# Incidence of Oral Injury and Risk Factors Associated with Oral Injury in Psychiatric Patients Undergoing Electroconvulsive Therapy in Siriraj Hospital

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## ABSTRACT

**Objective:** Oral injury during Electroconvulsive therapy (ECT) has been mitigated by modified ECT and the use of mouth protection. However, the number of reports of oral structure injuries remains high. The objectives of our study were to find out the incidence and possible risk factors of oral injury in patients undergone ECT.

**Methods:** Fifty one psychiatric patients undergoing ECT over a one-year period were reviewed. Patients' demographics, possible risk factors of oral injury, drugs used to anesthetize patients and the locations of oral structure injury were collected. The primary outcome was the incidence of oral injury, and the secondary outcome was factors affecting oral injury in modified ECT.

**Results:** ECT was performed 217 times among the 51 patients. There were 24 males and 27 females aged 44 ± 15 years old. Psychiatric problems were schizophrenia (80.4%), mood disorder (13.7%), depression (3.9%) and others (2%). Incidence of oral injury was 10.1% (22/217). Injury characteristics were abrasion at lips and mucosa (72.8%), bleeding at the gum (22.7%) and tooth avulsion (4.5%). Patients who received of a lower dose of succinycholine (0.9 versus 1 mg/kg) were more likely to have oral injury (p=0.009).

**Conclusion:** The incidence of oral injury in ECT was 10.1%. Abrasion at the lips and mucosa was common. A multidisciplinary approach, adjustment of the anesthetic drugs dosage and the use of delicate mouth protections might decrease the incidence of oral injury.

**Keywords:** Modified electroconvulsive therapy, oral injury, thiopental, succinylcholine

**Siriraj Med J 2012;64:145-148**
***E-journal: http://www.sirirajmedj.com***

## INTRODUCTION

Electroconvulsive therapy (ECT) is generally used to treat severe depression and various types of mood disorders.[1] The essential therapeutic component is to produce an adequate duration of a generalized seizure activity via transcutaneous electrodes placed close to the masticatory muscles. Direct electrical stimulation forces closure of the jaws during the procedure, but this risks injury to the teeth and oral structures. In addition, many factors affect the high incidence of oral injuries in patients undergoing ECT, such as drug induced xerostomia, poor oral hygiene, lack of dental guidance, displacement of the mouth protection or failure to support the patients' jaw.[2] In a recent large retrospective study, Watts et al., reported that morbidity involving the teeth or the mouth were the most common adverse events related to ECT.[3]

Pre-ECT oral assessment by dentists, modified ECT and the use of appropriate mouth protection have been encouraged to prevent injuries of teeth and other oral structures.[2,4] In our hospital, all psychiatric patients undergoing ECT receive brief anesthesia with thiopental and succinylcholine. Roll gauzes are placed on each patient's occlusion line before seizure induction. Pre-procedural oral assessment has been roughly performed by psychiatric nurses and anesthetic personnel.

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*Received 30 December 2011*
*Revised 13 February 2012*
*Accepted 12 February 2012*

The purpose of this study was, firstly, to estimate the incidence of oral structures injury in our institute and, secondly, to determine the factors associated with oral structures injury.

## MATERIALS AND METHODS

After Institutional Review Board approval, a retrospective study involving patients who had undergone ECT between 1st January and 31th December 2010 was performed. Eligibility criteria included psychiatric patients aged ≥18 who underwent ECT during the study period. Patients who had missing records were excluded. Data was retrieved from medical records, ECT records and anesthetic records.

*ECT procedure*

Standard monitors including non-invasive blood pressure, pulse oximetry and electrocardiogram were applied, and baseline vital signs were recorded. After preoxygenation, patients were anesthetized with thiopental and succinylcholine. In the first study session, empirical doses of thiopental and succinylcholine were used at around 1.5-2.5 mg/kg and 0.5-1.0 mg/kg, respectively. EEG duration greater or equal to 25 seconds was considered adequate treatment, and prescribed doses for the next session were followed. If the treatment failed and needed re-stimulation, anesthetics' doses were documented and were adjusted for the next session.

Seizures were also monitored using the cuff method. A blood pressure cuff was applied above the left ankle, and the pressure was raised to 50 mmHg above baseline systolic pressure just before the administration of a succinylcholine injection. The onset of paralysis by succinylcholine is signaled by visible motor unit contractions called fasciculations. Adequate ventilation was given until the fasciculations disappeared. Two disposable roll- gauzes (Fig 1) were placed between the occlusion lines, and they were extended back to cover the second molar after full relaxation. Support for the jaws, shoulder, back, pelvis and extremities were ensured. Unilateral or bilateral ECT was administered with electroencephalogram monitoring. After the procedure, adequate assisted ventilation and supplemental oxygen were given until patients recovered. Data collected included: demographic data, pre-existing problems, medications, anesthetic doses, ECT data and injury characteristics. The number of years of working experience of anesthetic personnel who was responsible for patients' airway management was also recorded in this study.

