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Evidence-practice Gap in Minimal Intervention Dentistry: Findings from a Dental Practice-based Research Network

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Abstract

Objectives: This study aimed to 1) quantify the evidence-practice gap (EPG) between dental clinical practice and published evidence on Minimal Intervention Dentistry (MID) among dentists in Japan; and 2) examine the hypothesis that dentist characteristics have a significant association with the EPG.

Methods: We conducted a cross-sectional study via use of a web-based questionnaire survey of dentists who were affiliated with the Dental Practice-based Research Network Japan (n=297). To quantify the EPG on MID, we used a questionnaire that included 10 clinical questions or scenarios to assess concordance between dental practice and published evidence on MID. We evaluated concordance by coding responses to each question as consistent or inconsistent with the evidence. An overall concordance was then determined as percent of responses that were consistent with published evidence for 10 questions. Subsequently, multiple logistic regression analysis was conducted to examine the associations between dentist characteristics and higher overall concordance (median) with published evidence.

Results: Mean and median overall dentist-level concordance were both 60% (SD: 18, interquartile range: 50–75%). Logistic regression analysis showed that “gender of dentist”, “city population”, and “frequency of obtaining evidence from the scientific journal articles in English” were significantly associated with high concordance, with odds ratios (95% CIs) of 2.33 (1.01–5.39), 2.01 (1.02–3.96), and 2.45 (1.08–5.59), respectively.

Conclusions: Japanese dentists demonstrated medium concordance with published evidence, indicating that an EPG on MID exists in Japanese dental clinical practices. Dentist-specific characteristics had significant associations with high concordance with published evidence.

Keywords

evidence-practice gap; minimal intervention dentistry; evidence-based dentistry; practice-based research

INTRODUCTION

Evidence-based practice is defined as the conscientious, explicit and judicious use of latest and best evidence in decision making about the care for individual patients [1,2]. However, there has always been a gap between scientific evidence and actual clinical practice, which is referred to as the “evidence-practice gap (EPG)” [3]. There has been an increase in the recognition of this gap in various healthcare fields [4–7]. McGlynn et al. reported that the proportions of the patients who received recommended preventive care, acute care, and chronic care are 55%, 54%, and 56%, respectively [4]. Closing the EPG is associated with decreases in patient morbidity, mortality, and healthcare costs [2,8–10] and would produce significant improvements in public health [11].

Minimal Intervention Dentistry (MID) was initially developed in the first policy statement on MID in the early 2000’s [12,13]. MID aims to maintain the maximum amount of healthy tooth structure and maintain teeth as functional for life. The World Dental Federation (FDI) support this idea as the contemporary way to manage dental caries [14]. MID involves the

treatment of caries lesions using conservative techniques which maximally preserve tooth structure. Major components of MID include: 1) early detection of carious lesions and the evaluation of caries risk and activity; 2) remineralization of demineralized enamel and dentine; 3) optimal measurement to maintain sound teeth in an optimum condition; 4) dental recall intervals customized to the individual patient's risk for new caries; 5) minimally invasive surgical interventions which ensure tooth survival; and 6) repair in place of replacement of defective restorations. Although it has been almost 20 years since the concept of MID was first developed, the extent to which this concept has disseminated throughout dental practice and the size of the EPG regarding MID in caries diagnosis and treatment are still unknown.

The Dental Practice-based Research Network (Dental PBRN) is a research network which links practitioners with clinical researchers and conducts relevant clinical research to address questions about quality improvement which directly influence routine clinical practice. The establishment of Dental PBRNs has created the opportunity to measure and compare actual practice patterns in dental clinical practice [15–18]. Former studies by the US National Dental PBRN (<http://www.nationaldentalpbrn.org/>) [19–24] and the Dental Practice-based Research Network Japan (JDPBRN) (<http://www.dentalpbrn.jp/>) [25–31] clarified substantial differences in dentist practice patterns concerning caries treatment [19,20,25,28], caries risk assessment [22,23,29], dietary counseling [26], caries prevention [21,27,30], and TMD-related pain [24,31]. Regarding MID, for example, the authors reported that endodontic-related procedures are still the most frequently used treatment option for deep occlusal caries with the possibility of mild pulpitis, and that practice patterns for treatment for deep occlusal caries vary among populations [32–34]. As far as we are aware, however, no international comparison of EPG for various aspects of caries diagnosis and treatment on MID has been reported.

Therefore, this study aimed to 1) quantify the EPG between dental practice and published evidence on MID among dentists in Japan; and 2) examine the hypothesis that dentists' characteristics have a significant association with the EPG.

