

Effectiveness of an Interdisciplinary Medical Hospital Admission Center: The Role of the Dental Section in the Interdisciplinary System for Perioperative Management of Patients Awaiting Surgery

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Abstract Perioperative oral functional management (POFM) involves total oral management of a patient before surgery. Considerable benefits have been reported, but POFM remains scarce in medical settings. An interdisciplinary Medical Hospital Admission Center (MHAC) opened in our hospital in December 2014, and has since provided unified perioperative management for patients. This study reports on the clinical system and contributions of the systematized, standardized POFM applied through the MHAC. Patients awaiting surgery undergo oral screening before admission, with patients classified into three groups: red, needing surgical oral management (tooth extraction or other oral surgery) before surgery; yellow, needing non-surgical oral management before surgery, due to the planned surgery or the risk of tooth injury in connection with general anesthesia; or green, patients with good oral hygiene considered capable of suitable oral self-management. Patients categorized as red or yellow undergo POFM in the dental section of the MHAC before surgery. Almost all patients (88.8%) awaiting surgery now undergo preoperative oral screening, excluding emergent surgeries. In addition, oral screening is important for preventing tooth injury during endotracheal intubation for general anesthesia, and a need for preventive measures was identified in 6.1% of patients. No traumatic injuries of the teeth in connection with general anesthesia have occurred since the opening of the MHAC.

Standardized POFM through an interdisciplinary MHAC thus seems extremely useful.

Keywords Perioperative oral functional management · Interdisciplinary · Admission center · Oral screening

Introduction

Since perioperative oral functional management (POFM) was started in a revision of medical services in fiscal year 2012, POFM has been adopted in many hospitals in Japan. POFM is defined as total oral management of a patient who is scheduled to undergo surgery for cancer or cardiologic disease, organ transplantation surgery, radiation therapy, or chemotherapy. Dentists and oral hygienists provide the oral medication for these patients, and act towards optimizing quality of life (QOL) during hospitalization and preventing perioperative complications.

POFM is performed in several hospitals in Japan. In our hospital, POFM has been used since 2008, beginning with patients treated for esophageal cancer, lung cancer and head and neck cancer. When a patient is scheduled for a surgical operation and POFM is judged as necessary, each medical doctor requests POFM for their patient from the Department of Oral and Maxillofacial Surgery. After receiving the request, dentists and oral hygienists perform dental treatment and oral management as POFM. Numerous studies have reported considerable benefits from POFM for patients scheduled to undergo various medical operations [1–12]. However, the approach for POFM is not yet widely recognized in medical settings [13]. As a result, the current situation in many hospital is that the request for POFM itself is not produced, and dental treatment and oral management for the patient thus cannot be

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performed. In several hospitals, POFM has not been performed yet at all because of these reasons [13].

There are more than 140 university hospitals in Japan, all of which are large hospitals with 500–1000 beds. Our university hospital with 941 beds is one of the larger hospitals. In our hospital, around 5000 operations are performed under general anesthesia each year. Recently, better medical service and medical safety have been required. In our university hospital, to improve health care services and the management of standardized hospitalizations, a Medical Hospital Admission Center (MHAC) was installed and opened in December 2014. Since then, the MHAC has been used to provide unified interdisciplinary perioperative management for patients, including sections for anesthesiologists, laboratory technicians, nurses, clerical staff, dietitians, pharmacists and dentists. In the dental section, a systematized and standardized POFM has been developed through this system. The present study reports on the clinical system and the contributions of systematized and standardized POFM through the interdisciplinary MHAC.

