



A Blood Pressure Check and Percutaneous Oxygen Saturation Measurement Improved Patient Safety in Dental Treatment

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Abstract

Objective: Japan is one of the most super-aged societies in the world. Dental treatment is risky for older people, both because they are more likely to have systemic diseases and because dental treatment is stressful. This study investigated how patient safety during dental treatment was affected by promoting the practice of measuring blood pressure and arterial blood oxygen saturation before and after dental treatment.

Methods: We promoted the claiming of patient safety management fees from the health care insurance system in Japan that requires dentists to perform a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment. We used a 4-step promotion with 355 dentists in a dental hospital over a 32-month period. Data about the number of claims for all types of patient safety management fees was obtained from the electronic dental health record system.

Results: The monthly average number of claims for the two types of patient safety management fees significantly increased during the promotion period in all patients and in patients with diseases related to patient safety management fees. Claims for fees for sharing medical information between dentists and medical doctors in the health care insurance system were significantly higher during the promotion period than during the no promotion period.

Conclusion: The promotion increased the number of claims for patient safety management fees and improved the patient safety management environment through the exchange of referral documents between dentists and medical doctors and screening for diseases in patients using vital signs.

Keywords: Dental treatment; Blood pressure; Percutaneous oxygen saturation measurement; Blood pressure

Introduction

The Japanese population has one of the longest life expectancies in the world. The population aging rate for people aged 65 and over is still increasing every year in Japan, and was 27.7% in 2017 [1]. Kyushu Dental University Hospital is located in Kitakyushu City in Fukuoka, which had the highest population aging rate in Japanese government designated cities in 2016 (28.6%) [2]. Our research has revealed that 36.8% of outpatients in the dental hospital were aged 65 or over [3]. Generally, the risk of cardiovascular diseases such as hypertension increases with age. The National Health and Nutrition Survey in 2016 showed that the prevalence of hypertension (systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg, or use of antihypertensive medication) was 60% for males aged 40 to 74, 41% for females in the same age range, 74% for males aged 75, and 77% for females in the same age range [4]. Additionally, a previous study [5], reported that the dental setting is viewed as a stressful environment, and the combination of high blood pressure and

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a stressful environment may have harmful, even fatal, consequences for patients. Calistro et al. [6] also reported that practitioners should routinely record blood pressure before establishing a treatment plan according to the patients' systemic conditions, aiming to reduce or avoid the likelihood of any hypertensive crises. Thus, older outpatients are at risk during dental treatment not only because of hypertension but also because of their increased incidence of other systemic diseases.

The Japanese government provides a health care insurance system for all Japanese people [7]. Japan is a welfare country and public healthcare systems are well developed [8]. The insurance system covers almost all medical and dental treatment and pharmacy care required by the population [8]. The fee schedule in the health care insurance system is reviewed every 2 years and inclusions/exclusions of each treatment option within the insurance scheme are reviewed by an expert committee established through the Ministry of Health, Labor and Welfare [8].

For patient safety reasons, the 2016 revision of the reimbursement of dental fees in the health care insurance system adopted two types of patient safety management fees from April 2016 for patients with hypertension, ischemic cardiac disease, arrhythmia, cardiac decompensation, asthma, chronic bronchitis, diabetes mellitus, thyroid deficiency, cerebrovascular disease, epilepsy, osteoporosis or chronic kidney disease. Dentists are required to perform a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment to claim these management fees. The 2018 revision of reimbursement of dental fees modified these fees and made a new fee for sharing medical information between dentists and medical doctors for patient safety from April 2018.

To improve patient safety, dentists in the hospital should perform a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment and could then claim the patient safety management fees; however, these management fees were rarely claimed, despite the fact that elderly outpatients present great risks during dental treatment in the hospital.

The aim of this study was to examine how to change the number of times the patient safety management fees were claimed by promoting the practice of performing a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment.

Materials and Methods

Investigation period and number of dentists

The investigation period was from April 1st, 2017 to November 30th, 2019 and there were 355 dentists working in Kyushu Dental University Hospital, Kitakyushu, Fukuoka, Japan. This study was conducted with an approval from the ethics committee in Kyushu Dental University.

Prevalence rate of each disease

The number of patients with diseases was divided by the number of outpatients to determine the prevalence of diseases. The total of number of patients was 189,465 during the investigation period.

Type of patient safety management fees in the health care insurance system in Japan

To claim any type of patient safety management fee, it is necessary to perform a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment and to record it in the dental health record.

