves in and out of bed or chair with assistance	Does not get out of bed
Continence: function of controlling elimination from the bladder and bowel		
Controls urination and bowel movement completely by oneself	Has occasional 'accidents'	Supervision helps keep urine or bowel control; catheter is used, or incontinent
Feeding: basic process of getting food from plate or equivalent into mouth		
Feeds self without assistance	Feeds self except for getting assistance in cutting meat or buttering bread	Receives assistance in feeding or is fed partly or completely by using tubes or intravenous fluids

The word 'assistance' means supervision, direction, or personal assistance.
Total ADL score = 12.

Appendix 2. Function in the dental setting (Dent)

Recognition: is the patient familiar with the dental office/dentistry? Item: familiar. 4 = Yes, immediately; 3 = after thinking; 2 = with assistance; 1 = probably; 0 = not at all.

Behavior in oral assessment with mirror and probe: the dentist introduces the action by stating that she is going to examine the patient's teeth and brings the instruments in front of the patient's mouth. Item: behavior. 4 = Opens his/her mouth spontaneously or after request; 3 = opens his/her mouth after instruction on how to do so; 2 = closes his/her mouth involuntarily (not an active movement); 1 = refuses to open his/her mouth, compresses his/her lips; 0 = sucking behavior when the lips are touched.

Recognition of a toothbrush: the dentist shows the patient a toothbrush and asks the patient if he/she recognizes what it is. Item: recognition. 4 = Yes, immediately; 3 = after thinking; 2 = with assistance; 1 = probably; 0 = not at all.

Toothbrushing: the dentist dips the toothbrush in a glass of water and asks the patient to use it to brush his/her teeth. A kidney bowl is placed in front of the patient. Item: toothbrushing. 4 = Adequate function; 3 = impaired function; 2 = poor function; 1 = refuses; 0 = no reaction.

Behavior on 'please rinse': the patient is given a glass of water, accompanied by the request 'rinse your mouth please', and a spittoon is placed in front. Item: rinsing. 4 = adequate function; 3 = after instruction; 2 = incorrect function; 1 = refuses; 0 = no action.

Five items and total Dent score = 20.

Appendix 3. Free-hand human-figure-drawing (HFD). Hierarchical levels of the free-hand HFD

Figurative
- 8 = Movements expressed by, for instance, joints (arm, legs, head/body) or body expressions.
- 7 = Coordination of ≥ 1 part of the figure (face, totality).
- 6 = Correct proportions on ≥ 2 of the details (arm, leg, trunk, feet, eyes).
- 5 = Two-dimensionality on ≥ 2 of the details (arms, leg, trunk, feet).
- 4 = Essential details (HFDess) ≥ 4/7 (head, eyes, mouth, nose, arms, legs, body), headfooter, or stick figure.

Non-figurative
- 3 = Circular form
- 2 = Character or number
- 1 = Scribbles
- 0 = Non-co-operation