Early identification of malignancy in trismus: ten-year evolution of a trismus checklist to improve patient safety

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Abstract

Introduction Trismus has been identified as a red flag sign that may lead to an early identification of a malignant lesion. A simple checklist was devised to allow clinicians to identify patients who may be at risk.

Methods The implementation of this checklist at the temporomandibular disorder clinic of the University Dental Hospital of Manchester has been audited through ten annual cycles, each examining a sample of 50 clinical records of patients referred to the clinic. The standards set were that the presence of the trismus checklist in new patient examination notes should be 100%, the recording of mouth opening should be 100% and that the trismus checklist should be correctly filled in 100% of the time.

Results The incidence of trismus ranged from 0–20%. The presence of the trismus checklist in new patient examination notes ranged from 78–100% compliance. The recording of mouth opening ranged from 80–100% compliance. The trismus checklist was not always filled in correctly: it ranged from 50–100%.

Conclusion The use of audit has led to the evolution of the checklist and to improvements in its implementation. The trismus checklist has aided the early identification of malignancy. Future work should look at its implementation in a wider range of settings.

Key points

Trismus can be a red flag sign that may lead to an early identification of malignancy. A simple checklist can help to identify patients who are at risk. Regular audit of the implementation of the trismus checklist is an important tool and aids the development of best practice.

Introduction

Trismus is defined as the restriction in the normal range of opening of the mandible.1 Trismus can impair a patient’s quality of life by causing pain, difficulties in mastication and subsequent nutrition, maintenance of good oral hygiene, receiving dental treatment and speech.2

There are a multitude of potential aetiologies for trismus, ranging from the intra-articular (such as disc displacement without reduction) to extra-articular (such as infection or trauma). A small number of cases will be as a result of malignant space occupying lesions. It is therefore critical that clinicians are vigilant when managing patients with trismus. The trismus checklist is designed to facilitate an appropriate level of patient care and/or referral onwards.

The trismus checklist

The original trismus checklist (Table 1) was developed in the dedicated temporomandibular disorder (TMD) clinic at the University Dental Hospital of Manchester (UDHM) to screen for potential malignancies that may present as a TMD. The checklist was first introduced in July 2010, following two cases of delayed diagnosis of carcinoma.

Table 1 Original trismus checklist. Reproduced from H. P. Beddis et al., ‘Temporomandibular disorders, trismus and malignancy: development of a checklist to improve patient safety’, British Dental Journal, 2014, Springer Nature

| Checklist                        | Yes | No |
|----------------------------------|-----|----|
| Opening less than 15 mm          |     |    |
| Progressively worsening trismus  |     |    |
| Absence of history of clicking   |     |    |
| Pain of non-myofascial origin (neuralgia etc) |     |    |
| Swollen lymph glands             |     |    |
| Suspicious intraoral soft tissue lesion |     |    |
initially treated as TMDs (though one of the patients did also have a TMD concurrent with their malignancy). Following its inception, a third patient who presented with TMD-like symptoms was quickly diagnosed and treated for an underlying neoplasm. We have previously described these malignancies, the initial development of the trismus checklist and its use up until 2013.3

Since 2013, we have seen further cases of undiagnosed malignancy presenting as trismus to the TMD clinic (see Box 1). Reflecting on these and understanding what lessons we can learn from these cases, through multidisciplinary discussion and regular audit of the actual usage, we have further developed and refined the checklist. This paper describes this process focusing on the use of audit.

Audit

Given the significance of the potential diagnoses, it is imperative that the trismus checklist is carried out routinely. The audit cycle is an established way of assessing if a healthcare service is reaching a recognised standard and maintaining that. It can also drive quality improvement.4

To ensure that this does happen, the TMD department at UDHM audit the actual use of the checklist annually. This paper tracks the audit process across ten years. It demonstrates how the audit process can be enlisted to:

1. Maintain standards of care and thus ensure patient safety
2. Highlight challenges faced by teams delivering patient care
3. Promote creativity in finding solutions to these challenges.

