

Mouth Guards and Intra-Oral Evaluation for Patients' Candidate to Electroconvulsive Therapy

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ABSTRACT

Objective: the aim of this article is to present a literature review on the mouthguards during electroconvulsive therapy (ECT) and describe a protocol of dental care that can be performed prior ECT. **Methods:** following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) the articles were selected according to the inclusion criteria described as follow: 1) articles published in English language; 2) Clinical follow-up studies, retrospective, prospective and randomized controlled clinical trials. Case reports were also considered as well as Letters to the Editor containing expert opinion. **Results:** seventy-seven articles were initially selected using the key words. After applying the inclusion criteria, 16 articles were selected based on the complete reading. A protocol is proposed based on the literature review and also based in the clinical expertise of the team of dentists working in the Psychiatric Institute of a Tertiary Hospital. **Conclusion:** trained dentists contribute to the safety of psychiatric patients' who undergo to ECT procedure by performing an intra oral evaluation prior ECT where they can evaluate and decide the best mouthguard type for each patient and also identify and address emergencies that could represent a problem during the procedure. In some cases, the dental clinician evaluation is also requested after ECT and as well as, in follow ups during and after the psychiatric treatment.

Keywords: Dental care; Electroconvulsive therapy; Psychiatry; Dental staff, hospital.

Introduction

There are many treatment modalities available for patients with psychiatric disorders such as major depressive disorder, bipolar disorder, schizophrenia, catatonia, and patients at risk of suicide. Electroconvulsive therapy (ECT) is an option often used when those patients do not respond to the pharmacological therapies.¹⁻³ During ECT, the masticatory muscles are stimulated by an electrical current, which causes muscular contractions and closure of the jaws. This may lead to intra-oral injury due to muscular force and contraction. The contraction of masticatory muscles is observed in these patients. The temporal masticatory muscle is directly affected by the electrical stimulation. However, the use of muscular relaxant medications does not seem to attenuate that effect.⁴

The psychiatric disorders can secondarily lead to intra-oral problems as they affect the patient's ability to perform self-hygiene (brush their teeth, floss, etc).⁵⁻⁷ In addition, some medications often present side effects such as xerostomia. Furthermore, there is a high prevalence of smokers among these patients which makes their conditions worse⁸. These patients have a lot of oral diseases because they neglect their teeth and there is a lack of dentists trained on how to evaluate them.⁹

A study performed in Israel evaluated the oral health condition of psychiatric hospitalized patients using the Decayed-Missing-Filled Teeth (DMFT) index.¹⁰ The results demonstrated an increase in DMFT index of 26.32 indicating

the need for dental treatments in these patients. The treatment should focus on oral disease prevention in order to increase their general health and life quality.¹⁰ Additionally, according to a systematic review, severe psychiatric patients presented a 3.4 times greater chance of tooth loss when compared to the general population.¹¹

Therefore, the fact that these patients present poor intra-oral health may cause complications during ECT. There is a major risk of tooth fracture, leading to complications such as dental avulsion and aspiration as well as muscular trauma and soft tissue laceration.⁹ Studies have suggested the use of gauze, silicon, and sports bite guards in order to protect the teeth and soft tissues injuries during the ECT procedure.^{4,12} However, there is a lack of studies in the literature highlighting the importance of a thorough dental evaluation in these patients prior to ECT in order to avoid complications during the procedure⁽¹³⁾. Therefore, the aim of this paper is to provide a literature review about the use of mouth guards during ECT and to propose a protocol of intra-oral evaluation of psychiatric patients prior to this procedure.

Material and Methods

PubMed (MEDLINE) was searched for research articles related to the interface of dentistry and ECT. The terms used included: "oral health", "dental", "dentistry", "teeth", "tooth damage", "dental protection" – combined with OR - and "electroconvulsive therapy" – combined with AND.

Only full text published articles or letters were included. All studies were screened at the title and abstract level, and the full texts were selected by two independent reviewers (RRNN and BLRV). No efforts were made to contact the authors.

Inclusion and exclusion criteria

The inclusion criteria comprised:

- 1) Studies published in English,
- 2) Clinical follow-up studies, retrospective, prospective and randomized controlled clinical trials, including Letters to the Editor and clinical case reports.

