Keywords: triazolam, sedation, conscious, outpatient, dental

Abstract: This article will present the use of Triazolam in the dental office setting. While in United States the Triazolam may serve as oral sedation in the dental office, in Romania this medication is not used. The article presents a retrospective study done on 79 patients. The patients were administered Triazolam for oral sedation in order to help with the outpatient treatment. During the treatment patients were connected to oxygen canal, and were continuously monitored with pulse-oxymeter. The Triazolam was administered to patients with high anxiety, where long dental appointments were necessary. 5% of these patients necessitated the use of N2O2 as addition to the oral sedation. During the treatment an average of four dosages of 0.25mg of Triazolam were used over a period of 4-5 hours of treatment, with no more than five dosages being administered over 7 hours of treatment. In order to avoid an involuntary apnea the authors used oxygen on nasal canula (2l/min), and as result the oxygen level measured by pulse-oxymeter never fell below 87%. The use of Triazolam allows the anxiety control for long duration dental treatment, improving the comfort of the patient.

Cuvinte cheie: triazolam, medicatie oral, sedarea concesinta, tratament ambulator stomatologic

Rezumat: Deși în Statele Unite, medicatiea orală cu Triazolam în cabinetele de Medicină Dentară este o metodă de sedare conșientă pre și peroperatorie, în România nu este încă utilizată. Am efectuat un studiu retrospectiv pe 79 pacienți, căreoră li s-a administrat oral Triazolam pre și peroperator, pentru sedarea conșientă în tratamentul ambulator stomatologic la pacienții cu anxietate crescută, ce au necesitat ședințe medicale și lunghi de tratament (½ - 7 ore). S-a efectuat monitorizarea continuă cu un puls-oximetru. 5% din cazuri au necesitat folosirea N2O2 pentru completarea medicației cu Triazolam. S-au administrat în medie 4 doze Triazolam 0,25mg în decursul a 4-5 ore de tratament, nedepășindu-se 5 doze în decursul a 7 ore. Evitarea apenei involuntare s-a făcut utilizând o canulă nazală cu un debit continuu de oxid 2 litri/min, iar nivelul O2 măsurat de puls-oximetru nu a scăzut nicodată sub 87%. Triazolamul administrat pre și peroperator a permis controlul anxietății în tratamentul ambulator stomatologic de lungă durată, îmbunătățind confortul actului medical.

INTRODUCTION

Dentistry is a surgical medical field requiring the use of anesthesia due to the painful nature of its procedures. Most of the time, the dentist employs local anesthesia. Although local anesthesia eliminates the painful component from dental procedures, the anxiety component will still be present. This could be explained either by a lower pain threshold, or because of memories of previous painful dental experiences.(1,2) As a result, a significant population segment avoids routine dental care. These patients will seek care only in dental emergencies, when an important symptom is pain, thus adding to the traumatic memories of the dental procedures.

Another variable characteristic of dental care is the duration of the out-patient dental procedures. Based on the complexities of the dental sessions, the length can vary from ½ hour up to 7 hours.

One option for anxiety management is the use of conscious sedation with various oral medications – barbiturates, benzodiazepines. Beginning with the 70’s, there was an increased interest in the dental community for a less dangerous method of conscious sedation. Triazolam (brand name Halcion) is a benzodiazepine, generally used for the short term treatment of insomnia. Triazolam has also amnesic (3), anxiolytic, sedative, anticonvulsive, and myorelaxant effects. Triazolam is metabolized by the liver (hydroxylation and oxidative mechanism), is excreted primary in urine, does not generate active metabolites, has a short half-life of approximate 2 hours.(4) In dentistry Triazolam has an “off-label” use.

METHODS

This article presents a retrospective study including all the patients seen in a private office requiring conscious sedation in order to mediate their dental treatment. The study was done on 79 patients seen in a private dental office in a rural setting in California, Unites States (Adrian Buca, DDS, zip code 93644). Both males and females were included, with an age range from 29 yo to 75 yo. The study analyzed all the charts of patients treated with help of conscious sedation during the period of 2004 to 2009.

The study included all patients who received oral sedation. The protocol excluded from oral sedation administration all patients with ASA status higher than II, patients with psychological conditions, or under psychological (psychiatric) care, minors under the age of 18, and pregnant patients (possible teratogen and secondary effects).
The patients who met the requirements for conscious sedation were prescribed Diazepam 10mg to be taken the evening prior to the dental procedure (to minimize the nocturnal anxiety), and Triazolam 0.25 mg one hour prior to the procedure. The patients were given a prescription for Triazolam 0.25 mg, disp. #6, as our office does not store this medication.

**Figure no. 1. Triazolam 0,25mg**

The treatment appointments with oral sedation were scheduled in the morning. The patients were not allowed to drive, and a designated driver was required to bring the patient to the office and to pick up the patient at the end of the appointment.

Upon arrival each patient was at all times under the direct supervision of a special team member. The patient was taken to the treatment room, and the level of sedation was verbally determined. The patient was connected to the pulse-oxy-meter and to oxygen via nasal cannula at 2 l/min. The pulse-oxy-meter continuously determined the tissue oxygen saturation, and the set-up was done to check blood pressures every 10 minutes. An alarm was set to go off if the pulse oxy meter dropped under 90%, and if blood pressure values exceeded 100 /200 mm Hg for the diastolic/systolic BP. During treatment the level of sedation was verbally assessed every 90-120 minutes. Based on the initial sedation level, if necessary, a second dose of Triazolam 0.25 mg was sublingually administered at the discretion of the dentist. (5,6)

No more than 5 doses were administered over the course of the dental appointment. Nitrous sedation was used if after the second dose of Triazolam the patient presented an insufficient level of sedation. The length of the treatment appointment varied from ½ hour (wisdom teeth extraction) up to 7 hours (complex dental appointments including surgical and restorative dentistry).