Method

In December 2010, the first trismus checklist audit was undertaken at UDHM and there have been 11 repeated annual audits. The local standards were set by the lead clinicians of the TMD clinic; consultants in restorative dentistry, oral medicine and oral and maxillofacial surgery (OMFS); and the clinical director at UDHM. The standards throughout have been as follows:

1. The trismus checklist should be present in 100% of new patient examination case notes
2. Maximum mouth opening should be documented in 100% of new patient examination case notes
3. If maximum mouth opening is less than the defined trismus measurement, the trismus checklist should be completed in 100% of cases
4. Following any ‘yes’ answers in the trismus checklist, the trismus flowchart should be followed correctly in 100% of cases.

In addition to these four standards, the definition of trismus (in regard to measurement of intra-incisal mouth opening) was documented. The incidence of trismus in new patients on the clinic was also calculated. For each audit cycle, 50 consecutive case notes were assessed retrospectively over a one-month period. A summary of the findings for these audits are shown in Table 2. It can be seen that the definition of trismus, in terms of inter-incisor mouth opening, varies (see discussion) which complicates comparison. Nonetheless, the aim of each audit remains the same: to ensure compliance with the trismus checklist by identifying patients with trismus and managing them appropriately.

Results

The following can be concluded from the results:

1. The incidence of trismus ranged from 0–20%
2. The presence of the trismus checklist in new patient examination notes does not always meet the 100% standard set: it has ranged from 78–100% compliance
3. The recording of mouth opening does not consistently meet the 100% standard set: it has ranged from 80–100% compliance
4. The trismus checklist is not always filled in correctly and does not meet the 100% standard set: it has ranged from 50–100%.

Discussion

A number of explanations have been offered by the various clinical audit leads for the levels of compliance when filling in the trismus checklist. These include high staff turnover within the TMD clinic at UDHM (due to the rotation of dental core trainees), the need for regular training, changes from paper to electronic patient record systems for regular training, changes from paper records to electronic patient record systems (potentially creating greater fluctuation in the results than if the sample size was larger).

With the high staff turnover in the TMD clinic because of rotating trainees, the yearly...
To minimise the risk of misdiagnosis, management protocols may differ depending on the clinical history. For example, a patient displaying an obvious pericoronitis would not require formal escalation to a senior colleague. Such justified exceptions would not be picked up through the audit process and this is a potential limitation of the audit technique.

Several changes have been implemented as a result of the trismus checklist audits, in an attempt to improve compliance (Table 3). These changes emerge out of review of the audit findings by senior clinicians. For example, the changes made to the inter-incisal mouth opening values used to define trismus across the ten years relate to the use of recognised diagnostic criteria and also clinical experience.

In 2018, the checklist was updated with additional questions incorporating that were considered to also be indicators of a potential malignancy (Table 4).

The revised checklist is now used when there is a mouth opening of less than 30 mm (the locally agreed lower limit of normal mouth opening). Any positive findings for the screening questions are followed up with senior clinician input. Locally, this is dictated by a trismus flowchart (Fig. 1) that guides further management. After a thorough intraoral examination, consideration is given to further imaging/investigations and urgent onward referral. Depending on the findings, patients may be referred directly to OMFS colleagues on an urgent cancer pathway or they may be seen on a joint TMD/OMFS clinic.

Although quick and easy to use, one must appreciate the checklist’s weaknesses:
- If mouth opening is restricted to <20 mm, it can be challenging to examine intraorally to identify a potential lesion. In the absence of other potential causes for such severe trismus, there should be a low threshold for imaging urgent referral
- Patients’ actual mouth opening is different to the intra-incisal distance with the difference being the patients’ overbite. Consideration could be given to measuring the overbite additionally

