Management decisions of questionable occlusal carious lesions by California and French dentists – a comparison of scientific evidence and clinical practice

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Abstract:
Introduction: Many questionnaire surveys evaluating caries management strategies in dental practices have been undertaken around the world; nevertheless, less is known about the care delivery specifically related to questionable occlusal carious lesions (QOCLs).

Aim: The aim of the study was to investigate management strategies for two clinical cases toward QOCLs by California (CA) and French dental general practitioners (GDPs).

Materials and methods: A questionnaire was sent by e-mail to 16,960 CA licensed dentists and by postal mail to 2,000 randomly selected French GDPs. Descriptive analyses were performed to characterise the responses to the different questions related to the management strategies for the two clinical cases.

Results: The results showed an absence of understanding about carious lesion management for both CA and French GDPs. There was a substantial variability between and within the two GDP populations with a marked tendency among the respondents of both countries to intervene surgically for the management of QOCLs that may benefit from non-invasive therapies.

Conclusion: As it takes time for paradigm shifts in dentistry, it can be hypothesised that the marked tendency among the respondents of both countries to intervene surgically for the QOCL management still persists.

Key words: Questionable occlusal carious lesions, decision-making, minimum intervention, evidence-based

Doi: https://doi.org/10.36161/FJDM.0004

INTRODUCTION

Minimal or minimum intervention (MI) in cariology includes preventive regimens and non-invasive therapies.1 In 1992, MI was first cited in the literature.2 More than a decade ago, Sheiham stated that ‘dentists need to know the likely benefits of their treatment and side-effects and alternative options’.3 He also indicated an interventionist orientation to dental diseases leads to a spiral of damage and more importantly ‘limiting intervention to the absolute minimum and giving prevention the opportunity to work should be the basis for quality dental care’.4

Several articles have promoted the concept of MI.1,4 However, dental practitioners still practice invasive restorative dentistry for carious lesion management.9,10 A guide for caries prevention and management, the CariesCare International (CCI™), was recently developed for dental practitioners to help them deliver optimal caries care and outcomes for their patients.14 CCI™ promotes patient-centred caries management based on individual risk and designed for dental practice. CCI™ presents a simplified and updated version of the International Caries Classification and Management System (ICCMS™) and is linked to the International Caries Detection and Assessment System (ICDAS).15,16 CCI™ guides the dental team through a four-step process leading to personalised interventions (4D system: 1st D: Determine caries risk; 2nd D: Detect lesions, stage their severity and assess their activity status; 3rd D: Decide on the most appropriate care plan for the specific patient at that time; and then, finally, 4th D: Do the preventive and tooth-preserving care which is needed). It takes time for paradigm shifts in dentistry.17 To date, the ICDAS, ICCMS™ and CCI™ concepts have not yet been fully implemented into everyday clinical practice.
Practitioners generally characterise occlusal carious lesions as: presence of a lesion (cavitated versus non-cavitated), absence of a lesion, or an uncertainty about the presence of a lesion (a questionable lesion). Although restorations are required for cavitated lesions, non-cavitated occlusal carious lesions may benefit from non-invasive therapies and invasive restorations should be omitted when a questionable occlusal carious lesion (QOCL) exists.14, 18-20 QOCLs are defined by the following criteria: non-cavitated (no break in enamel continuity); no radiographic evidence of caries, but possible presence of a carious lesion due to roughness, surface opacities; or staining of the occlusal surface.20-21 Makhija et al. reported from a practice-based survey of American and Scandinavian practitioners that 34% of all patients seen by the practitioners had QOCLs.21 These QOCLs were found on 11% of the unrestored occlusal surfaces of those patients. This prevalence clearly demonstrates the importance to consider QOCL related management strategies.

Many questionnaire surveys evaluating caries management strategies in dental practices have been undertaken around the world. The most recent surveys concluded that there continues to be a wide variability of decisions made by practitioners within a country, but also disparate management strategies between different countries.10-13 All surveys reported that practitioners surgically intervene at carious lesion levels that might have benefited from non-invasive management strategies. However, less is known about the care delivery specifically related to QOCLs. Only one survey about the management of QOCLs is available and was carried out among a practice-based network in the USA and Scandinavia.22 The authors showed that QOCL management strategies varied remarkably by regions with 1% of the dentists in Denmark and 53% of the members of the Permanente Dental Associates in the US suggested invasive solutions for the management of QOCLs.