Method

System of medical hospital admission center (MHAC)

The MHAC comprises 7 sections: anesthesiology; laboratory; nursing department; clerical section; dietetic section; pharmacy; and dental section (Fig. 1). In order to optimize healthcare services and the management of standardized hospitalizations

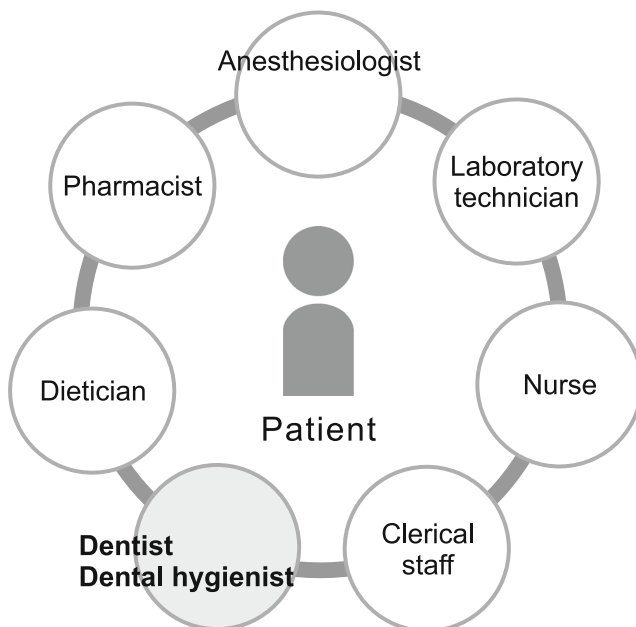


Fig. 1 Components of the MHAC. The Medical Hospital Admission Center (MHAC) is interdisciplinary center comprising 7 sections: anesthesiology, laboratory, nursing department, clerical section, dietetic section, pharmacy, and dental section

through the interdisciplinary system of MHAC, all patients who are to be admitted undergo preadmission screenings such as general medical pre-hospitalization screenings, and preoperative explanations of possible procedures during and after hospitalization. The following are the main contributions of each section:

- 1) Clerical staff provide explanations of the admission procedure.
- 2) Nurses interview the patient to obtain relevant medical information.
- 3) Pharmacologists check the pharmacotherapies currently prescribed for patients awaiting surgery.
- 4) Dietitians interview the patient regarding ingestion/swallowing function, and food allergies, then adjust the in-hospital diet to be provided for the patient.
- 5) Laboratory technicians check the preadmission screening laboratory data.
- 6) Anesthesiologists conduct a preoperative interview of patients awaiting surgery.
- 7) In the dental section, POFM is planned as total oral management during hospitalization for patients awaiting surgery under general anesthesia.

Role of the dental section in preoperative patient management

In the dental section, anamnesis and an intraoral exam focusing on teeth, gums, tongue, and other oral organs are performed by a dentist, and POFM will be planned and performed for patients scheduled to undergo surgery under general anesthesia. Before the opening of the MHAC, POFM was requested by individual doctors at various perioperative times when the medical doctor decided the patient needed POFM (sometime postoperatively). After receiving requests from each medical doctor, dentists and oral hygienists performed dental treatment and oral management as POFM. In contrast to that previous system, patients awaiting surgery now systematically pass through the MHAC before admission (Fig. 2). Therefore, all patients awaiting surgery can undergo oral screening in the dental section of the MHAC before admission. After oral screening, POFM is planned and performed depending on the interventional necessities of the patient's condition. In practical terms, in the dental section, oral screening of each patient is systematically classified into one of three groups: red, yellow or green. The following are the contributions of each group:

1. Red: patients who need surgical oral management (tooth extraction or other oral surgery) before their surgical operation.