The papers that did not comprise the topic of the review were excluded.

Protocol of Electroconvulsive Therapy (ECT) intra-oral Evaluation

A protocol proposal and a flow chart were elaborated based on the literature review and the clinical experience of the Team of Dentists from a Psychiatric Institute of a Tertiary Hospital - Brazil.

Results

Initially, 77 papers were selected after the search using the key words. Afterward the exclusion of duplicated articles and screening of the title and abstract, 16 papers were selected (Figure 1).

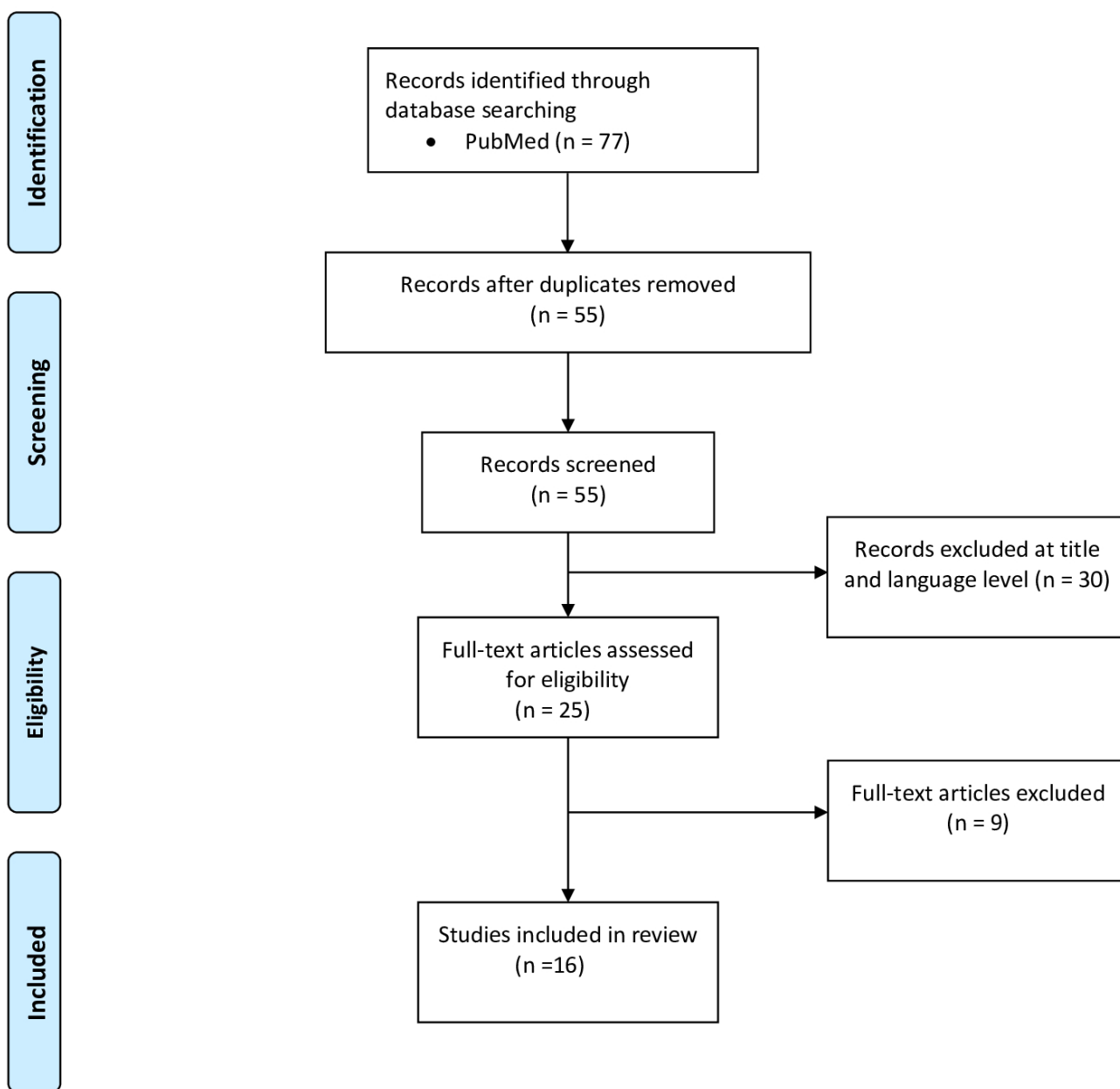


Figure 1. Flow chart following Prisma model of the literature review.