METHODS

Study Design

The study was conducted under a cross-sectional study design via use of a web-based questionnaire survey in Japan from January 2017 to November 2017. The questionnaire can be accessed at <http://www.dentalpbrn.jp/image/EPG20questionnaire.pdf>. Approval for the study was provided by an Institutional Review Board and this investigation was performed in compliance with the World Medical Association Declaration of Helsinki. All subjects provided informed consent before participation in this study.

Participants

Study participants were the dentists working in outpatient clinical practices who are affiliated with JDPBRN (n=297). The JDPBRN [18,25] is a clinical research network of dental clinics and practices with broad representation concerning types of practice, treatment

philosophy and patient characteristics. It shares a common goal with the National Dental PBRN [16,17]. The JDPBRN regions cover the seven major geographical regions of Japan, namely Hokkaido, Tohoku, Kanto, Chubu, Kansai, Chugoku-Shikoku and Kyushu [25–31,34]. Participants were recruited via the JDPBRN website and targeted mailings to members who reported that they utilize some degree of restorative dentistry at their practice. To enhance the likelihood that participants would be considered representative, they were recruited from the seven regions of Japan.

Questionnaire items

1) EPG on MID—To quantify the EPG on MID, we used the Practice Impact Questionnaire [32], which was developed in a former study by the US National Dental PBRN. Of 12 question items, we adopted 10 clinical questions or scenarios to calculate concordance between dental practice and published evidence on MID (Table 1). The questionnaire consists of three clinical areas: “area 1”: primary caries diagnosis and treatment (five questions); “area 2”: deep caries diagnosis and treatment (two questions); and “area 3” restoration diagnosis and treatment (three questions). We excluded the question regarding “third molar extraction” to focus on MID as a concept of managing dental caries [14]. In addition, we also excluded “defective amalgam restoration” because amalgam restoration is no longer a dental care service [35] covered by Japanese National Health Insurance [36–38]. This in turn means that amalgam restoration is not a common dental treatment in Japan. These questionnaires were translated into Japanese by four dentists and clinical epidemiologists.

2) Dentists’ characteristics—Dentists were characterized under three categories: 1) individual characteristics (years since graduation, gender and specialty practice), 2) practice characteristics (city population [government ordinance-designated city with a population over 700,000; other], type of practice and busyness), and 3) preference for obtaining evidence (internet, non-academic journal, textbook, scientific journal articles in Japanese, scientific journal articles in English, and clinical practice guideline).

Primary outcome

An overall concordance was determined as percent of responses that were consistent with published evidence. We evaluated concordance by coding responses for the 10 clinical procedures as consistent (i.e., ‘1’) or inconsistent (i.e., ‘0’) with the available evidence. We then calculated the percent of responses that were consistent with the evidence, with a higher percentage indicating higher concordance between practice and the published evidence.

Statistical analysis

We performed multiple logistic regression analysis to evaluate the associations between independent variables and a higher concordance with published evidence (median) as a dependent variable. The main outcome of interest, concordance, was normally distributed. Because of this, three analytic approaches were used: (1) a linear regression that used no re-scaling of the outcome variable; (2) an ordinal logistic regression in which the outcome was divided into terciles; and (3) a logistic regression in which the outcome was re-scaled as a binary variable at the median. We chose to present the results from the binary logistic

regression in this report for these reasons: (a) the substantive conclusions were similar for these three methods; (b) our main interest was to compare characteristics between dentists in a “higher concordance” group to those in a “lower concordance” group; and (c) to compare results from this same sample of dentists regarding how they treat deep occlusal caries [34]. Independent variables were dentists’ individual characteristics, practice characteristics, and preference for obtaining evidence. With regard to preference for obtaining evidence, ‘*Frequently*’ or ‘*Occasionally*’ were considered as ‘*Higher frequency*’ and ‘*Never*’ or ‘*Rarely*’ as ‘*Lower frequency*’. Odds ratio (OR) and 95% confidence interval (CI) were calculated. All statistical analyses were conducted with the IBM SPSS Statistics 23 ® (IBM Corporation, Somers, NY), with level of statistical significance set at $p < .05$.

RESULTS

Participant characteristics

Questionnaires were provided to 297 dentists, and 206 (69%) responses were collected. Participant characteristics are provided in Table 2. Mean years since dental school graduation was 20 ± 12 (SD) years and 79% ($n=162$) were male. Regarding city population, 46% ($n=94$) of practices were located in government ordinance-designated cities. With regard to type of practice, 35% ($n=72$) were employed by another dentist. For preference in accessing evidence, respective values for those reporting higher frequency from the textbook, internet, non-academic journals, scientific journal articles in Japanese, clinical practice guideline, and scientific journal articles in English were 95% ($n=195$), 91% ($n=188$), 66% ($n=135$), 61% ($n=126$), 58% ($n=120$), and 32% ($n=65$).