Questionnaire surveys have been undertaken in California and in France to describe restorative threshold and treatment decisions; nevertheless, the management of QOCLs has not been specifically approached.23,24 Consequently, the aim of the present study is to investigate and compare California (CA) and French dental general practitioners (GDPs) diagnostic decisions and the management strategies for QOCLs of permanent molars in adults.

Figure 1: Clinical case 1 – a) occlusal view, b) radiograph.

MATERIALS AND METHODS

The survey protocols have been described in previous papers regarding restorative thresholds and management for carious lesions in CA and France.23,24 The survey was conducted using a questionnaire originally designed by Espelid et al.25 Diagrams, clinical views, and radiographs of different stages of carious lesions were shown to ascertain dentists’ management strategies.

This present paper focused on the comparisons between CA and France regarding carious lesion management strategies for occlusal surfaces on permanent molars in adults. Therefore, the participants were shown two clinical cases (CCs) that may represent a carious lesion (Figures 1 and 2) and they were asked for their diagnosis and management strategy for the following scenario: the patient is 20 years of age, sees a dentist once a year, has adequate oral hygiene and uses fluoride toothpaste daily.

For the two described CCs, traditional restorative strategies are not a matter of dental emergency.14,15,16 Indeed, the ‘drilling and filling’ of non-cavitated teeth starts the ‘repeat restoration cycle’ process that ends with each restoration being less prophylactic and more iatrogenic than the previous one.26-27 The restorative threshold is only reached when caries extends to the middle third of the dentine and/or a definitive cavitation of the enamel occurs.28 Both of these situations were not existent in the CCs presented to the respondents.

CA approval for the study was obtained from the Committee on Human Research at the University of California, San Francisco (IRB approval number: 12-10135). The questionnaire was electronically administrated (spring 2013) to 16,960 CA licensed dentists. French approval was obtained by the Comité National Informatique et Liberté (CNIL) board (# 0104) and the Direction de la Recherche Clinique et de l’Innovation (DRCI) of Clermont-Ferrand university hospital. The questionnaire was administrated (fall 2012) by postal mailing to 2,000 dentists, which were randomly selected from a national database (n = 40,800).

The statistical analyses were performed using SPSS 19 (Statistical Package for Social Sciences, Armonk, NY). The level of significance was set at 5%. Descriptive analyses were performed to characterize the responses to the different questions related to the management strategies for the two CCs. A Chi-square test
assessed possible differences between CA and France in terms of diagnosis and management strategies. For both CCs, the treatment decisions were analysed for each suggested diagnostic decision: ‘sound surface’ versus ‘presence of an enamel lesion’ versus ‘presence of a dentine lesion’ versus ‘I am uncertain.’

For management strategies the choices were: ‘non-invasive (fluoride and sealants)’ versus ‘minimally invasive (prepare and restore carious part only or prepare and restore carious part and seal)’ versus ‘invasive (prepare and restore whole fissure).’

The significance level was set at p=0.05.

RESULTS

Study populations (respondents)

A total of 1,922 CA dentists (11.3%) replied to the web-based survey after one e-mail reminder was sent two weeks later.80 Eighty responses were excluded for partially answered questions related to their demographic characteristics. This present study reports the diagnostics and management decisions of 1,600 responding CA GDPs (after answers of 242 specialists were excluded to allow a comparison between the two countries). Among these GDPs, 51.6% had participated in continuing education (CE) about cariology/operative dentistry during the last five years.

In France, a total of 838 dentists (41.9%) responded after receiving one written reminder by postal mail.81 Sixty-eight respondents were excluded (aged 65 years or older, had ceased practice, had moved, or had become specialists). The diagnostics and management decisions of 770 responding French GDPs were recorded. During the last five years, 36.4% of these GDPs had participated in CE courses about cariology/operative dentistry.

Diagnosis

Table 1 shows the diagnostic decisions for the two CC scenarios made by the CA and French GDPs. The diagnosis varied markedly within and between CA and French GDPs for both CCs (p<0.001).