From: Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* 2009 Jul 21;6(7):e1000097.

The oldest paper was an expert opinion about dental protection during ECT. At that time, it was very little considered in most articles.¹² The author used a previous Swedish protector as a prototype to develop a new one, it was made of soft dental rubber and a wire forming a handle. The author described its main advantages as: remaining inside the mouth during muscle contraction and providing good protection even for patients with dental prosthesis such as bridges and crowns.¹²

McClure, 1969, recommended that the mouth examination should be performed by a qualified dental surgeon, who could be aware of the side effects of ECT on the intraoral structures. Also, he suggested the use of a plastic mouth guard during the ECT procedure. The author described the great success of the mouth guard in 242 patients, from them only three had loosened teeth: two were due to a periodontal disease and one was because of a misplacing of the mouth guard.¹⁴

However, the cost and the technical difficulty of this appliance led Barnes and Relyea, 1970, to develop and report a different type of dental protection made of an orthopedic felt enclosed by a transparent bag of polyethylene.¹⁵ The orthopedic felt mouth guard could be placed over the tooth extraction site for patients with partial dentition, while for edentulous patients no mouth guard was necessary. Also, the authors asked the patients to remove any partial or full dental prosthesis and bridges before the ECT.¹⁵

Literature also reports a "Letter to the Editor" from 1983 where the author expressed his concern about dental complications during ECT. The author described a case report where a dental fracture occurred. The patient was an 84-year-old male diagnosed with a major depressive episode. Two weeks before ECT the patient had a dental examination that revealed a partial dentition compromised by periodontal disease and small dental cavities. This patient had four successful ECT sessions using a rubber bite block for mouth protection. However, at the fifth session, the rubber block was unavailable, and a hard-plastic airway was used instead, which led to the fracture of his right upper incisor.¹⁶

Historically, the American Psychiatric Association recommendations on clinical practice of ECT did not mention the need for an intra-oral evaluation as part of the pre-ECT protocol, which led to comments and criticisms by specialists.¹⁷

A clinical controlled trial was performed in a group of 82 patient candidates for ECT in 1992. The purpose of this trial was to select the most effective types of mouth guard, according to the oral health status of each patient. A thorough dental evaluation was performed by a dentist. Patients with healthy teeth used the standard Oberto mouth device during ECT, while patients with loose or decayed anterior teeth used a disposable foam jaw lock ("Bite" by Halbrand Inc., Willoughby, OH, USA) positioned between the upper and

low posterior teeth. Both groups had severe chronic and acute dental diseases. The result showed no damage to healthy teeth, except for two cases that required the extraction of one posterior tooth because of the increased tooth mobility. Both patients had periodontal disease diagnosed before the treatment.¹⁷ A recent Sweden study reported an incidence of dental fracture during ECT of 0.2% during 2011 to 2018. The pre ECT dental evaluation is not routinely performed in Sweden.¹⁸

Later, a modified technique was applied using two foam bite blocks in patients who present a wide mouth opening and powerful masseter contraction instead of one bite block.¹⁹

Literature reports a "Letter to the Editor" from 2009, where the author described the use of gauze mouth guards as a promising result. Literature does not encourage the use of Guedel airway, since it seems to injure the intra-oral soft tissues. Also, the author commented that a mouth guard made of hard material may not absorb the jaw forces satisfactory. The letter describes the use of a cotton and gauze roll placed on the molar region, not allowing the incisors to touch each other when the jaw closes. The advantages include low costs, easy to use, disposability of the material, and cost-effectiveness.⁴

A literature review from 1995 described several types of mouth guard used since 1949. After an extensive description of mouth guards available, the authors concluded that there was not just one type that could protect all the patients during ECT since each patient presented unique oral conditions.²⁰

Another study aimed to check the need of a team of dental clinicians in order to provide a thorough intra-oral evaluation prior to ECT. The authors concluded that when the exam was performed by specialized dental clinicians the patients' safety improved.²¹

Later, the same conclusion was reported by a letter to the editor describing the use of orthopantomography of the jaws in helping the intra-oral evaluation prior to ECT.²²