Concordance

Mean and median overall concordance were both 60% (SD: 18, interquartile range: 50–75%). The mean concordance of clinical areas 1, 2 and 3 were 68%, 53%, and 54%, respectively. Distribution for concordance by specific clinical questions or clinical scenarios is displayed in Table 3. Procedures having more than 60% of participants concordant with published evidence were “use of air drying”, “treatment of unrestored occlusal surface (occlusal 1)”, and “treatment of unrestored occlusal surface (occlusal 2)”. In contrast, procedures for which less than 60% were in accord with published evidence were “assessment of caries risk for individual patients in any way”, “use of magnification”, “treatment options for patient with deep occlusal caries (deep caries 1)”, “treatment options for excavation of deep caries (deep caries 2)”, “defective composite restoration with enamel margins”, “defective composite restoration with cementum-dentinal margins”, and “lesion depth for permanent restoration (proximal caries)”.

Factors affecting dentist concordance with published evidence

On multiple logistic regression analysis, three factors were identified as significantly associated with higher concordance (> 60%) with published evidence (Table 4). Odds ratios (95% CIs) for “gender of dentist”, “city population”, and “frequency of obtaining evidence from the scientific journal articles in English” were 2.33 (1.01–5.39), 2.01 (1.02–3.96), and 2.45 (1.08–5.59), respectively.

DISCUSSION

In this study, the mean and median overall concordance were 60%, which indicates that Japanese dentists demonstrated medium concordance with published evidence and that an evidence-practice gap exists in Japanese dental clinical practice. Results of logistic regression analysis suggested that “female dentist”, “dental clinic location in a government-ordinance-designated city”, and “frequently obtaining evidence from the scientific journal articles in English” had significant associations with high concordance with published evidence.

In the present study we used the 10 questions on MID out of the 12 questions developed by the US National Dental PBRN [32] to focus on assessing the EPG for MID in caries diagnosis and treatment. In the previous study [32] using the 12 questions, the existence of a substantial evidence-practice gap was reported in 2009 to 2010 from the US National Dental PBRN, which revealed that mean concordance between practice and published research evidence at the US practitioner level was 62%. Harmeet et al. [33] used the same questionnaire in 2014 to evaluate the evidence-practice gap at the Virginia Commonwealth University. Faculty had an average of 75% and graduating students had an average of 67%. The Japanese dentists' concordance may be said to be closely similar to that of US dental practitioners, although there are differences in the number of questions and survey execution periods.

Compared with these previous studies, the concordances in Japan are lower than those in the United States regarding “assessment of caries risk for individual patients (US 85% vs Japan 51%)”, “use of magnification to diagnose caries lesions (US 57% vs Japan 33%)”, “Defective composite restoration with cementum-dentinal margins (US 67% vs Japan 48%)”. Although this study was unable to clarify the specific reasons for these differences, regarding caries risk assessment, one possibility is that assessment for individual patients is not included under Japanese National Health Insurance dental reimbursement [36–38].

To identify the factors associated with EPG among Japanese dentists, we conducted logistic regression analysis. The results revealed that “female dentist”, “dental clinic location in a government-ordinance-designated city”, and “frequently obtaining evidence from the scientific journal articles in English” had significant associations with high concordance with published evidence. The US National Dental PBRN previously did a survey and found that female gender showed a significant association with a higher concordance [32]. Our former results also revealed that female dentists showed a greater provision of diet counseling than male dentists [26] and that female dentists tended not to use surgical intervention in enamel carious lesions, in accordance with published best practice for non-cavitated caries limited to the enamel [25]. Given that MID is a conservative and preventive way of treatment, these results together suggest that dentist gender is possibly related to overall MID practice. The findings of this study also suggested that city population was associated with EPG on MID. According to a previous study performed by the US National Dental PBRN, a regional difference has also been identified regarding EPG [32]. In Japanese urban areas, there are schools of dentistry and university libraries. Since many academic conferences are held in the city, dentists who live in urban areas may have more study

opportunities than those in rural areas. The frequent use of findings from scientific journal articles in English had a significant association with high concordance, while frequent use of other information sources was not. Although our previous report [34] also indicated that frequent use of evidence from scientific journal articles in English showed a significant association with a higher concordance with the treatment for deep occlusal caries, that analysis did not examine dentists' specialty practice or preference for the use of evidence from scientific journal articles in Japanese. In the present study, the significance of use of evidence from scientific journal articles in English remained even after adjustment for these two additional factors above. Studies from the US National Dental PBRN indicated that 41% of dentists rated "printed peer-reviewed journals" as the most influential information sources, versus "Web searches" by 8% and "printed non-peer-reviewed journals" by 1% [39]. Additionally, dentists who are eager to learn additional skills and who have achieved advanced-level postgraduate certification utilize a broader set of information sources and indicate a clear preference for peer-reviewed findings [40]. Another study demonstrated that 87% of dentists in the UK described having changed their clinical practice after reading a research article [41]. Taken together, the present results indicate that the frequent utilization of evidence-based information from scientific journal articles in English may benefit Japanese dentists' EPG on MID.