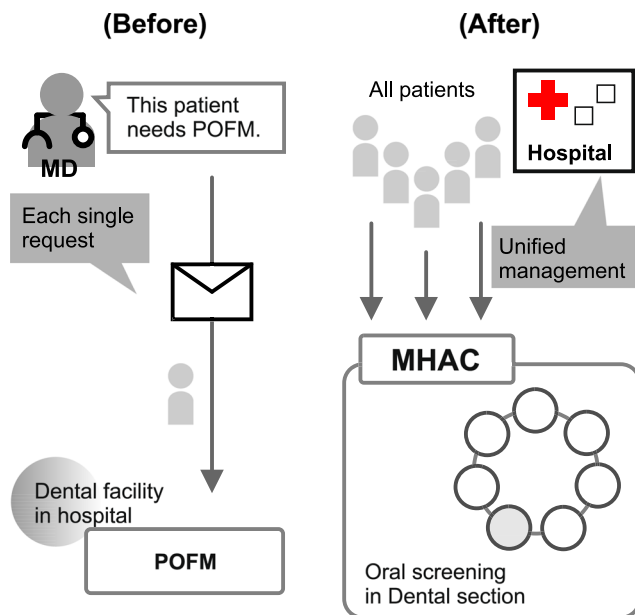


Fig. 2 Systematic improvement of POFM. Before installing the MHAC, POFM was requested from the Department of Oral and Maxillofacial Surgery by the individual medical doctor at various perioperative times. After receiving the request, oral screening was performed by the dentist. POFM was dependent on a request from each medical setting (*left*). In contrast, after installing the MHAC, patients awaiting surgery have been systematically passed through the MHAC before admission. All patients can then systematically undergo oral screening as POFM in the dental section of the MHAC before admission (*right*)

2. Yellow: patients who need non-surgical oral management before the operation. This group includes: i) patients for whom particular surgical operations are planned (cancer surgery, organ transplantation surgery, head & neck surgery, prosthetic replacement arthroplasty, and cardiovascular surgery); and ii) patients in whom traumatic injuries of the teeth can be predicted in connection with general anesthesia as perianesthetic complications, and need tooth fixation and/or application of tooth protectors.
3. Green: patients with good oral hygiene who are judged as capable of performing suitable oral self-management before the surgical operation.

Patients categorized as Red and Yellow are instructed to undergo POFM in the dental section of the MHAC before their surgical operation. Patients are instructed how to brush their teeth and tongue and how to maintain a high level of oral hygiene. In the case of the Red group, surgical oral management such as tooth extraction is performed before the surgical operation. Then, for both groups, removal of dental plaque and calculus is performed by an oral hygienist. For patients in the Green group, the importance of oral care and how to perform oral self-care is explained, and instructions are given on their oral care by their primary dentist before the surgical operation.

Evaluation of outcome after opening MHAC

For the evaluation of the preoperative oral screening ratio as an outcome after opening MHAC, patients who passed through the MHAC for surgical operation between April 1st 2016 and September 30th 2016 were examined. For comparison, the preoperative oral screening ratio before installing the MHAC was obtained for patients treated between April 1st 2014 and September 30th 2014. We studied these patients retrospectively and performed statistical analyses. The χ^2 and Fisher's exact test were used to compare differences before and after opening MHAC. Values of $P < 0.05$ were considered significant.

Results

All patients awaiting surgical operation systematically undergo preoperative oral screening in the dental section through the interdisciplinary MHAC, and POFM is being effectively started before admission.

Since the importance and approach of the POFM is not yet widespread in medical settings, requests for POFM itself are not being widely produced by medical doctors. In cases of large-scale hospitals, full dissemination of information about POFM to all medical doctors is difficult. We obtained the preoperative oral screening ratio evaluated for patients who underwent the surgical operation between April 1st 2014 and September 30th 2014, before the opening of the MHAC. A total of 2424 patients underwent surgical operation during this 6-month period, and only 106 of these patients (4.4%) underwent preoperative oral screening. However, with systematic oral screening in the dental section of the MHAC, requests from clinicians are no longer necessary. Individual medical doctors do not need to make time for explanations of and requests for POFM for each patient during the perioperative period. Similarly, we evaluated the preoperative oral screening ratio after opening MHAC. A total of 2394 patients awaiting surgical operation systematically passed through the MHAC in the 6 months between April 1st 2016 and September 30th 2016. In all, 2127 of these patients (88.8%) underwent preoperative oral screening in the dental section through the interdisciplinary MHAC. Nearly all patients had preoperative oral screening unless there was a particular reason with scheduling or the condition of the patient, such as emergent surgical operation. The preoperative oral screening ratio after opening the MHAC (88.8%) increased significantly compared to that before opening MHAC (4.4%). Table 1 shows changes in the preoperative oral screening ratio for each department before and after opening the MHAC. Almost all patients awaiting surgical operations now undergo preoperative oral screening, with the exception such as being in the case of emergent surgeries.