A research was made in the Veterans Affairs National Center for Patient Safety Database in order to find the most common side effect related to ECT. The authors reported intraoral injury as the most common adverse effect, including dental and tongue injury, because of the misplacing of the bite guard or non-use of a bite guard at all.²³

Despite the use of a single mouth guard, Woo and Do (2012) described a tongue laceration during ECT, where the patient seemed to have bitten his tongue placed between the mouth guard and the lower teeth. The mouth guard was made from a prefabricated silicon immersed in hot water, to better fit the upper dentition of the patient⁽²³⁾. The authors suggested that such a mouth guard can be customized in order to adapt to the needs of each patient. It is also observed that the intra-oral evaluation prior to ECT is extremely important and in many cases, the patient should get dental

treatment in advance to ensure the safety of ECT.²⁴

A clinical study aimed at assessing the efficacy of an individualized mouth guard made from three-millimeter ethyl-vinyl-acetate (EVA, Erkodent, Pfalzgrafenweiler, Germany) during ECT. The authors tried a pressure-sensing film (Dental Prescale, Fuji Film, Tokyo, Japan) in

the patient's mouth with and without the mouth guard. As a result, the authors pointed out that the mouth guard helped to decrease occlusal forces by $58 \pm 22\%$ on average, which reduced the risk of intra-oral injuries such as mucosal lacerations and mouth bleeding.²⁵ Table 1 presents the main characteristics of the papers included.

Table 1. Characteristics of studies included in the review

Author, (Country)	Study design	Aims	Major findings
Scott, 1956 (Sweden)	Letter to the Editor	Describe a mouthguard.	A mouthguard made of soft dental foam and a wire is developed with measures and photographs. It was described as a good option especially for patients with dental prosthesis such as bridges and crowns.
McLure, 1969 (United States)	Expert opinion	Describe the experience of the team.	The oral evaluation is required. Only three patients lost teeth during ECT, because of periodontal disease and misplacing of the mouthguard, showing its importance in the patient's safety.
Barnes <i>et al.</i> , 1970 (United States)	Letter to the editor	Describe a mouthguard.	A mouthguard is described using orthopedic felt enclosed by a plastic polyethylene bag.
Faber, 1983 (United States)	Letter to the editor	Report a dental fracture during ECT.	Besides performing a dental exam prior to ECT, a dental fracture occurred when mouthguard was not used.
Weiner <i>et al.</i> , 1992 (United States)	Letter to the editor	Support dental evaluation prior to the ECT.	The author recommends the inclusion of a brief oral examination or a full dental exam depending on the incidence of dental pathologies.
McCall <i>et al.</i> , 1992 (United States)	Clinical study	Perform dental examination prior to the ECT and choose the best mouthguard.	The standard Oberto mouth guard was chosen for patients with healthy teeth and a disposable foam jaw lock was chosen for patients with damaged anterior teeth. Despite all the concerns, two patients had the extraction of posterior teeth because of increased tooth mobility after ECT.
Minneman, 1995 (United States)	Literature review	Describe mouthguards.	There is not a unique model of bite guard that could be used in all patients. A dental evaluation should be performed by a dentist who knows the side effects of the ECT procedure.
Morris <i>et al.</i> , 2002 (United Kingdom)	Case control study	Implement best practices in ECT regarding mouth and dental injuries.	An oral evaluation made by a dental team seems to provide more security to the patient than the evaluation made by trained doctors.
Kiran <i>et al.</i> , 2009 (India)	Letter to the editor	Describe an adaptation to the gauze mouthguard.	The cotton and gauze rolls used to protect the teeth and mouth during the ECT seems to be promising.
Watts, <i>et al.</i> , 2011 (United States)	Retrospective study	Search for information on adverse events related to ECT.	The Veterans Affairs National Center for Patient Safety database showed that the most common side effect was the intraoral injury, including dental and tongue injury, because of the misplacing of the mouth guard.
Woo <i>et al.</i> , 2012 (South Korea)	Letter to the editor	Describe a tongue laceration during ECT.	Dental assessment and treatment should be done before ECT and the mouthguard can be adapted in special cases.
Ogami <i>et al.</i> , 2014 (Japan)	Clinical study	Evaluate the efficacy of a mouthguard.	The occlusal force was reduced when using the ethyl-vinyl-acetate mouthguard. Oral mucosal trauma and bleeding were also reduced during ECT.
Muzyka <i>et al.</i> , 2017 (United States)	Literature review	Assess oral health and mouth guards.	More studies needed to achieve the best mouthguard. The patient should be accompanied by the dentistry team before and after the ECT treatment.
Plevin <i>et al.</i> , 2019 (Australia)	Letter to the editor	Describe an oral evaluation prior the ECT.	Dental services should be available at institutions where ECT is performed. This could be crucial not only for the safe administration of ECT, but also to provide the best protection for the teeth – and consequently the general physical health and well-being of patients.
Paparone <i>et al.</i> , 2019 (United States)	Images in ECT	Describe the use of foam bite block during ECT.	Foam bite blocks are disposable and can be used as mouthguard.
Göterfelt <i>et al.</i> , 2020 (Sweden)	Retrospective study	Access the incidence of dental fracture during ECT.	The research pointed an incidence of dental fracture of 0.3% per patient. No significance association was found between the fractures and age, sex, or diagnosis groups.