The subjects of this study were from a fairly diverse array of dental practices from Japan's seven major geographical regions and had an age and gender distribution which similarly reflected the actual distribution in Japan [42]. This enhances the generalizability of the study findings. Nevertheless, a few limitations exist in this study. First, the subjects were not randomly sampled. This may have caused some sampling bias. Second, the results were derived from dentists' responses to a self-reported questionnaire, indicating that possible recall bias may have occurred. Finally, the cross-sectional design of the study prevents us from identifying any causal relationship between specific dentist characteristics and a higher concordance.

In conclusion, Japanese dentists demonstrated medium concordance with published evidence on MID despite dissemination of the concept of MID. Because the latest evidence is published in scientific journals in English, one strategy to close the EPG in Japan may be to provide more opportunities to dentists to obtain evidence from the English-language literature. In our effort to help reduce the reported EPG on MID, a next step is to share the results of this study with the participants as an educational intervention, followed by measurement of its impact. In addition, we aim to perform exploratory qualitative studies to clarify the mechanism of EPG. Further studies on closing the gap will aid the implementation of MID in daily dental clinical practice.

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REFERENCES

- [1]. Sackett DL, Rosenberg MC, Gray JA, Haynes RB, Richardson WS, Evidence based medicine: what it is and what it isn't, *Br. Med. J* 312 (1996) 71–72, 10.1136/bmj.312.7023.71. [PubMed: 8555924]
- [2]. Bryant J, Boyes A, Jones K, Sanson-Fisher R, Carey M, Fry R, Examining and addressing evidence-practice gaps in cancer care: a systematic review, *Implement. Sci* 9 (2014) 37, 10.1186/1748-5908-9-37. [PubMed: 24666544]
- [3]. Elliott JH, Turner T, Clavisi O, Thomas J, Higgins JP, Mavergames C, Gruen RL, Living systematic reviews: an emerging opportunity to narrow the evidence-practice gap, *PLoS. Med* 11 (2014) e1001603, 10.1371/journal.pmed.1001603. [PubMed: 24558353]
- [4]. McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, Kerr EA, The quality of health care delivered to adults in the United States, *N. Engl. J. Med* 348 (2003) 2635–2645, 10.1056/NEJMsa022615. [PubMed: 12826639]
- [5]. Cochrane LJ, Olson CA, Murray S, Dupuis M, Tooman T, Hayes S, Gaps between knowing and doing: understanding and assessing the barriers to optimal health care, *J. Contin. Educ. Health. Prof* 27 (2007) 94–102, 10.1002/chp.106. [PubMed: 17576625]
- [6]. Buchan H, Gaps between best evidence and practice: causes for concern, *Med. J. Aust* 180 (2004) S47–S48.
- [7]. Grol R, Successes and failures in the implementation of evidence based guidelines for clinical practice, *Med. Care* 39 (2001) II46–II54, 10.1097/00005650-200108002-00003. [PubMed: 11583121]
- [8]. Komajda M, Lapuerta P, Hermans N, Gonzalez-Juanatey JR, van Veldhuisen DJ, Erdmann E, Tavazzi L, Poole-Wilson P, Le Pen C, Adherence to guidelines is a predictor of outcome in chronic heart failure: the MAHLER survey, *Eur. Heart. J* 26 (2005) 1653–1659, 10.1093/eurheartj/ehi251. [PubMed: 15827061]
- [9]. McCullough ML, Patel AV, Kushi LH, Patel R, Willett WC, Doyle C, Thun MJ, Gapstur SM, Following cancer prevention guidelines reduces risk of cancer, cardiovascular disease, and all-cause mortality, *Cancer. Epidemiol. Biomarkers. Prev* 20(2011) 1089–1097, 10.1158/1055-9965.EPI-10-1173. [PubMed: 21467238]
- [10]. Shapiro D, Lasker R, Bindman A, Lee P, Containing costs while improving quality of care: the role of profiling and practice guidelines, *Annu. Rev. Public. Health* 14 (1993) 219–241, 10.1146/annurev.pu.14.050193.001251. [PubMed: 8323588]
- [11]. Evensen AE, Sanson-Fisher R, D'Este C, Fitzgerald M, Trends in publications regarding evidence-practice gaps: a literature review, *Implement. Sci* 5 (2010) 11, 10.1186/1748-5908-5-11. [PubMed: 20181079]
- [12]. Tyas MJ, Anusavice KJ, Frencken JE, Mount GJ, Minimal intervention dentistry—a review. FDI Commission Project 1–97, *Int. Dent. J* 50 (2000) 1–12, 10.1111/j.1875-595X.2000.tb00540.x. [PubMed: 10945174]
- [13]. Momoi Y, Hayashi M, Fujitani M, Fukushima M, Imazato S, Kubo S, Nikaido T, Shimizu A, Unemori M, Yamaki C, Clinical guidelines for treating caries in adults following a minimal intervention policy—evidence and consensus based report, *J. Dent* 40 (2012) 95–105, 10.1016/j.jdent.2011.10.011. [PubMed: 22079371]
- [14]. FDI World Dental Federation, FDI policy statement on Minimal Intervention Dentistry (MID) for managing dental caries: adopted by the general assembly: September 2016, Poznan, Poland, *Int. Dent. J* 67 (2017) 6–7, 10.1111/idj.12308. [PubMed: 28194784]
- [15]. DeNucci DJ, Dental practice-based research networks, in: Giannobile WV, Burt BA, Genco RJ (Eds.), *Clinical Research in Oral Health*, Wiley-Blackwell, Hoboken, New Jersey, 2009 pp. 265–293.
- [16]. Gilbert GH, Williams OD, Rindal DB, Pihlstrom DJ, Benjamin PL, Wallace MC, DPBRN Collaborative Group, The creation and development of the dental practice-based research network, *J. Am. Dent. Assoc* 139 (2008) 74–81, 10.14219/jada.archive.2008.0024. [PubMed: 18167389]