For CC 1, the majority of the GDPs diagnosed the presence of a dentine lesion (93.4% in CA and 76.8% in France). Approximately 3% of the CA dentists and 10% of the French GDPs marked that they were ‘uncertain’ about a diagnosis, that is whether the picture showed a sound surface, an enamel, or a dentine lesion.

For CC 2, the most selected option was the presence of an enamel lesion (51.1% in CA and 41.3% in France). The number of GDPs who were uncertain about a lesion existence was even higher for this case with approximately 15% for both CA and French GDPs.

Management options

Table 2 presents the cross-tabulations assessing the differences between GDPs in CA and France in terms of treatment strategies. For CC 1, the vast majority of respondents diagnosed the lesion as a dentine lesion. GDPs in both countries chose mainly invasive treatments (CA 98.9% and France 97%). For CC 2, the majority of respondents judged the lesion as more likely representing an enamel lesion. French GDPs would be less invasive than the CA GDPs. Amongst French GDPs 46.3% chose fluoride application or sealant placement while only 25.7% of the CA dentists would recommend these non-invasive treatments (p<0.001), 6.9% of the CA and 11.4% of the French GDPs decided for ‘no treatment’.

For CC 1, a sizeable majority of the respondents who were uncertain about the presence or absence of a carious lesion would remove tooth structure and place a restoration (77% of the CA and of 82% of the French GDPs). In case of a questionable lesion, 11.4% of the CA GDPs would prefer not to undertake any treatment and 15.3% of the French GDPs would place a sealant.

Similar decisions toward surgical management in case of doubting the existence of a carious lesion were reported for CC 2 (Table 2). When uncertain about the existence of a carious lesion, 51.1% of the CA and 45.4% of the French GDPs chose the ‘drill-and-fill’ approach. Nevertheless, around one third of the GDPs decided for a sealant and 16.7% of the French and 12% of the CA dentist, respectively opted for ‘No treatment’.
DISCUSSION

This study investigates and compares the diagnosis decisions and the management strategies for QOCLs on permanent molars in adults between CA and French GDPs. The two CCs presented have previously been used for other publications related to decision-making in CA, France, Croatia, and Sweden. At that time all the analyses considered the management decisions at the clinical case level (management options ‘non-invasive’ versus ‘minimally invasive’ versus ‘invasive’ for all diagnostic decisions ‘sound surface’, ‘presence of an enamel lesion’, ‘presence of a dentine lesion’ and ‘I am uncertain’ merged together). In the present analysis, it had been decided to step deeper into the description of the management options (‘non-invasive’ versus ‘minimally invasive’ versus ‘invasive’) and to consider each potential diagnostic decision (‘sound surface’ versus ‘presence of an enamel lesion’ versus ‘presence of a dentine lesion’ versus ‘I am uncertain’) separately. Subsequently, these specific differentiations provided a better understanding of the decision-making, and consequently clearly revealed the inadequacies between scientific evidence and clinical practice related to caries management in CA and in France. Responses to questionnaire scenarios by individual GDPs have been shown to represent actual treatment in their clinical practice. Therefore, there appears to be, at the time of the study, a general deficiency of understanding and knowledge about caries disease and carious lesion management for both CA and French respondents. Indeed, there was a great variability, in 2012-2013, between and within the two GDPs populations with a marked tendency among the respondents of both countries to intervene surgically for the QOCL management (Table 2). It can be hypothesised that this tendency still persists as it takes time for paradigm shifts in dentistry.

In 1998, Choi et al. recognised a need for increased accuracy and reduced variability of treatment decisions to improve health care. This problem still persists despite efforts to develop evidence-based education in dental schools that emphasises the MI concept in the US and in Europe at the time of the study. Consequently, it is not surprising that only 36.4% of the French and 52.2% of the CA respondents reported to have undergone CE in the field of cariology in the past five years. The reasons for a lack of knowledge or interest to undergo CE is difficult and rarely complete. Innes et al. in 2016 suggested that a lack of knowledge could be due to a ‘problematic wilful ignorance, where the subject chooses not to learn more about a topic’. The interest of GDPs toward CE in the area of prevention may be influenced by the lack of recognition and reimbursement of actual caries management concepts by insurance companies in the US and the national health coverage system in France.