The old type1 patient safety management fee (O-1) (*Shikachiryō-*

sogoiroyo-kanriryō-1, ¥1,400 per month) was available from April 2017 to March 2018. Dentists needed to receive patient referral documents from primary medical doctors before claiming O-1 in their monthly dental fee claims. O-1 was intended for patients with hypertension, ischemic cardiac disease, arrhythmia, cardiac decompensation, asthma, chronic bronchitis, diabetes mellitus, thyroid deficiency, cerebrovascular disease, epilepsy, osteoporosis treated with bisphosphonate agents, or chronic kidney disease (receiving dialysis).

The old type 2 patient safety management fee (O-2) (*Shikachiryō-sogoiroyo-kanriryō-2*, ¥450 per day) was available from April 2017 to March 2018. Although dentists did not require a patient referral document from a primary medical doctor, they had to check the prescription record books from patients. O-2 was intended for patients with hypertension, ischemic cardiac disease, arrhythmia, cardiac decompensation, or cerebrovascular disease.

The new type1 patient safety management fee (N-1) (*Sogoiroyo-kanri-kasan*, ¥500 per month) has been available since April 2018. Dentists require patient referral documents from primary medical doctors before claiming N-1. N-1 is intended for patients with diabetes mellitus, those taking osteoclastic inhibitors, those with a high risk of infectious endocarditis or rheumatoid arthritis, or those taking blood coagulation inhibitors.

The new type 2 patient safety management fee (N-2) (*Shikachiryō-ji-iryokanriryō*, ¥450 per day) has been available since April 2018. Although dentists don't require a patient referral document from a primary medical doctor, they have to check the prescription record books from patients. N-2 is intended for patients with hypertension, ischemic cardiac disease, arrhythmia, cardiac decompensation, asthma, chronic bronchitis, cerebrovascular disease, diabetes mellitus, adrenocortical hypofunction, epilepsy, chronic kidney disease (receiving dialysis), and those using mechanical ventilation or receiving domiciliary oxygen therapy.

Communication between dentists and medical doctors using documents

The old fee for sharing medical information between dentists and medical doctors (O-S) (*Shinryō-jyōho-teikyōryō-1*, ¥2,500 for each hospital or clinic) has been available for many years. Dentists and medical doctors exchanged patient referral documents when dental or medical treatment was necessary. When confirming and exchanging medical information such as diagnosis, treatment status, medications, and the results of blood tests using patient referral documents, no payment was received from the government.

The new fee for sharing medical information between dentists and medical doctors (N-S) (*Shinryō-jyōho-renkei-kyōyuryō*, ¥1,200 for each hospital or clinic) has been available since April 2018. Dentists and medical doctors can confirm and exchange medical information such as diagnosis, treatment status, medications, and the results of blood tests by exchanging patient referral documents.

Promotional methods

Step 1: On December 14th, 2017 and July 16th, 2019, we made a presentation for all dentists on the necessity of enhancing patient safety by performing a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment in the hospital.

Step 2: We made an Excel file listing patients with systemic

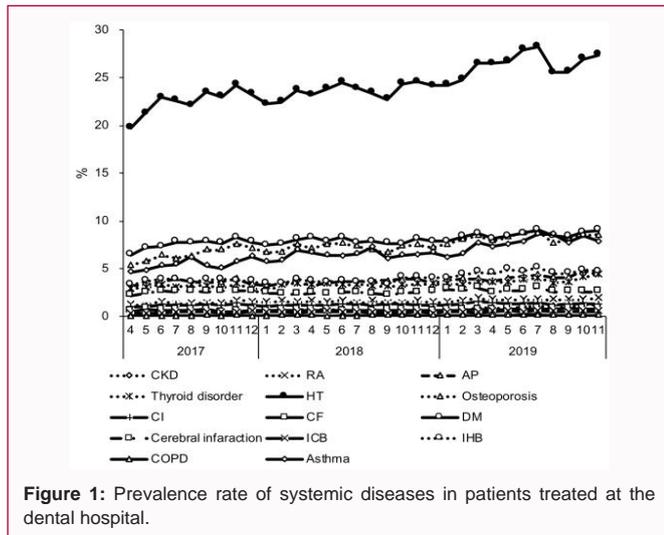


Figure 1: Prevalence rate of systemic diseases in patients treated at the dental hospital.

diseases using the patients’ ID numbers. This was provided on all electronic dental health record system terminals from February 28th, 2018. This step was continued until the end of April 2018.

Step 3: Each week we sent all dentists the number of times patient safety management fees had been claimed by each dentist via a mailing list in our hospital from February 6th, 2018 to July 3rd, 2018. This was also shown on a message board for the system during the same time period.