- [17]. Gilbert GH, Williams OD, Korelitz JJ, Fellows JL, Gordan VV, Makhija SK, Meyerowitz C, Oates TW, Rindal DB, Benjamin PL, Foy PJ; National Dental PBRN Collaborative Group. Purpose, structure, and function of the United States National Dental Practice-Based Research Network, *J. Dent* 41 (2013) 1051–1059, 10.1016/j.jdent.2013.04.002. [PubMed: 23597500]
- [18]. Kakudate N, Yokoyama Y, Sumida F, Matsumoto Y, Riley JL 3rd, Gordan VV, Gilbert GH. Practice-based research agenda priorities selected by patients: findings from a dental practice-based research network, *Int. Dent. J* 69 (2019) 183–191, 10.1111/idj.12447. [PubMed: 30350855]
- [19]. Gordan VV, Garvan CW, Heft MW, Fellows JL, Qvist V, Rindal DB, Gilbert GH, DPBRN Collaborative Group, Restorative treatment thresholds for interproximal primary caries based on radiographic images: findings from the Dental Practice-Based Research Network, *Gen. Dent* 57 (2009) 654–663, 10.1111/idj.12447. [PubMed: 19906618]
- [20]. Gordan VV, Bader JD, Garvan CW, Richman JS, Qvist V, Fellows JL, Rindal DB, Gilbert GH, Dental Practice-Based Research Network Collaborative Group, Restorative treatment thresholds for occlusal primary caries among dentists in the dental practice-based research network, *J. Am. Dent. Assoc* 141 (2010) 171–184, 10.14219/jada.archive.2010.0136. [PubMed: 20123876]
- [21]. Riley JL, Richman JS, Rindal DB, Fellows JL, Qvist V, Gilbert GH, Gordan VV, Dental PBRN Collaborative Group, Use of caries-preventive agents in children: findings from the dental practice-based research network, *Oral. Health. Prev. Dent* 8 (2010) 351–359, 10.3290/j.ohpd.a19970. [PubMed: 21180672]
- [22]. Riley JL 3rd, Qvist V, Fellows JL, Rindal DB, Richman JS, Gilbert GH, Gordan VV, DPBRN Collaborative Group, Dentists' use of caries risk assessment in children: findings from the Dental Practice-Based Research Network, *Gen. Dent* 58 (2010) 230–234. [PubMed: 20478803]
- [23]. Riley JL 3rd, Gordan VV, Ajmo CT, Bockman H, Jackson MB, Gilbert GH, Dental PBRN Collaborative Group, Dentists' use of caries risk assessment and individualized caries prevention for their adult patients: findings from The Dental Practice-Based Research Network, *Community. Dent. Oral. Epidemiol* 39 (2011) 564–573. 10.1111/j.1600-0528.2011.00626.x.
- [24]. Velly AM, Schiffman EL, Rindal DB, Cunha-Cruz J, Gilbert GH, Lehmann M, Horowitz A, Friction J, The feasibility of a clinical trial of pain related to temporomandibular muscle and joint disorders: the results of a survey from the collaboration on networked dental and oral research dental practice-based research networks, *J. Am. Dent. Assoc* 144 (2013) e1–10, 10.14219/jada.archive.2013.0022. [PubMed: 23283934]
- [25]. Kakudate N, Sumida F, Matsumoto Y, Manabe K, Yokoyama Y, Gilbert GH, Gordan VV, Restorative treatment thresholds for proximal caries in Dental PBRN, *J.Dent. Res* 91 (2012) 1202–1208. 10.1177/0022034512464778. [PubMed: 23053847]
- [26]. Yokoyama Y, Kakudate N, Sumida F, Matsumoto Y, Gilbert GH, Gordan VV, Dentists' dietary perception and practice patterns in a dental practice-based research Network, *PLoS One* 8 (2013) e59615 10.1371/journal.pone.0059615. [PubMed: 23536883]
- [27]. Yokoyama Y, Kakudate N, Sumida F, Matsumoto Y, Gilbert GH, Gordan VV, Dentists' practice patterns regarding caries prevention: results from a dental practice-based research network, *BMJ Open* 3 (2013) e003227 10.1136/bmjopen-2013-003227.
- [28]. Kakudate N, Sumida F, Matsumoto Y, Yokoyama Y, Gilbert GH, Gordan VV, Patient age and dentists' decisions about occlusal caries treatment thresholds, *Oper. Dent* 39 (2014) 473–480, 10.2341/13-141-C. [PubMed: 24809540]
- [29]. Kakudate N, Sumida F, Matsumoto Y, Yokoyama Y, Riley JL 3rd, Gilbert GH, Gordan VV, Dentists' decisions to conduct caries risk assessment in a Dental Practice-Based Research Network, *Community. Dent. Oral. Epidemiol* 43 (2015) 128–134, 10.1111/cdoe.12127. [PubMed: 25175077]
- [30]. Yokoyama Y, Kakudate N, Sumida F, Matsumoto Y, Gilbert GH, Gordan VV, Evidence-practice gap for in-office fluoride application in a dental practice-based research network, *J. Public. Health. Dent* 76 (2016) 91–97, 10.1111/jphd.12114. [PubMed: 26235360]
- [31]. Kakudate N, Yokoyama Y, Sumida F, Matsumoto Y, Gordan VV, Gilbert GH, Velly AM, Schiffman EL, Dentist practice patterns and therapeutic confidence in the treatment of pain related to temporomandibular disorders in a Dental Practice-Based Research Network, *J. Oral. Facial. Pain. Headache* 31 (2017) 152–158, 10.11607/ofph.1730. [PubMed: 28437512]

