

ORAL MANAGEMENT IN REHABILITATION MEDICINE: ORAL FRAILTY, ORAL SARCOPENIA, AND HOSPITAL-ASSOCIATED ORAL PROBLEMS

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Abstract: Oral health is a crucial but often neglected aspect of rehabilitation medicine. Approximately 71% of hospitalized rehabilitation patients and 91% of hospitalized acute care patients have impaired oral health. Poor oral condition in hospitalized patients can be attributed to factors such as age, physical dependency, cognitive decline, malnutrition, low skeletal muscle mass and strength, and multimorbidity. Another major factor is a lack of knowledge and interest in oral problems among health care workers. Recently, new concepts have been proposed, such as oral frailty, oral sarcopenia, and hospital-associated oral problems. Oral frailty, the accumulation of a slightly poor status of oral conditions and function, strongly predicts physical frailty, dysphagia, malnutrition, need for long-term care, and mortality in community-dwelling older adults. Oral sarcopenia refers to sarcopenia associated with oral conditions and function, although its definition has not yet been fully discussed. Hospital-associated oral problems are caused by disease, disease treatment, surgery, endotracheal intubation, poor self-care abilities, lack of care by medical staff, drugs, and iatrogenic factors during hospitalization. Furthermore, oral problems have negative impacts on rehabilitation outcomes, which include functional recovery, length of hospital stay, discharge home, and in-hospital mortality. Oral health management provided by dental hygienists improves not only oral status and function, swallowing function, and nutritional status but also activities of daily living, discharge home, and in-hospital mortality in post-acute rehabilitation. Oral rehabilitation, promotion, education, and medical–dental collaboration can be effective interventions for oral problems and therefore are necessary to improve rehabilitation outcomes.

Key words: Oral health, rehabilitation, dental hygienist, medical-dental collaboration.

Introduction

Oral health is a crucial yet often neglected aspect of rehabilitation. Oral problems, or impaired oral health status, affect the rate of decline in oral function related to aging and disease, oral diseases related to lifestyle, and frailty (1-4). Moreover, the oral health-related quality of life of nursing home residents is significantly impaired (5). Recently, with the growing interest in oral management in rehabilitation, new concepts have been proposed, such as oral frailty (4), oral sarcopenia (6), and hospital-associated oral problems (7, 8).

Oral problems have adverse impacts on rehabilitation outcomes. Poor oral condition in hospitalized older adults can be attributed to various factors such as age, physical dependency, cognitive decline, malnutrition, low skeletal muscle mass and strength, and multimorbidity (4, 6). Lack of knowledge and interest in oral problems among health care workers is another important factor (9). Further, older inpatients with poor oral health on admission have poorer functional recovery, less opportunity to be discharged, and higher in-hospital mortality rates (10). Therefore, early detection of oral problems, treatment by dental professionals, education on oral management for nurses and other non-dental professionals, multidisciplinary oral rehabilitation, and medical–dental collaboration are essential. However, the evidence in oral management in rehabilitation settings is scarce and has not been

fully discussed.

This review outlines the epidemiology and factors of oral problems, their relationship to outcomes, the effectiveness of interventions, and the need for medical and dental collaboration in rehabilitation medicine.

Epidemiology and associated factors of oral problems

Aging

Aging causes a decline in oral function—the number of teeth, occlusal strength, and thickness of the masseter muscle decrease (11-14). According to a survey in the US, 96.4% of older adults aged 65 and over have periodontal disease (15). Periodontal disease is often associated with chronic diseases (16). In older adults with chronic illnesses, prescribed medications may also cause xerostomia and increase the risk of oral disease (17).