Step 4: From April 25th, 2018 we programmed the system to show an automatic alert message if a patient had a disease related to a patient safety management fee claim when the dentist logged into a patient’s health record.

Definition of the promotion period and the no promotion period during the investigation period

We defined before December 2017 as the “no promotion period” and after January 2018 as the “promotion period”.

Data extraction and analysis

Data about the number of times all types of patient safety management fees and the two types of fees for shared medical information between dentists and medical doctors were claimed

from the electronic dental health record system, ACTIS-ERD (Canon Medical Systems Corporation, Tochigi, Japan), and the patients’ IDs and information about systemic diseases were obtained from the patient profile data in the system. The data were analyzed and assessed using Qlik sense® February 2018 (Qlik Technologies, Inc., USA).

Statistical analysis

Statistical analyses were performed using JMP® 9.0.2 (SAS Institute Inc., Cary, NC, USA). A p value of less than 0.05 was considered to indicate a statistically significant difference. Results are expressed as the Mean ± Standard Deviation (SD). A Wilcoxon rank sum test was used to analyze differences in the mean monthly average number of claims and the use rate of all types of patient safety management fees. A Steel-Dwass test was used to examine differences in the mean use rate of O-S and N-S claims in all patients, the O-1 and N-1 groups, and the O-2 and N-2 groups.

Results

Figure 1 shows the characteristics of each disease prevalent in outpatients in the hospital. The prevalence of hypertension was markedly higher than that of other diseases. The prevalence of hypertension gradually increased every year.

Figure 2A shows the number of claims for all types of patient safety management fees during the investigation period. The number of claims in the O-2 and N-2 groups was markedly higher during the promotion period than during the no promotion period. The number of claims in the N-1 group was slightly higher in the promotion period than in the no promotion period.

Figure 2B shows the monthly average number of claims for all types of patient safety management fees between all patients and patients with diseases related to patient safety management fees. There was no significant difference between the no promotion period and the promotion period in the O-1 and N-1 groups in all patients. The monthly average number of claims in the O-2 and N-2 groups in all patients was significantly higher in the promotion period than in the no promotion period. In patients with diseases related to patient safety management fees, the O-1 and N-1 groups and the O-2 and N-2 groups each had significantly higher numbers of claims during the promotion period than during the no promotion period.

Figure 2C summarizes the rate of performing a blood pressure

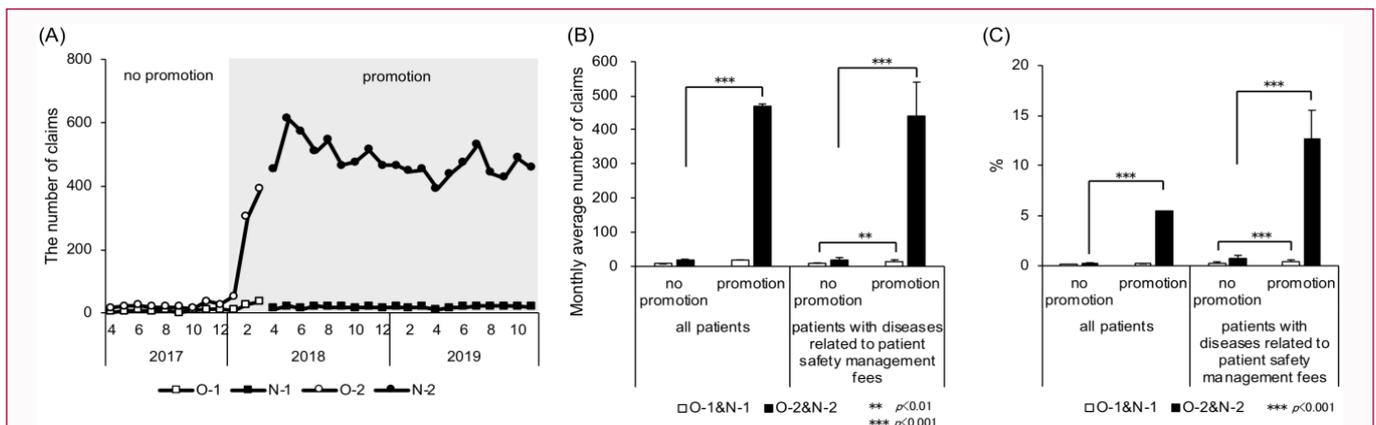


Figure 2: (A) The number of claims for all types of patient safety management fees during the no promotion period and the promotion period. (B) Monthly average number of claims for all types of patient safety management fees between all patients and patients with diseases related to patient safety management fees. (C) Rate of performing a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment between all patients and patients with diseases related to patient safety management fees.