Table 1 Changes in preoperative oral screening ratio on each department with installation of the MHAC. Ratio of preoperative oral screening

Department	Ratio of preoperative oral screening before installing MHAC (%)	Ratio of preoperative oral screening after installing MHAC (%)
Ophthalmological surgery	0 / 84 (0.0)	67 / 96 (69.8)
Surgery	32 / 818 (3.9)	727 / 807 (90.1)
Orthopedic surgery	0 / 193 (0.0)	192 / 192 (100.0)
Otolaryngology	6 / 281 (2.1)	249 / 249 (100.0)
Plastic surgery	0 / 232 (0.0)	209 / 223 (93.7)
Cardiac surgery	0 / 188 (0.0)	110 / 182 (60.4)
Urological surgery	0 / 92 (0.0)	102 / 102 (100.0)
Gynecology	0 / 222 (0.0)	251 / 252 (99.6)
Dermatology	0 / 17 (0.0)	11 / 11 (100.0)
Neurosurgery	0 / 117 (0.0)	75 / 110 (68.2)
Oral and Maxillofacial surgery	68 / 68 (100.0)	88 / 92 (95.7)
Obstetrics	0 / 1 (0.0)	0 / 1 (0.0)
Pediatric surgery	0 / 36 (0.0)	32 / 32 (100.0)
Emergency medicine	0 / 65 (0.0)	6 / 37 (16.2)
Others	0 / 10 (0.0)	8 / 8 (100.0)
Total	106 / 2424 (4.4)	2127 / 2394 (88.8)

Of the 2127 patients who passed through MHAC, patients categorized as Red or Yellow were instructed to undergo POFM in the dental section before surgery. Nineteen patients were categorized as Red, and 620 patients as Yellow during this period. Thus, 30.0% of all patients were diagnosed as needing POFM through the dental section. Patients for whom particular surgical operations (head & neck surgery, esophageal surgery, lung surgery, prosthetic replacement arthroplasty, and cardiovascular surgery) were planned were systematically categorized as Yellow, and underwent POFM. Patients awaiting surgical operations can undergo preoperative oral screening in the dental section through the MHAC, and POFM has started to be applied during the preadmission period. As a result, for example, patients who underwent the lung cancer surgery after the opening of the MHAC, categorized as red or yellow, displayed a lower incidence of postoperative pneumonia (2.4%), compared to that (3.1%) before opening MHAC (unpublished data). In particular, the ratio of preoperative oral screening among patients awaiting prosthetic replacement arthroplasty (from 0.0% to 100.0%) and cardiovascular surgery (from 0.0% to 60.4%) increased dramatically, facilitating the prevention of possible arthroplastic infections and infectious endocarditis [5, 8, 11]. The effect of POFM for infective endocarditis and odontogenic infection of prosthetic joints cannot be evaluated at present, because these infections arise after several years. Further annual observation of these patients is needed. Oral check-ups after leaving hospital are currently performed depending on the interventional necessities of the patient's condition, either by our institution or by the primary-care dentists.