### Table 2: Summary of consecutive annual audit outcomes since 2010

| Standard | Compliance |
|----------|------------|
|          | Initial audit | Re-audit |
|          | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Trismus definition (mm) | <25 | <35 | <30 | <35 | <35 | <30 | <30 | <30 | <30 | <30 | <30 | <30 |
| Trismus checklist present? (%) | 90 | 100 | 100 | 100 | 98 | 100 | 96 | 98 | 100 | 98 | 100 | 78 |
| Mouth opening recorded? (%) | 94 | 90 | 96 | 96 | 100 | 100 | 100 | 96 | 100 | 80 | 98 |
| Incidence of trismus (%) | 6 | 16 | 8 | 20 | 20 | 16 | 6 | 8 | 15 | 15 | 4 | 0 |
| Trismus checklist completed correctly? (%) | 54 | 71 | 100 | 100 | 70 | 87.5 | 67 | 50 | 86 | 100 | 100 | NA* |
| Trismus flowchart followed correctly (%) | 67 | 80 | NA | 100 | 0 | 0 | 67 | 100 | 86 | 86 | 100 | NA* |

*Compliance with the trismus checklist and trismus flowchart could not be assessed in the eleventh cycle due to 0% of patients presenting with mouth opening <30 mm

### Table 3: Table showing the changes implemented as a result of the trismus checklist audits

| Audit | Changes implemented | Justification |
|-------|---------------------|---------------|
| December 2010 (first cycle) | Development of the trismus flowchart (February 2011) | To ensure appropriate patient management following clinical finding of <30 mm mouth opening |
| | Re-designing and permanently adding the trismus checklist to the new patient exam pro forma (February 2011) | To ensure staff understand when the trismus checklist should be complete |
| October 2011 (re-audit 1) | Provision of disposable rulers on TMD clinic at UDHM (February 2012) | To ensure clinicians take accurate measurements of mouth opening at all new patient examinations |
| February 2015 (re-audit 4) | One trismus flowchart must be present within each clinical area for reference (March 2015) | To allow clinicians to familiarise themselves with the trismus flowchart and are able to utilise it when required |
| January 2016 (re-audit 6) | Numerical value to define trismus set at <30 mm (January 2016) | To standardise the definition of trismus |
| | Electronic version of checklist available | To improve accessibility, legibility and data protection |
| February 2018 (re-audit 8) | Trismus checklist updated to include additional ‘red flag’ signs | To minimise the risk of misdiagnosis |
| | ‘Opening less than 15 mm’ changed to ‘opening less than 20 mm’ within the trismus checklist | To lower the threshold for raising concerns |
| December 2019 (re-audit 10) | Update of the trismus flowchart to include consultation with a senior colleague | To utilise senior clinicians experience and avoid unnecessary escalation |
| February 2021 (re-audit 11) | Complete shift to electronic record keeping | To standardise record keeping protocol, improve accessibility, legibility and data protection |
To assess for ‘progressively worsening trismus’, clinicians rely on a patient’s history or must monitor the patient over time. Although it would be possible to monitor the patient over time, this could allow disease progression, delayed treatment and subsequently, a poorer prognosis. So again, a low threshold should be employed in decision-making.

The trismus flowchart must be followed if indicated. This requires active action from the clinician and as shown by previous audits, is not always pursued. Clinicians must understand the reason behind both the checklist and flowchart. The flowchart ensures that trismus patients are appropriately followed-up with onward referral as required.

Thanks to the progression towards fully electronic record keeping, the decision has been made to alter the method for future audits. Software managers will be asked to identify all patients who had a mouth opening <30 mm over the selected time period. Compliance with the trismus checklist will then be assessed in these patients. This will allow a more targeted analysis of a relevant cohort of patients. Additionally, the current method will still be used in order to ensure that clinicians are still recording mouth opening at first presentation.

The trismus checklist should be a part of every clinician’s diagnostic armamentarium. A patient with an undiagnosed malignancy may first present to a general dental practitioner or specialist with trismus. Early detection and management is possible with appropriate referral. As mentioned, the most common causes for trismus are benign; however, should a patient present with unexplained trismus, the checklist can be used to alert the clinician to ‘red flag’ signs of underlying malignancy. If there are positive findings on the checklist, then further investigation and appropriate referral should be instigated. There is no reason why the trismus checklist could not be used effectively in primary care (as illustrated by the case history in Box 1).