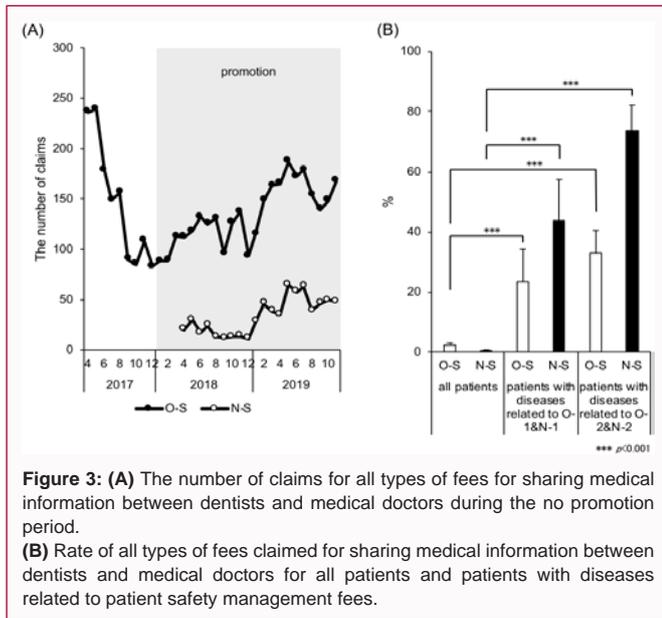


Figure 3: (A) The number of claims for all types of fees for sharing medical information between dentists and medical doctors during the no promotion period. (B) Rate of all types of fees claimed for sharing medical information between dentists and medical doctors for all patients and patients with diseases related to patient safety management fees.

check and a percutaneous oxygen saturation measurement before and after dental treatment. The rate in the O-2 and N-2 groups in all patients was significantly higher in the promotion period than in the no promotion period. In patients with diseases related to patient safety management fees, the O-1 and N-1 groups and the O-2 and N-2 groups each had a significantly higher rate during the promotion period than during the no promotion period.

Figure 3A shows the number of claims in O-S and N-S. The number of claims in O-S was consistently higher than that of N-S during the investigation period. The number of claims in N-S was higher during the promotion period.

Figure 3B summarizes the rate of all types of fees claimed for sharing medical information between dentists and medical doctors. The rate of use of O-S was significantly higher in patients with diseases related to patient safety management fees in the O-1 and N-1 groups and the O-2 and N-2 groups than in the group of all patients. The rate of use of N-S was significantly higher in patients with diseases related to patient safety management fees in the O-1 and N-1 groups and the O-2 and N-2 groups than in the group of all patients.

Discussion

The aim of this study was to examine how the number of claims for patient safety management fees in the hospital was affected by promoting the practice of performing a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment. We have shown that promoting the practice of performing a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment using safety management fee claims enhances patient safety in the hospital. Our findings suggest that we should continue to promote this practice to enhance safety for all patients.

We found that the average prevalence of hypertension during the investigation period was 22.3% in our hospital (Figure 1). This result is similar to a previous study that showed the prevalence of hypertension was 32% in the patients of a dental school [5]. In contrast with the previous study [5], which studied only 500 patients, our study examined 189,465 patients. It is expected that the prevalence of

hypertension will increase gradually in our outpatients in the future and that risks to patient safety in dental treatment will also gradually increase.

Our data shows that the four steps of our promotion affected the monthly average number of O-2 and N-2 claims in the group of patients with diseases related to patient safety management fees (Figure 2B). O-2 and N-2 were more easily claimed in the monthly dental fees compared with O-1 and N-1, because they did not require patient referral documents from medical doctors. In fact, the number of N-1 claims was slightly higher than those of O-1 claims regardless of the presence of the promotion. It is possible that the presence and absence of patient referral documents affects dentists' behavior. Additionally, our data suggests that O-2 and N-2 claims including hypertension affected the monthly average number of O-2 and N-2 claims, because the prevalence of hypertension is higher than other diseases in the hospital.

Our data revealed that the rate of performing a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment in O-2 and N-2 claims during the promotion period was significantly higher than during the no promotion period (Figure 2C). However, the rate was still only 12.7%, although the monthly average was significantly increased.

A previous study [6] indicated that practitioners should record a preliminary routine blood pressure before starting any kind of treatment because the diagnosis of a disease will contribute to the establishment of a treatment plan according to the patient's systemic conditions. The results shown in Figure 2 indicate that the risk to patient safety during dental treatment was lower in the promotion period than in the no promotion period. However, the rate of claims for patient management fees was still low, and needs to be increased in the future.