ECT = Electroconvulsive therapy

Flow chart proposal

Based on the literature review and on the expertise acquired in many years, we developed a protocol of intra-oral assessment prior to ECT applied in the patients from a Psychiatric Institute of a Tertiary Hospital, Brazil. (Figure 2).

First, the patient is evaluated by a psychiatrist, who requests a pre-ECT medical evaluation, including pre-anesthesia and

dental evaluation. During the intra-oral evaluation protocol, the dentist asks the patient about any dental pain. Even if there are no complaints, the protocol is performed investigating intra-oral or dental findings that could lead to complications during ECT. Table 2 summarizes intra-oral/dental causes and how they should be addressed prior to ECT procedure avoiding any interferences.

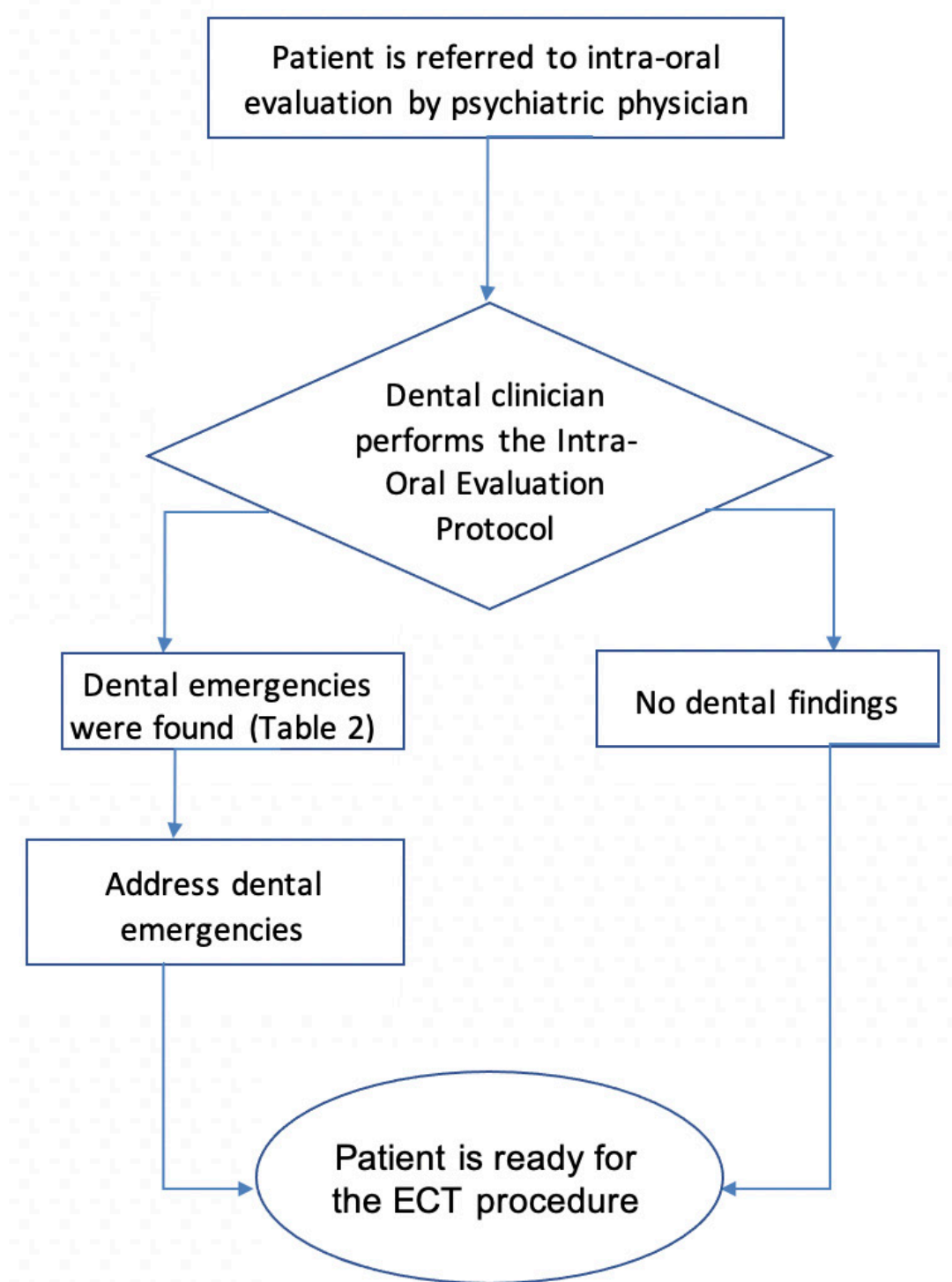


Figure 2. Flow chart of the dentistry evaluation for patients previous the electroconvulsive therapy (ECT).

Table 2. Protocol of ECT Intra-Oral Evaluation, Dental Team, Psychiatric Institute, HCFMUSP

What to check?	What to do?	Implications	Next step prior to ECT
Facial Symmetry	Identify causes of facial asymmetry, such as swelling and infections.	Infectious processes and tumors.	Treat acute infections.
Presence of dental prosthesis -Full denture/ partial removable denture	Evaluate stability and traumatic injuries.	Traumatic injuries and difficulty of approach in case of emergency.	Ask the patient to remove his prosthesis before ECT.
-Fixed prosthesis/ implant supported prosthesis or protocols	Evaluate retention and stability.	Detaching and spiration.	In the case of unstable prosthesis, evaluate the possibility of removing or cementing it.
Mucous membranes	Identify injury to mucous such as ulcers, white lesions or red lesions	Contribution to the process of care and early diagnosis. Map pre-existing lesions.	Follow-up the evolution of lesions and consider diagnostic approaches. These alterations do not seem to complicate the ECT, but are necessary to continue to monitor injuries.