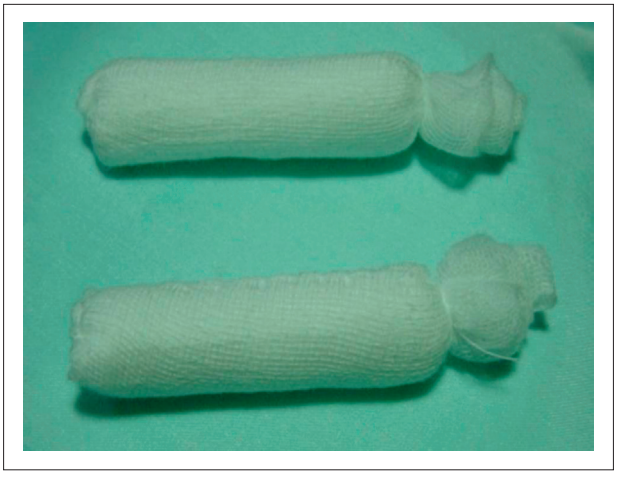

**Fig 1.** Roll gauze mouth guard.

*Statistical analysis*

The primary objective of the study was to estimate the incidence of oral structures injury in patients undergoing ECT. Sample size calculation was based on an expected incidence of oral structures injury of 10% derived from a 10-22% incidence in a previous study. To obtain a 95% confidence interval (CI) of 10±4%, a sample of 217 times of ECT was required.

Descriptive statistics were used to examine clinical characteristics. The Chi-square test was used to examine all categorical variables. The independent student's t-test was used to examine continuous variables. Statistical analysis was conducted using the software program, SPSS version 17 Inc., Chicago, IL, USA. Data have been presented as mean ± standard deviation (SD) or number (percent) or 95% CI, as appropriate. $P < 0.05$ was considered to indicate statistically significant differences.

## RESULTS

Two hundred and seventeen sessions of ECT from 51 patients were retrieved. There were no data losses. Twenty four (47.1%) patients were male and 27 (52.9%) were female, with a mean age of 44 years. All patients were categorized to ASA physical status II. Most patients (80.4%) were diagnosed with schizophrenia. The remaining diagnoses were mood disorder (13.7%), depression (3.9 %) and others (2%). Other demographic data have been described in Table 1.

Of the 51 patients, 24 were new patients, and they received 6-10 ECT treatments per course. Maintenance ECT was performed at least once a month in 27 patients. Two hundred and twelve treatment sessions showed adequate EEG seizures, while 5 events needed re-stimulation (3 events related to technical errors, and 2 events related to inadequate EEG seizures). Airway evaluation and preprocedural oral assessment were performed briefly before ECT treatment. No patients had abnormal facial anatomy, and one patient had severe tooth mobility of the upper anterior tooth. All patients were taking anticholinergic drugs, which can induce xerostomia.

The incidence of oral injury was 10.1% (22/217). Injury characteristics were abrasion at lips and mucosa (72.8%), bleeding at the gum (22.7%) and tooth avulsion (4.5%). (Table 2) Patients who received a lower dose of

**TABLE 1.** Patients' characteristics.

| Variables | Mean ± SD (min, max) or number (%) |
|---|---|
| Female gender | 27 (52.9) |
| Age (year) | 44.3 ± 15.5 (18, 66) |
| Body weight (kg) | 59.0 ± 14.3 (43, 119) |
| Height (cm) | 159.6 ± 8.0 (148, 180) |
| Body mass index (kg/m$^2$) | 23.2 ± 5.4 (17.3, 47.67) |
| ASA classification; Class II | 51 (100) |
| Diseases: | |
| Depression | 2 (3.9) |
| Schizophrenia | 41 (80.4) |
| Mood disorder | 7 (13.7) |
| Other | 1 (2.0) |

**TABLE 2.** Injury characters.

| Injury characters | Number of injury (%) |
|---|---|
| Abrasion at lips and mucosa | 16 (72.8) |
| Bleeding per gum | 5 (22.7) |
| Tooth avulsion | 1 (4.5) |

succinycholine (0.9 versus 1 mg/kg) was more likely to have oral injury (p=0.009). There were no differences between the EEG and motor seizure durations in the groups with and without oral injury. Working experience was not a factor which determined the incidence of oral injury. (Table 3)

## DISCUSSION

In this study, we found that the incidence of oral injury was 10.1%. Most oral injuries were abrasion at lips and mucosa (72.8%), followed by bleeding from the gum (22.7%) and tooth avulsion (4.5%). The study has shown that oral injuries were related to anesthetic drugs dosages; lower doses of thiopental and succinylcholine were more likely to have oral injuries.