Impaired oral health, e.g. tooth loss and subjective difficulties in eating directly, leads to functional decline, frailty, and disability (11). Previous studies have reported an association between oral function and physical condition. Low masticatory ability is associated with weaker physical performance (18), sarcopenia (19), and mortality (20), whereas low tongue pressure is significantly associated with frailty in older individuals (21) and reflects dysphagia (22). In addition, low occlusal force, masseter muscle thickness, and articulatory

oral motor skill have been cross-sectionally associated with frailty (11). Frailty increases the vulnerability for developing increased dependency and/or mortality when exposed to a stressor (23). These findings suggest that impaired oral function could be closely associated with frailty.

Recently, new concepts such as oral frailty (4) and oral sarcopenia (6) have been proposed and have gained attention. Oral frailty—the accumulation of a slightly poor status in oral conditions and function—strongly predicted physical frailty, dysphagia, malnutrition, the need for long-term care, and mortality in community-dwelling older adults (4). Oral sarcopenia refers to sarcopenia associated with oral conditions and function, but its definition has not yet been fully discussed (2, 6, 24). These age-related concepts of «oral decline» are clinically relevant in rehabilitation settings because they represent a precursor to functional impairment, although more research is needed to determine their definitions and diagnoses.

Disease

Oral problems can be attributed to various chronic diseases. Periodontitis is a common chronic inflammatory disease characterized by the destruction of the supporting structures of the teeth (the periodontal ligament and alveolar bone). It is highly prevalent (severe periodontitis affects 10-15% of adults) and has multiple negative impacts on quality of life (25). Epidemiological data confirm that diabetes is a major risk factor for periodontitis; susceptibility to periodontitis is increased by approximately threefold in people with diabetes (26). There is a clear relationship between degree of hyperglycemia and severity of periodontitis (27). The mechanisms that underpin the links between these two conditions are not completely understood, but involve aspects of immune functioning, neutrophil activity, and cytokine biology (27). In addition, poor oral health assessed using self-report or clinical examination is related to an elevated risk of coronary heart disease (28). Mechanistic support for this relationship may be associated with increased systemic inflammatory activity, which has itself been implicated in the etiology of coronary heart disease (29). Poor oral health is also commonly found in patients with chronic kidney diseases and may contribute to protein-energy wasting, systemic inflammation, infections, and atherosclerotic complications (30). One randomized controlled study demonstrated that intensive periodontal treatment had beneficial effects on oral health, which were associated with improvement in endothelial function (31).

Sarcopenia decreases oral function. Sarcopenia, the loss of muscle mass and strength or function, occurs with aging and is recognized as an independent medical condition by the International Classification of Diseases (32). A close relationship between impaired oral function and systemic sarcopenia has been shown in stroke patients (6); the association was independent of age, sex, nutritional status, comorbidities, physical and cognitive independence, and stroke severity. Sarcopenic dysphagia is a condition characterized

by sarcopenia-induced swallowing disorder and the loss of swallowing muscle mass and function (33). Four Japanese professional organizations consolidated the currently available evidence about sarcopenia and dysphagia in a position paper report in 2019 (34). In rehabilitation settings, dysphagia is independently associated with sarcopenia in patients with stroke, musculoskeletal diseases, and hospital-associated deconditioning (35, 36). The atrophy of swallowing muscles is associated with the severity of dysphagia in patients who experience an acute stroke (37). Furthermore, a previous report shows that skeletal muscle mass, activities of daily living (ADL), and body mass index are independent predictors of dysphagia in hospitalized older adults (38). Therefore, early detection, prevention, and improvement of sarcopenia should be one of the central roles of oral management in clinical practice.