Teeth -Cariou lesions	Look for caries lesions, large crown destructions and unsatisfactory fillings.	The carious lesion, mainly the large ones fragilize the dental tissues. During ECT, these teeth are likely to break which increases the risk of aspiration.	Evaluate each case and consider the best treatment (temporary fillings, resinous fillings, extractions).
-Sharp edges	Evaluate broken teeth and the presence of sharp edges. Cusp tips with sharp angles.	Sharp edges can cause traumatic lesions in soft tissues during ECT.	Consider wear and polish.
-Dental mobility	Evaluate the periodontal condition.	Teeth with big bone loss and mobility associated with periodontal disease are more likely to increase the risk of aspiration during ECT.	Provide dental splints or extractions.
-Dental calculus	Evaluate periodontal condition and dental surfaces.	Large amounts of calculus may loosen and increase the risk of aspiration.	Dental/root scaling and prophylaxis are indicated.
-Orthodontic fixed/ removable braces, orthodontic splints	Evaluate the model of the device and the risk of lesions.	During ECT, braces may cause traumatic injuries. Loosen braces increase the risk of aspiration.	Protection of braces with dental wax. Take out removable devices prior to ECT.

ECT = electroconvulsive therapy

Discussion

This review demonstrates that the literature focuses on describing the several types of mouth guards and the different materials they are made from. It is known that the use of a mouth guard during the ECT procedure helps to protect the teeth and tongue from injury caused by the occlusion trauma due to the stimulus in the masticatory muscles.⁹ Also, most of the studies in literature agree that the use of mouth guards must be adapted according to the patient's needs.