The British Dental Association reports that between March and September 2020, over 14 million dental appointments have been missed as a result of COVID-19. Consequently, there will inevitably be patients who have developed undetected malignancies. Dental professionals must be more vigilant than ever to detect these patients by ensuring they are aware of all the ‘red flag’ signs that indicate an urgent referral. This may require further education to upskill dentists and dental care professionals. In addition, colleagues from other disciplines where trismus may be noted, such as physiotherapists, ear, nose and throat departments and general medical practice, would benefit from a heightened awareness of the potential red flags associated with trismus.

### Table 4 Updated (2018) trismus checklist with additional questions. Adapted from H. P. Beddis et al., ‘Temporomandibular disorders, trismus and malignancy: development of a checklist to improve patient safety’, British Dental Journal, 2014, Springer Nature

| Checklist                                      | Yes to any | No |
|------------------------------------------------|------------|----|
| Opening less than 20 mm                       |            |    |
| Progressively worsening trismus               |            |    |
| Absence of history of clicking                |            |    |
| Pain of non-myofascial origin (neuralgia etc)  |            |    |
| Swollen lymph glands                          |            |    |
| Suspicious intra-oral soft tissue lesion      |            |    |
| Over 45 years old                            |            |    |
| Difficulty in swallowing                     |            |    |
| Recent weight loss                           |            |    |

### Fig. 1 The trismus flowchart

1. **REFER TO MANCHESTER ROYAL INFIRMARY FOR NEXT TUES. CLINIC** (NOT GENERAL OS CONSULT) BY GOING TO OS DESK IN DH
2. **DICTATE A REFERRAL LETTER WHICH MUST BE TYPED BY DH SECRETARY IMMEDIATELY AND SECRETARY TO KEEP ELECTRONIC COPIE**
3. **PIN THE LETTER TO THE NOTES**
4. **ASK FOR THE NOTES TO BE TRANSFERRED TO MRI ASAP**
Conclusion

By implementing this simple screening tool in clinical practice, the chance of early detection and diagnosis of malignancy presenting as trismus is increased.

Across the span of this audit, there is improvement in compliance when it comes to the appropriate management of patients presenting with trismus. It is intended by the authors to continue to audit the use of the trismus checklist in practice and modify as needed in the light of new information. Further research could look to assess the effectiveness of the trismus checklist in identifying potential malignancy in general dental practice.

Use of the trismus checklist could be also be expanded to other disciplines with appropriate education and training.

Ethics declaration

The authors do not have any conflicts of interest. This audit is registered and monitored within Manchester Foundation Trust.

Author contributions

Conceptualisation was performed by Charles Crawford, Michael Pemberton and Stephen Davies. Data collection and analysis was performed by Anurag Srinivas, Pushpa Momin and Jacob Watts. Drafting of the manuscript was carried out by all authors. Final approval of the manuscript was carried out by Charles Crawford and Michael Pemberton.

References

1. Santiago-Rosado I M, Lewison C S. Trismus. Treasure Island: StatPearls Publishing, 2018.
2. Johnson J, Johansson M, Rydén A, Houlit E, Finizia C. Impact of trismus on health-related quality of life and mental health. Head Neck 2015; 37: 1672–1679.
3. Beddiss H P, Davies S J, Budenberg A, Horner K, Pemberton M N. Temporomandibular disorders, trismus and malignancy: development of a checklist to improve patient safety. Br Dent J 2014; 217: 351–355.
4. Limb C, Fowler A, Gundogan B, Kochy K, Agha R. How to conduct a clinical audit and quality improvement project. Int J Surg Oncol (NY) 2017; DOI: 10.1097/ IJ9.0000000000000024.
5. Schiffman E, Ohrbach R, Truelove E et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. J Oral Facial Pain Headache 2014; 28: 6–27.
6. British Dental Association. Dentists facing uphill struggle, as missed appointments top 14m. 2020. Available at https://bda.org/news-centre/press-releases/dentists-facing-uphill-struggle-as-missed-appointments-top-14m (accessed November 2020).