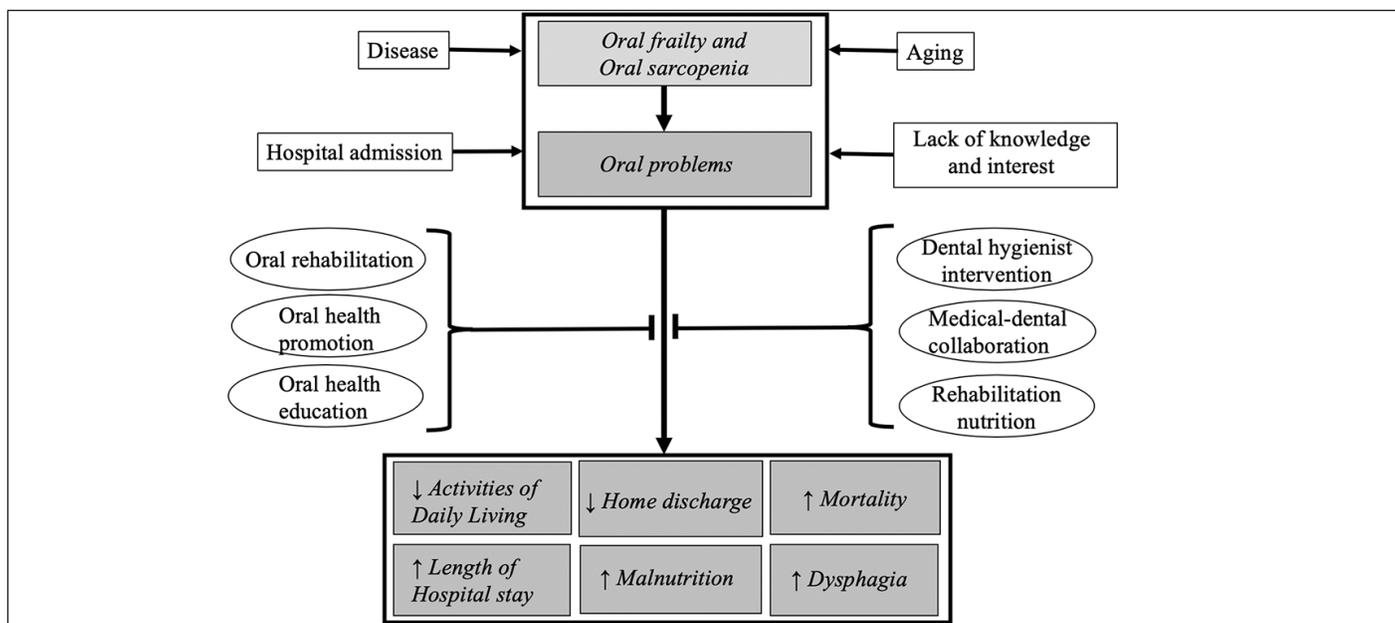
Hospital-associated oral problems

Oral problems commonly occur, sometimes unintentionally, in hospitals, which is called “hospital-associated oral problems” (39). It is caused by disease, disease treatment, surgery, endotracheal intubation, poor self-care abilities, lack of care by medical staff, drugs, and iatrogenic factors during hospitalization. Although it is difficult to completely prevent hospital-associated oral problems caused by these conditions, iatrogenic complications can be prevented or treated. During hospitalization, oral status and function can easily deteriorate, particularly in intubated patients, leading to an increased risk of hospital-acquired infections and reduced life quality (7). There is evidence that biofilms formed on the oral surface and endotracheal tubes act as a reservoir of organisms that cause ventilator-associated pneumonia; thus, oropharyngeal decontamination and other intensive strategies aimed at preventing this translocation must be emphasized (40). Patients hospitalized in intensive care units (ICU) have a high prevalence of periodontal disease that is likely to be exacerbated (8). Although daily oral hygiene measures are an important part of the care of ICU patients, it often seems to be given a low priority by medical staff in the acute care setting (41). A survey of nursing home staff found that they tended to prioritize non-oral-care activities over oral care activities (42). Moreover, nurses and other non-dental professionals tend to be less interested in oral hygiene in post-stroke care (43).