- [32]. Norton WE, Funkhouser E, Makhija SK, Gordan VV, Bader JD, Rindal DB, Pihlstrom DJ, Hilton TJ, Frantsve-Hawley J, Gilbert GH, Concordance between clinical practice and published evidence: findings from The National Dental Practice-Based Research Network, *J. Am. Dent. Assoc* 145 (2014) 22–31, 10.14219/jada.2013.21. [PubMed: 24379327]
- [33]. Chiang HK, Best AM, Sarrett DC, Concordance between clinical practice and published evidence: findings from Virginia Commonwealth University School of Dentistry, *J. Evid. Based. Dent. Pract* 17 (2017) 169–176, 10.1016/j.jebdp.2017.03.004. [PubMed: 28865813]
- [34]. Kakudate N, Yokoyama Y, Sumida F, Matsumoto Y, Gordan VV, Gilbert GH, Dentists' practice patterns of treatment for deep occlusal caries: Findings from a dental practice-based research network, *J. Dent* 84 (2019) 76–80, 10.1016/j.jdent.2019.03.009. [PubMed: 30935965]
- [35]. Japanese Ministry of Health, Labour and Welfare, Outline of 2016 Revision of Medical Fee <https://www.mhlw.go.jp/file/06-Seisakujouhou-12400000-Hokenkyoku/0000115718.pdf>. (accessed 11 July, 2020).
- [36]. Japanese Ministry of Health, Labour and Welfare, Health and Medical Services <https://www.mhlw.go.jp/english/wp/wp-hw11/dl/02e.pdf>. (accessed 11 July, 2020).
- [37]. Japanese Ministry of Health, Labour and Welfare, Overview of Medical Service Regime in Japan https://www.mhlw.go.jp/bunya/iryouhoken/iryouhoken01/dl/01_eng.pdf. (accessed 11 July, 2020).
- [38]. Japan Dental Association, Dental Health Care <https://www.jda.or.jp/en/introduction.html#label4>. (accessed 11 July, 2020)
- [39]. Funkhouser E, Agee BS, Gordan VV, Rindal DB, Fellows JL, Qvist V, McClelland J, Gilbert GH, DPBRN Collaborative Group, Use of online sources of information by dental practitioners: findings from The Dental Practice-Based Research Network, *J. Public. Health. Dent* 74 (2014) 71–79, 10.1111/j.1752-7325.2012.00373.x. [PubMed: 22994848]
- [40]. Melkers J, Hicks D, Isett KR, Kopycka-Kedzierawski DT, Gilbert GH, Rosenblum S, Burton V, Mungia R, Melkers MJ, Ford G, National Dental PBRN Collaborative Group, Preferences for peer-reviewed versus other publication sources: a survey of general dentists in the National Dental PBRN, *Implement. Sci* 14 (2019) 19, 10.1186/s13012-019-0854-x. [PubMed: 30823931]
- [41]. Iqbal A, Glenney AM, General dental practitioners' knowledge of and attitudes towards evidence-based practice, *Br. Dent. J* 193 (2002) 587–591. 10.1038/sj.bdj.4801634. [PubMed: 12481184]
- [42]. Ministry of Health Labour and Welfare. Survey of Physicians, Dentists and Pharmacists: Trends in the Number of Dentists 2018 <https://www.mhlw.go.jp/toukei/saikin/hw/ishi/18/dl/kekka-2.pdf>. 2020 (accessed 11 July, 2020).