In addition, oral screening is important to prevent tooth injury during endotracheal intubation under general

anesthesia. Oral screening by a dentist rather than a medical anesthesiologist gives more technical expertise regarding complicated teeth, complicated prosthodontics, deciduous teeth during the exchange period, and ceramic prosthodontics. Needs for tooth extraction, tooth fixation and/or application of tooth protectors are identified to protect against oral complications. In the case of tooth protectors, an impression is taken using alginate impression materials directly in the individual mouth, and a protector made of polylactides is prepared. With oral screening for possible traumatic injuries of the teeth that might be predicted to occur in connection with general anesthesia, tooth extractions and fixations or creation of tooth protectors are provided for these patients. A need for such preventive measures was identified in 6.1% of all patients ($n = 145 / 2394$) who passed through the MHAC by preoperative oral screening. Because of this protection, traumatic injuries of the teeth have not occurred in connection with general anesthesia since the opening of the MHAC.

Discussion

The present study offers the first report of this clinical system and the contributions of systematized, standardized POFM through the interdisciplinary MHAC. Through the MHAC, all patients awaiting surgical operations can undergo preoperative oral screening in the dental section, and POFM for all patients has started to be applied during the preadmission period. This contributes to better medical service and medical safety to improve healthcare services and the management of standardized hospitalization.

Since a notable 1999 report that oral care of elderly occupants in residential homes is associated with preventive effects against pneumonia [14], considerable benefits of POFM have been reported in various studies. POFM reduces the likelihood of various perioperative complications, particularly: 1) surgical-site infection after head and neck surgery; 2) postoperative pneumonia after surgery for esophageal or lung cancer; 3) ventilator-associated pneumonia; 4) possible infective endocarditis; and 5) odontogenic infection of prosthetic joints [1, 2, 4–6, 8, 9, 11, 15]. However, more than 80% hospitals in Japan do not yet have a dental section [13]. Dentists and dental hygienists thus do not participate in the interdisciplinary treatment of patients. Even in those hospitals that actually have a dental section, 40% of these hospitals still have not performed POFM. In addition, 70% of general dental clinics and 10% of university hospitals have not performed POFM in Japan [13], although the importance of POFM has gradually become more widely known and applied in medical settings recently. A large-scale survey by the Health, Labour and Welfare Ministry of Japan has shown that POFM has not been performed because requests have not been produced in the medical setting [13]. This is because POFM is not considered a major issue, and is treated as a secondary concern for patients despite representing a basic prophylactic treatment. Full dissemination of the importance of POFM to all medical settings is very difficult in large-scale hospitals. Incorporating a dental section in the interdisciplinary MHAC is thus a systematic and effective way to standardize POFM for inpatients. As a result, by installing a dental section in the MHAC, the interventional ratio of patients undergoing POFM dramatically increased for all patients awaiting surgical operations, as shown in Table 1. The interventional ratio is not 100% because emergency surgeries such as cardiovascular surgery are exceptions to the rule of screening in the MHAC. However, most patients undergoing surgery received preoperative oral screening in the dental section. Reductions in the risk factors for oral complications by systematic preoperative screening and POFM will lead to improvements in the quality and safety of healthcare services, and to medical economic effects by shortening the hospitalization period.

POFM produces an additional benefit in protecting against perianesthetic dental injuries. The endotracheal intubation used in anesthesia carries a possibility of causing damage to the teeth. More than 10% of patients receiving anesthesia medication reportedly sustain some form of dental injury and patients undergoing surgery under endotracheal intubation are recommended to receive preoperative oral screening [16]. Another study showed that dental damage accounted for one-third of all medicolegal claims against anesthesiologists, representing a major medical safety issue [17]. Clearly, specialized oral examinations by dentists, rather than by anesthesiologists, conducted prior to the surgical operation contribute to better medical service and medical safety. Remedial dental

treatments such as tooth fixation and/or making a customized mouth guard can be carried out. After incorporating a dental section into the MHAC, no perianesthetic oral complications have been reported.

At present, POFM is used for patients awaiting surgical operations. Patients admitted for non-surgical treatments such as cardiovascular medicine, internal medicine for endocrine metabolism, gastroenterological medicine, respiratory medicine, or radiotherapy for the head and neck region also need oral functional management. This seems likely to lead to improvements in patient satisfaction and safety. Construction of similar systems for oral screening is thus required.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

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