Education and practice programs in oral health care management for medical staff are needed to prevent or treat hospital-related oral problems. Improved oral hygiene reduces the occurrence of respiratory tract diseases among older patients in the ICU (44). Moreover, approximately one out of ten cases of death from pneumonia among geriatric inpatients could be prevented by improving their oral hygiene (45). Nurses and speech-language pathologists can participate in oral rehabilitation to improve the outcome of impaired oral status (function) and dysphagia (43). Oral health knowledge was positively associated with the clinical practice of providing better oral hygiene care for patients after stroke (46). A simple,

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Figure 1
Risk factors, therapeutic interventions and rehabilitation outcomes for oral problems



Factors that contribute to oral problems in rehabilitation patients include aging, disease, oral frailty, oral sarcopenia, hospitalization, and lack of knowledge and interest of health care providers. Oral problems have negative impacts on outcomes for these patients, including reduced activities of daily living, lower rates of home discharge, higher in-hospital mortality, and prolonged hospitalization, malnutrition, and dysphagia. Oral rehabilitation, promotion, education and dental hygienist interventions, medical-dental collaboration, and rehabilitation nutrition can be effective interventions for oral problems to further improve rehabilitation outcomes

inexpensive oral hygiene regimen resulted in positive outcomes for patients with and without dysphagia in inpatient stroke rehabilitation settings (47). In addition, preoperative oral care by dentists has reduced postoperative complications in patients undergoing cancer surgery (48). Therefore, oral health management needs to be improved and integrated into the care-chain of hospitalized individuals. This is not only a matter of oral health but may also lead to saving patients' lives.

Oral status and rehabilitation outcomes

Oral problems are frequently found in rehabilitation. Impaired oral health status is common in hospitalized patients, particularly among physically disabled, demented, or malnourished older adults (10, 49, 50). The proportion of hospitalized older patients with oral health problems is greater than 80% (10, 50). Furthermore, 71% of hospitalized rehabilitation patients (51) and 91% of hospitalized acute care patients are reported to have impaired oral health (52).

Oral problems have negative impacts on rehabilitation outcomes. In convalescent rehabilitation inpatients, oral problems were independently associated with inpatient discharge, ADL, length of hospital stay, discharge at home, and in-hospital mortality; this association was regardless of age, sex, disease severity, nutritional status, comorbidities, and physical and cognitive dependency (10, 50). Poor oral status and function could have direct effects on denture wearing, dental occlusion, chewing ability, and the consequent

dysphagia, which could be a major cause of malnutrition. Moreover, malnutrition and dysphagia have direct effects on functional recovery (53-55). Therefore, oral problems have indirect adverse effects on ADL recovery. Furthermore, reduced self-care ability is an important factor affecting oral health in hospitalized patients. Oral health care is an important form of self-care included in subcategories of basic ADL assessment, such as Functional Independence Measure and Barthel Index. Factors contributing to reduced self-care ability may include physical dependency or disability due to aging, disease, sarcopenia, malnutrition, cognitive and psychological disorders, and socioeconomic factors. In addition, reduced ADL, dysphagia, and malnutrition indirectly caused by impaired oral health status may lead to prolongation of hospital stay among patients undergoing rehabilitation.

Oral problems are associated with physical and cognitive function. Masticatory performance is associated with handgrip strength, maximum voluntary occlusal force, and diadochokinesis (56). Tooth loss is associated with an accelerated decline in walking speed in older adults (57). Occlusal support is associated with improved nutrition, dysphagia, and ADL recovery in patients recovering from hip fractures (58) and among older adults needing long-term care (59). Improving occlusion by wearing an occlusal splint improves trunk balance and lower extremity muscle strength (60). Furthermore, oral problems are associated with cognitive decline (50). Oral health and cognitive impairment have a direct effect on denture placement, and the resulting dysphagia

is positively associated with cognitive impairment and malnutrition (61-63). Therefore, early detection and therapeutic interventions of oral problems are essential to prevent and delay physical and cognitive decline and to improve rehabilitation outcomes.