Clinical Significance:

Despite the establishment and dissemination of the concept of MID, the EPG on MID exists in Japanese dental clinical practices. A high concordance was significantly associated with the following dentist characteristics: “female dentist”, “dental clinic location in a government-ordinance-designated city”, and “frequently obtaining evidence from the English-language scientific journal articles”

Categorization of Concordance between Clinical Practice and Published Evidence (modified by Norton et al. [32])

Table 1.

Clinical Area	Clinical Question or Scenario	Response option(s) classified as inconsistent with evidence	Response option(s) classified as consistent with evidence
Primary caries diagnosis and treatment	1. Use of air drying to diagnose primary caries lesion	<80%	80% or every time
	2. Assessment of caries risk for individual patients in any way	No	Yes
	3. Treatment of unrestored occlusal surface of a mandibular left first molar that has brown discoloration in some of the fissures in the occlusal surface and no cavitation (occlusal 1)	Composite restoration or indirect restoration or amalgam restoration;	Any non-invasive restoration procedure
	4. Treatment of unrestored occlusal surface of a mandibular left first molar that has brown discoloration in most of the fissures in the occlusal surface and no cavitation (occlusal 2)	Composite restoration or indirect restoration or amalgam restoration;	Any non-invasive restoration procedure
	5. Use of magnification to diagnose caries lesions	<80%	80% or every time
Deep caries diagnosis and treatment	6. Treatment options for patient with deep occlusal caries in the mandibular right first molar and possible mild pulpitis (deep caries 1)	Stop removing all caries and perform an indirect pulp cap: <25% of the time	Stop removing all caries and perform an indirect pulp cap: 25% of the time
	7. Treatment options for excavation of caries deeper than anticipated for a patient with deep occlusal caries in the mandibular right first molar and perhaps involving the mesio-buccal pulp horn (deep caries 2)	Continue and remove all the decay; Temporize and treat or refer the tooth for endodontics	Stop removing decay near the pulp horn and remove it elsewhere
Restoration diagnosis and treatment	8. Defective composite restoration with enamel margins	Response included (but not limited to) replace entire restoration	Response included (but not limited to) polish, re-surface, or repair restoration but not replace
	9. Defective composite restoration with cementum-dentinal margins	Response included (but not limited to) replace entire restoration	Response included (but not limited to) polish, re-surface, or repair restoration but not replace
	10. Lesion depth for permanent restoration instead of only preventive or non-surgical therapy (proximal caries)	Radiograph #1 or 2 (lesion in enamel only)	Radiographs #3, 4, or 5 (lesion into dentin)

Table 2.