We found that each step of the promotional method was effective. Step 1 may have been effective because the presentation about increased patient safety affected dentists' behavior. As a result, the monthly average number of claims in July 2019 increased dramatically. Step 3 may have been especially effective because email messages and a message board in the electronic dental health record revealed the names of each dentist and the number of claims for all types of patient safety management fees once a week for all dentists in the hospital. Additionally, step 4 may have been effective because the program showed an automatic alert message when the dentist logged into the patient's health record if the patient had a disease related to patient safety management fees. We found that this was a useful function for dentists. Our study had a limitation in that we were unable to distinguish which step was the most effective, because we could not stop the alert messages for patient safety reasons.

O-S claims were frequently used in the beginning of the no promotion period, but this decreased to around 100 claims in the middle of the no promotion period and the beginning of the promotion period, after a dentist in the hospital pointed out an error in claiming O-S. Dentists in the hospital misunderstood how to claim O-S, although O-S was needed to refer patients to medical doctors for necessary medical treatment. They just confirmed and exchanged medical information such as diagnoses, treatment status, medications, and the results of blood tests using patient referral documents using O-S. N-S, without referring patients' treatment to medical doctors started in April 2018 for patient medical safety management, and

the number of N-S claims gradually increased in the promotion period. Our findings showed that N-S claims increased significantly in patients with diseases related to O-1/N-1 and O-2/N-2 rather than in all patients.

One previous study [6] reported that dentists should seek advice from medical doctors, as the patient's health should always come first. Our results showed that dentists in the hospital gradually understood the need to consult medical doctors about patients' conditions using O-S and N-S claims. Our results also suggest that this promotion contributed a great deal to the success of patient safety management in the hospital.

Another study [9] recommended that blood pressure be measured at all appointments. It was easy to detect patients with suspected hypertension by performing a blood pressure check and a percutaneous oxygen saturation measurement before and after dental treatment as a screening examination. We usually found patients with suspected hypertension before dental treatment. Many patients with suspected hypertension were unaware of their health condition, because they had not had a physical examination for a long time. Once we had detected it, we frequently referred them to medical doctors for hypertension treatment.

We were able to purchase many additional blood-pressure gauges and pulse oximeters for use in all treatment rooms in the hospital in October 2019, because the N-1 and N-2 claims brought in increased revenue. Therefore, we could establish an environment that will enable dentists to routinely use blood-pressure gauges and pulse oximeters in all treatment rooms in the hospital for patient safety management in the event of an emergency situation during dental treatment.

We should continue to perform blood pressure checks and percutaneous oxygen saturation measurements before and after dental treatment for all patients at all appointments regardless of the patient safety management fees, because professional education about patient safety management is an important part of clinical training for dental students in the dental hospital.

Conclusion

The promotion related to claiming all types of patient safety management fees in the health care insurance system in Japan

improved the conditions related to patient safety management, such as communication between dentists and medical doctors via exchange of documents, screening of the patient's condition using vital signs, and the routine use of blood-pressure gauges and pulse oximeters in all treatment rooms for all patients in the dental hospital.

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References

1. Cabinet office. Annual Report on the Aging Society: 2018.
2. Institute for Global Environment Strategies. Kitakyushu City the Sustainable Development Goals Report 2018.
3. Morishita M, Owatari T, Muraoka K, Hayashi M, Tsukiashi T, Tominaga K, et al. Relationship between the number of new patients per day and various factors including weather-related factors using 10,870 patients over 5 years at Kyushu dental university hospital. *Jpn J Dent Prac Admin.* 2019;54:177-83.
4. The Ministry of Health, Labour and Welfare. The National Health and Nutrition Survey in Japan, 2016.
5. Kellogg SD, Gobetti JP. Hypertension in a dental school patient population. *J Dent Educ.* 2004;68(9):956-64.
6. Calistro LC, Tinoco EJJ, Alcolumbre SB, Paraguassu EC, Voss D. Dental care in hypertense patients: Systematic review. *Brazilian J Implantol Health Sci.* 2019;1(6):152-68.
7. The Ministry of Health, Labor and Welfare. Health and Medical Services. 2018.
8. Zaitso T, Saito T, Kawaguchi Y. The Oral Healthcare System in Japan. *Healthcare.* 2018;6(3):79-95.
9. Salkic S, Batic-Mujanovic O, Ljuca F, Brkic S. Clinical presentation of hypertensive crises in emergency medical services. *Mater Sociomed.* 2014;26(1):12-6.