Intervention for oral problems

Oral rehabilitation improves impaired oral status and function. Oral rehabilitation refers to rehabilitation of oral function, and it improves quality of life (64, 65). An oral exercise program focusing on enhancing mastication, salivation, and swallowing function was shown to effectively improve oral function (66). Prosthodontic rehabilitation increases oral health-related quality of life, orofacial esthetics, and chewing function (67). A combination of oral functional training and dietary supplements improves nutritional status in malnourished older patients in nursing homes (64). Tongue resistance training improves tongue pressure and swallowing function in stroke patients (66, 68). Other effective treatment options include jaw opening exercise (69), self-exercise of oral function (70), and Shaker exercise (71, 72), which are reported to improve swallowing function and reduce aspiration pneumonia.

Oral health promotion and education positively impact oral problems (73, 74). A three-month oral function promotion program improved oral function and oral health-related quality of life for older adults (75). Another similar program including facial muscle and tongue exercises and salivary gland massage was effective in improving oral health status and function in independent older adults (76). In Japan, one of the duties of the long-term care insurance system is the prevention of oral function degradation, and professionals involved in that program include nurses, speech-language pathologists, and dental hygienists (74). The effects of the Japanese «Prevention of Long-Term Care» Project was confirmed in regard to oral status and function (73, 77, 78). However, there is currently a lack of evidence of the impact of oral promotion programs on rehabilitation outcomes.

Medical–dental collaboration

Medical–dental collaboration is crucial in rehabilitation (79). Perioperative oral function management can reduce the risk of postoperative pneumonia and is covered by health insurance in Japan. Additionally, collaboration between dental practitioners and non-dental care providers may improve oral health care for people in rural and remote areas with limited access to oral health services (80).

However, medical–dental collaboration and knowledge of oral health management are insufficient in rehabilitation and general medicine. Dentists focus on the diagnosis and treatment of oral diseases and tend to overlook general health problems. Similarly, physicians tend not to address patients' oral health issues (81). The competency level of physicians, residents, and

nurses was lower than 30% for identifying tooth decay and oral pathology (9). Frequency rates for dental referral by medical providers were 32% “frequently” and 68% “infrequently” (9). A qualitative study exploring general practitioners' and dentists' experiences and expectations of interprofessional collaboration revealed that both reported perceived knowledge deficits of the other profession (82). Moreover, most general practitioners saw no need for medical–dental collaboration, although dentists were interested in extending medical–dental collaboration (82). Medical–dental collaboration is inadequate and should be improved in rehabilitation and general medicine.

Dental hygienists can play a central role in rehabilitation collaboration. The role of dental hygienists includes screening and assessing oral health and function and providing treatment, education, and counseling in oral health management, oral and dysphagia rehabilitation, and interprofessional collaboration (83). Oral health management provided by dental hygienists improves not only oral status, swallowing function, and nutritional status, but also ADL, home discharge, and in-hospital mortality in post-acute rehabilitation (83). Therefore, early detection of oral problems, early oral health management by dentists and dental hygienists, and medical–dental collaboration should be implemented in rehabilitation. The presence of dental hygienists is indispensable for rehabilitation hospitals and rehabilitation nutrition (83, 84).

Conclusions

Oral health is a crucial aspect of rehabilitation. Oral problems occur frequently in rehabilitation patients and can be attributed to various factors. Health care providers need to understand and take adequate measures to prevent the onset of “hospital-associated oral problems”. Furthermore, oral problems have adverse impacts on rehabilitation outcomes. Oral rehabilitation, promotion, education, and medical–dental collaboration can be effective interventions for oral problems. However, there is a lack of knowledge and interest in oral health in rehabilitation. Therefore, prevention and early detection of oral problems, multidisciplinary oral rehabilitation, and the promotion of medical and dental collaboration are necessary to improve rehabilitation outcomes.

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Ethical Standards: This study has been performed in accordance with the ethical standards established in the 1964 Declaration of Helsinki and later amendments.

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