Demographic characteristics of participants and overall concordance by characteristic

	Ditribution of participants	Concordance (%)
	Mean±SD or Number (%)	Mean±SD
< Dentists' individual characteristics >		
Years since graduation from dental school (N=205)	20±12	
Gender (N=206)		
<i>Male</i>	162 (79)	59±18
<i>Female</i>	44 (21)	65±17
Specialty practice (N=206)		
<i>Operative dentistry</i>	52 (25)	59±18
<i>Not operative dentistry</i>	154 (75)	61±18
<Practice characteristics>		
City population (N=206)		
<i>Government-ordinance-designated city</i>	94 (46)	62±17
<i>Non-government-ordinance-designated city</i>	112 (54)	59±19
Type of practice (N=206)		
<i>Employed by another dentist</i>	72 (35)	61±19
<i>Self-employed without partners and without sharing of income, costs, or office space</i>	134 (65)	60±18
Practice busyness (N=206)		
<i>Busy</i>	103 (50)	59±18
<i>Not busy</i>	103 (50)	62±18
<Preference for obtaining evidence>		
Internet (N=206)		
<i>Higher frequency (Frequently/Occasionally)</i>	188 (91)	60±19
<i>Lower frequency (Never/Rarely)</i>	18 (9)	61±18
Non-academic Journal (N=206)		
<i>Higher frequency (Frequently/Occasionally)</i>	135 (66)	61±18
<i>Lower frequency (Never/Rarely)</i>	71 (34)	60±18
Textbook (N=206)		
<i>Higher frequency (Frequently/ Occasionally)</i>	195 (95)	60±18
<i>Lower frequency (Never/ Rarely)</i>	11 (5)	60±17
Scientific journal articles in Japanese (N=206)		
<i>Higher frequency (Frequently/ Occasionally)</i>	126 (61)	61±18
<i>Lower frequency (Never/ Rarely)</i>	80 (39)	59±19
Scientific journal articles in English (N=206)		
<i>Higher frequency (Frequently/ Occasionally)</i>	65 (32)	65±17
<i>Lower frequency (Never/ Rarely)</i>	141 (68)	58±19
Clinical Practice Guideline (N=206)		
<i>Higher frequency (Frequently/ Occasionally)</i>	120 (58)	62±17
<i>Lower frequency (Never/ Rarely)</i>	86 (42)	58±20

Table 3.

Concordance with published evidence

Clinical Area	Clinical Question or Scenario	N (%)	Mean±SD
Overall			60±18
1) Primary caries Diagnosis and Treatment	1. Use of air drying (>80% of the time)	159/206 (77)	
	2. Assessment of caries risk for individual patients in any way	106/206 (51)	
	3. Treatment of unrestored occlusal surface (occlusal 1)	200/206 (97)	
	4. Treatment of unrestored occlusal surface (occlusal 2)	168/206 (82)	
	5. Use of magnification (>80% of the time)	67/206 (33)	68±21
2) Deep Caries Treatment and Diagnosis	6. Treatment options for patient with deep occlusal caries (deep caries 1)	107/206 (52)	
	7. Treatment options for excavation of deep caries (deep caries 2)	112/206 (54)	53±42
3) Restoration Diagnosis and Treatment	8. Defective composite restoration with enamel margins	119/200 (60)	
	9. Defective composite restoration with cementum-dentinal margins	96/200 (48)	
	10. Lesion depth for permanent restoration (proximal caries)	109/206 (53)	54±33

Table 4.

Logistic regression of factors affecting dentists' concordance with published evidence (n=197)

Variable	OR	95% CI		p value
		Lower	Upper	
<Dentists' individual characteristics>				
Years since graduation from dental school *	0.98	0.95	1.01	0.159
Gender (reference: male)	2.33	1.01	5.39	0.048
Specialty practice (reference: not operative dentistry)	0.71	0.35	1.46	0.356
<Practice characteristics>				
City Population (reference: non-government-ordinance-designated city)	2.01	1.02	3.96	0.043
Type of practice				
Employed by another dentist	1			
Self-employed without partners and without sharing of income, costs, or office space	1.61	0.68	3.79	0.277
Practice busyness (reference: not busy)	0.76	0.40	1.44	0.398
<Preference for obtaining evidence>				
Internet (reference: Lower frequency)	0.81	0.41	1.62	0.554
Non-academic journal (reference: Lower frequency)	1.29	0.65	2.58	0.470
Textbook (reference: Lower frequency)	1.97	0.47	8.26	0.354
Scientific journal articles in Japanese (reference: Lower frequency)	0.76	0.37	1.58	0.459
Scientific journal articles in English (reference: Lower frequency)	2.45	1.08	5.59	0.033
Clinical practice guideline (reference: Lower frequency)	1.41	0.73	2.75	0.307

CI, confidence interval

Overall predictive accuracy is 72.6%

* Continuous variable

Dependent variable: Percentages of concordance were dichotomized using the median (60%) as a cut off value.