As mentioned in the materials and methods section, traditional restorative strategies were not a matter of dental emergency in the two CCs presented here. In this context, CA and French patients may have received unnecessary or inappropriately invasive restorative treatment. Therapeutic sealants were considered an option by a relatively high number of GDPs when they questioned the presence/absence of a carious lesion, particularly for CC 2 (29.6% in CA and 35.2% in France). This option is more conservative than removing tooth structure and placing a restoration, especially for the patient that was assessed as low caries risk (20 years old; use of fluoride toothpaste on a daily basis; satisfactory

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Table 1: Do you think that, from its clinical and radiographic appearance, the teeth have an occlusal (enamel or dentine) carious lesion? (Clinical cases 1 and 2)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Definitions</th>
<th>California</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical case 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California (n= 1,576)*</td>
<td>Sound surface</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>(p&lt;0.001)</td>
<td>Enamel lesion</td>
<td>54</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Dentine lesion</td>
<td>1,472</td>
<td>578</td>
</tr>
<tr>
<td></td>
<td>Uncertain</td>
<td>45</td>
<td>73</td>
</tr>
<tr>
<td><strong>Clinical case 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California (n= 1,566)*</td>
<td>Sound surface</td>
<td>293</td>
<td>249</td>
</tr>
<tr>
<td>(p&lt;0.001)</td>
<td>Enamel lesion</td>
<td>801</td>
<td>310</td>
</tr>
<tr>
<td></td>
<td>Dentine lesion</td>
<td>240</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>Uncertain</td>
<td>232</td>
<td>114</td>
</tr>
</tbody>
</table>

*Not all participants responded to all questions.
Table 2: How would you treat this occlusal surface (clinical cases 1 and 2)?

The patient is 20 years of age. You have not seen the patient before, and 2 years have elapsed since his/her last dental examination. The patient uses fluoride toothpaste on a daily basis and dietary and oral hygiene habits are considered satisfactory.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Management strategies</th>
<th>Clinical case 1</th>
<th>Clinical case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enamel lesion</td>
<td></td>
<td>California</td>
<td>France</td>
</tr>
<tr>
<td></td>
<td>No treatment</td>
<td>n= 54*</td>
<td>n= 84*</td>
</tr>
<tr>
<td></td>
<td>Fluoride</td>
<td>1 (1.9%)</td>
<td>6 (7.1%)</td>
</tr>
<tr>
<td></td>
<td>Sealant</td>
<td>8 (14.8%)</td>
<td>15 (17.9%)</td>
</tr>
<tr>
<td></td>
<td>Prepare carious part and restore</td>
<td>16 (29.6%)</td>
<td>34 (40.5%)</td>
</tr>
<tr>
<td></td>
<td>Prepare carious part, restore, and seal whole fissure</td>
<td>21 (38.9%)</td>
<td>21 (25.0%)</td>
</tr>
<tr>
<td></td>
<td>Prepare whole fissure and restore</td>
<td>7 (13.0%)</td>
<td>4 (4.8%)</td>
</tr>
<tr>
<td>Dentine lesion</td>
<td></td>
<td>n= 1,467*</td>
<td>n= 575*</td>
</tr>
<tr>
<td></td>
<td>No treatment</td>
<td>5 (0.3%)</td>
<td>2 (0.3%)</td>
</tr>
<tr>
<td></td>
<td>Fluoride</td>
<td>3 (0.2%)</td>
<td>3 (0.5%)</td>
</tr>
<tr>
<td></td>
<td>Sealant</td>
<td>9 (0.6%)</td>
<td>12 (2.1%)</td>
</tr>
<tr>
<td></td>
<td>Prepare carious part and restore</td>
<td>292 (19.9%)</td>
<td>236 (41.0%)</td>
</tr>
<tr>
<td></td>
<td>Prepare carious part, restore, and seal whole fissure</td>
<td>777 (53.0%)</td>
<td>236 (41.0%)</td>
</tr>
<tr>
<td></td>
<td>Prepare whole fissure and restore</td>
<td>381 (26.0%)</td>
<td>86 (15.0%)</td>
</tr>
<tr>
<td>Uncertain</td>
<td></td>
<td>n= 44*</td>
<td>n= 72*</td>
</tr>
<tr>
<td></td>
<td>No treatment</td>
<td>5 (11.4%)</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td></td>
<td>Fluoride</td>
<td>2 (4.5%)</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td></td>
<td>Sealant</td>
<td>3 (6.8%)</td>
<td>11 (15.3%)</td>
</tr>
<tr>
<td></td>
<td>Prepare carious part and restore</td>
<td>7 (15.9%)</td>
<td>29 (40.3%)</td>
</tr>
<tr>
<td></td>
<td>Prepare carious part, restore, and seal whole fissure</td>
<td>22 (50.0%)</td>
<td>26 (36.1%)</td>
</tr>
<tr>
<td></td>
<td>Prepare whole fissure and restore</td>
<td>5 (11.4%)</td>
<td>9 (5.6%)</td>
</tr>
</tbody>
</table>