In our experience, the gauze bite guard previously reported in the literature⁴ should be the first choice as it has several advantages, such as low cost and easy intra-oral insertion.

Even though the foam bite blocks seemed promising, it was considered too expensive.¹⁹ The same occurred to the method described by McClure (1969), where the use of dental impressions and vacuum machines increased the costs and were time consuming.¹⁴

There is still a need for further controlled studies for comparing the different models of mouth guards and which one would be indicated according to the dental condition of each patient.^{4,9,17,19,24}

Despite the benefits of the mouth guards they do not seem to prevent all the interurrences related to the patient's intra-oral condition. As described in the literature, even when a mouth guard was used during ECT, some complications still occurred, related to the teeth affected by periodontal disease,¹⁴ such as increased dental mobility,¹⁷ dental fractures¹⁸ and soft-tissue trauma.²⁴

In order to avoid these complications, we believe that a proper intra-oral evaluation should be performed before ECT. Through the intra-oral evaluation, the dental clinician might identify and address any issues that would prevent interurrences. Moreover, the intra-oral evaluation can help to define the best mouth guard to use and its specific adaptations, if any, to each patient.



Therefore, the intra-oral evaluation prior to ECT is an important topic directly related to the patient's safety. Unfortunately, there is a lack of studies focusing on the intra-oral evaluation prior to ECT.^{12,15,19,20,23} There is also a lack of studies demonstrating the association between oral health status and dental procedures prior to ECT aiming to minimizing complications during ECT.^{9,21,22} For example, Scott (1959), expressed his concern regarding dental prosthesis protection of bridges and crowns during the ECT procedure. However, his study did not mention fractured, decayed teeth, periodontal disease or soft tissues lesions prior to ECT.¹²

The first citation in the literature regarding an intra-oral evaluation prior to ECT was referred by Barnes & Relyea (1970), in which the physical evaluation of the patients prior to ECT included a dental exam section and described the presence of dental prosthesis. However, there were no details about the patient's oral health status and their periodontal conditions.¹⁵

According to studies^{13,17} having a dental evaluation prior to ECT depends on several features including the patient's economic and social-cultural aspects. For example, in a private practice where patients usually have a better economic situation and a good intra-oral health, the preliminary intra-oral assessment can be performed by a member of the ECT team such as a psychiatrist who might refer the patient to a dental clinician if they believe it to be necessary.¹⁷ On the other hand, the intra-oral evaluation prior to ECT should be performed by a trained dental clinician where patients are financially deprived and present poor oral hygiene.¹⁷

In our experience, we highly recommend the intra-oral evaluation to be performed by a trained dentist who is familiar with the possible damages to the intraoral structures that could occur during the ECT procedure, as described previously.²⁰

It is known that psychiatric patients present a higher incidence of oral diseases, due to several reasons such as poor intra-oral hygiene, side effects of psychiatric drugs, high

incidence of smoking or difficult access to dental treatment, which justifies the intra-oral evaluation to be performed by a dental clinician.^{5,6,8}

Some authors recommend the use of orthopantomography to help in this evaluation.²² However, we strongly believe that the intra-oral evaluation should be performed first and, if necessary, orthopantomography could be requested and performed afterward. It is important to note that orthopantomography is not necessary in the majority of the cases. It could be time-consuming and expensive.

This paper describes a Protocol (Flow chart 2) that has been used for many years by the dental clinicians' team who treat psychiatric patients at the Psychiatric Institute of a Tertiary Hospital, Brazil.

This protocol aims to increase the patients' safety during the ECT procedure. The flow chart presents a very simple step-by-step that can be applied before ECT and describes a strategy for dental emergencies that can be identified and addressed so the patient can have ECT and continue their psychiatric treatment. After ECT is performed and once the patient improves their psychiatric condition, the full dental treatment can be completed.

Conclusions

There are several types of mouth guard and we strongly recommend the use of a custom-fitted mouthguard during ECT and a trained dental clinician to be part of the ECT team. They ensure safety to the patients who undergo ECT by performing an intra-oral evaluation prior to ECT, and contribute to the patient's follow-up by monitoring their dental health and oral hygiene.

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