ECT is a safe treatment for medication-resistant depression, schizophrenia, catatonia and bipolar disorder.[3] However, generalized autonomic nervous system stimulation can be dangerous. Some responses can produce profound bradycardia followed by dysrhythmias, exaggerated hypertension, increase myocardial oxygen consumption and myocardial ischemia.[5,6,7] Other serious complications such as neurological disorders or respiratory adverse events are rare.[3,5,8] Nuttall et al., reported the incidence of cardiorespiratory events related to ECT was only 0.61%, and none of the complications resulted in permanent injury or disability. They also reported no peri-procedural mortality in 2,279 patients given 17,394 ECT treatments.[9] Minor adverse events were more common, including headache, dizziness, nausea, vomiting, myalgia, amnesia, confusion and injury to oral structures.[3,5,10]

To prevent oral injury, various types of mouth protections have been developed to absorb the intense occlusal pressure and protect oral soft tissue.[2] In 1969, McClure devised a dental plastic bar wrapped tightly in a layer of gauze and an individually molded, mandibular mouth guard.[11] Although the incidence of tooth avulsion from his report was very low, a mouth protection prepared individually by a dentist is not practical for many institutions. Other mouth protections described in literature are rubber bite blocks, braided gauze gags and cotton wrapped in sterile gauze.[12,13] Guedel airways should never be used for injury prevention because they cannot separate upper and lower teeth, resulting in tooth dislodgement.[14] We have been using 2 soaked roll-gauzes of the size 8x2x1.5 cm. The advantages of these materials are they are easy to prepare, cheap and disposable, and they do not hamper face mask ventilation.[12] However, abrasion of oral mucosa was the most common type of injury in our study. Therefore, rough gauzes might not be appropriate for patients taking anticholinergic drugs. Furthermore, roll-gauzes were available in only one size. Improper sizing can cause injuries to tongue and buccal mucosa.

Routine dental examination and referral to dental services has been recommended to prevent oral injury. Morris et al., reported some limitations to achieve this recommendation. Firstly, dental services are not always available for routine dental examination, and secondly, there are some barriers to involving dentists in the care team.[4] Dental avulsion occurred in one case in our study. The patient had upper tooth mobility and was informed of the risk of dental damage. From this stand point, we recommend that a co-operative psychiatric patient should visit a dentist before ECT. Loosened teeth may cause serious complications if aspiration occurs.

A modified ECT technique has been applied to minimize adverse events. The empirical doses of 1.5-2.5 mg/kg of thiopental and 0.5-1 mg/kg of succinylcholine were recommended in the first treatment session,[15,16] and these were adjusted to the optimal duration of seizure in the next session. Since the anticonvulsant property of thiopental will shorten the duration of seizure activity, the balance between the adequacy of anesthetic effects and the proper duration of seizure activity must be considered.[5] Moreover, a larger dosage of anesthetics results in delayed recovery and increased time to resume spontaneous breathing after the procedure. In line with Mulari et al., we recommend a dose of 1 mg/kg of succinylcholine should be used.[17] The incidence of oral injury was higher in those patients receiving a lower dose of succinylcholine. Working experience was not a factor which determined the incidence of oral injury in this study. Therefore, we hypothesize that difficulties from roll-gauzes placement might occur in patients with inadequate paralysis.

Our study has some limitations. First, this was a retrospective study. Second, some important data were not documented in patients' records, such as adequacy of paralysis, the time for return to spontaneous ventilation, the details of oral health and the severity of dryness of oral mucosa.

In summary, the incidence of oral injury in ECT was not low in our institute. Abrasion at the lips and mucosa was common. A multidisciplinary approach, adjustment of the anesthetic drugs dosage and the use of delicate mouth protections might decrease the incidence of oral injury. Further studies are needed to identify the optimal

**TABLE 3.** Factors associated with oral structures injury and data during ECT.

| Factors | Injury group | No injury | 95% CI | p value |
|---|---|---|---|---|
| Dose thiopental (mg/kg) | 2.13 ± 0.62 | 2.42 ± 0.68 | (-0.59) to 0.01 | 0 .055 |
| Dose succinycholine (mg/kg) | 0.85 ± 0.24 | 0.97 ± 0.21 | (-0.22) to (-0.03) | 0.009 * |
| Seizure duration (second) | | | | |
| Clinical | 33.77 ± 14.74 | 32.53 ± 12.17 | (-4.27) to 6.76 | 0.65 |
| EEG | 32.45 ± 13.31 | 33.07 ± 15.77 | (-7.51) to 6.28 | 0.861 |
| Experience (year) | | | | |
| < 5 | 9 (6.9) | 121 (93.1) | - | - |
| ≥ 5 | 13 (14.9) | 74 (85.1) | - | 0.055 |

Data are mean ± SD or number (%)
*significant difference p value < 0.05

dose of succinylcholine and appropriate types of mouth protections.

## ACKNOWLEDGMENTS

The authors thank Chulaluk Komoltri, Ph.D. (Biostatistics), Division of Clinical Epidemiology, Department of Research Development Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand, for statistical advice.

This work was presented, in part, as an abstract at the Joint Conference in Medical Sciences 2011 Chula-Rama- Siriraj, Muangthong Thani, Thailand, June 15-17, 2009.

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