*Not all the respondents associated a management option to their diagnosis.

dietary and oral hygiene habits). Therapeutic sealants are indicated for non-cavitated carious lesions that involve the enamel only or the enamel and outer third of the dentine and have been shown to be stabilised or even reversed by non-invasive protective strategies.37-39 Placing unnecessary sealants exposes the patient to failure/partial lost and consequently to caries initiation and progression and, in case of QOCL in a low caries risk patient, long-term monitoring seems to be the more evidence-based option.14,20,40

Makhija et al. suggested that clinicians should consider long-term monitoring of a QOCL.41 They showed that 90% of the QOCLs that were followed after a 20 months re-evaluation had not progressed. Lesions monitoring and non-invasive strategies with additional preventive measures can delay or eliminate restorative intervention.14,20,37,38,42-46

Monitoring QOCLs as opposed to invasive interventions may be considered a more prudent ethical decision.

For more than a decade, dental professionals have discussed the inadequacies between scientific evidence and clinical practice in cariology and the need for a paradigm shift in clinical management.47,52 Presently, effective measures for change have not generally occurred. Over 15 years ago, McGlone et al. reported that funding arrangements appear to be a major factor influencing treatment decisions in dentistry. Impediments for change in professional dental practices persist and the appropriate solutions have not been supported.53

In France, if non-invasive approaches (e.g. therapeutic sealants, fluoride varnish applications, oral hygiene education) are part of several best practice recommendations for non-cavitated lesions, none was subject to reimbursement by the National Health services. As a result, GDPs are discouraged to provide minimally invasive protocols to their patients in contrast to invasive restorative procedures that were better reimbursed.54 The situation in CA is similar, nevertheless, private insurers reimburse for therapeutic sealants and fluoride varnish applications typically for patients up to the age of 14 years. Brocklehurst et al. reported that despite insufficient information regarding the cost-effectiveness of the different payment methods, financial incentives within remuneration systems may encourage changes to clinical activities performed by primary care dentists.55

Finally, patient demand should be addressed when debating professional changes.53 Most patients remain unaware of the alternatives to traditional restorative dentistry. New media could influence patient demand for preventive and non-iatrogenic strategies. This may lead to professional transformation to non-invasive and preventive management, which emphasises the patients’ empowerment on their dental health.
CONCLUSION
As it takes time for paradigm shifts in dentistry, it can be hypothesised that the marked tendency among the respondents of both countries to intervene surgically for the QOCL management still persists. Further investigations are needed to follow paradigm shifts and describe how MI, a concept almost 30 years old, is implemented into everyday clinical practice.

DECLARATIONS

Ethics approval and consent to participate
California approval was obtained from the Committee on Human Research at the University of California, San Francisco (IRB approval number: 12-10135).
French approval was obtained by the Comité National Informatique et Liberté (CNIL) board (# 0104) and the Direction de la Recherche Clinique et de l’Innovation (DRCI) of Clermont-Ferrand university hospital.

Consent for publication
Not applicable

Declaration of interests
The authors declare that they have no competing interests.

Funding
The study was funded by the authors and their institutions.

Acknowledgements
The authors thank Profs. Espelid and Tveit for allowing the use of their original questionnaire and pictures for the California and French surveys.

References