At the end of the dental appointment the patient was assisted until s/he proved a good time-space orientation, being asked the following questions: Where are you now? Do you know who are you talking to now?, What date is today?, and Who is the president of the United States (orientationx3).

Each patient had a detailed chart, with a medical history filled by the patient and reviewed by the dentist. The primary medical doctor was informed about the procedure, and a medical clearance was requested. A visual analog scale (VAS) consisting of a 10 cm long straight line with gradations at each cm was used in order to determine the patients’ subjective anxiety. (1) Patients were instructed to consider 0 as lack of anxiety, and 10 as maximum possible anxiety for them. For all the patients who received the conscious sedation the self-assessed anxiety was higher than 9.5. During the clinical exam we were able to observe psycho-somatic changes as: profuse sweating of the palms, increased heart rate, intense blushing, avoidance of the direct eye contact with the dentist, preference not to sit in the dental chair while waiting for the doctor in the treatment room.

A small number of the patients (four) refused to have an initial exam in the treatment room, preferring a discussion in the consultation room (which doesn’t have any kind of dental equipment).

The details of the dental treatment, options, advantages, and disadvantages, type of the sedation were discussed during the preliminary appointments. The patients were allowed to ask questions, and then informed consent was obtained. At the last preliminary appointment, the baseline vital signs (BP, HR, PO2) were recorded. In order to prepare the patients for the oral sedation appointment the following recommendations were made:

- no food or drinks after 9.00 pm the evening before the oral sedation appointments. This recommendation was made to reduce the possibilities for complications, and to minimize the need for using the bathroom, as this would imply the patients being alone for certain periods of time;
- no grapefruit fruits and juices, as the grapefruit inhibits CYP3A4, involved in the triazolam metabolism;
- if the patients used diuretic medication, their diuretic use was postponed if their primary care physician agreed until after the oral sedation appointment;
- if the patients used other medication they were instructed to take their medication normally;
- the patients taking diabetic medication were instructed to take their normal medication, and to bring with them juice or candy to avoid a hypo-glycemic accident.

**RESULTS**

The sex distribution of the patients requiring oral sedation was in accordance with the general sex distribution of the patients in the dental office (figure no. 3).

**Figure no. 3. Gender distribution of the oral sedation patients**

The oral sedation was administered to patients with a high value of anxiety (>9.5 on the VAS). The breakdown of procedures that the patients underwent is as following: 11% surgical (extractions, dental implants, periodontal surgery), 41% restorative and prosthodontics, and 48% complex procedures involving oral surgery and restorative procedures (figure no. 4).

There were three components in assessing the oral sedation efficacy: the state of the patients during the dental procedures under oral sedation, the need to augment the oral
sedation using nitrous sedation, and the patients’ testimonials the day after the dental appointment.

**Figure no. 4. Dental procedures with oral sedation**

There were no situations requiring the postponement of the dental treatment due to an insufficient anxiety control. The patients were relaxed during the procedure, and there were moments when they even fell asleep. While dosing off is to be expected during oral sedation, the sleep state can mask a very strong sedation (leading to deep sedation, which is to be avoided in the dental office).

To differentiate between the two, the patients were involved in short conversations to periodically assess the level of sedation. Seven patients required 5 doses of Triazolam 0.25 mg in order to achieve a comfortable level of sedation. For a 4-5 hour-long dental appointment the patients required an average of 4 doses of Triazolam 0.25 mg (including the pre-op dose). No incidents requiring reversal of sedation occurred.

A small percentage of patients (four patients – 5%) required the use of nitrous sedation in order to augment the oral sedation.

The patients’ interview the following day after the sedation showed three types of responses:

- patients with total amnesia;
- patients with minimal memories of the dental appointment – “I remember coming to the office, I remember when you numbed me, then you asked me something, and then I woke up home”;
- patients who declared that they remembered everything. For this category of patients further questions showed that the memories were not continuous, and the temporal perception was affected, as they stated that they were in the dental office for 30-40 minutes. In one situation the patient overheard a conversation between a hygienist and her patient in another treatment room, she distorted what she heard, and applied the dialog to herself, leading afterwards to a confrontational attitude. The management of the patient was done through counseling and explaining the situation.

**Figure no. 5. Satisfaction level with the oral conscious sedation**

The patients’ level of satisfaction with the sedation was 100% (figure no. 5), even for the patients who stated they remembered everything, as they also stated that they were more relaxed during the appointment. 16.45% of the patients (thirteen) were satisfied enough to ask for oral sedation for subsequent dental appointments.

**DISCUSSIONS**

Because of the high level of anxiety the majority of the population has for dental procedures (anecdotal evidence shows the general population in United States fears more the dentist than the IRS agents), the use of a safe and efficient way of conscious oral sedation represents a step forward in increasing the comfort level of patients. The first demonstration of sedation for surgery was done by a dentist, Horace Wells, in 1841. He used nitrous to demonstrate sedation for extraction of wisdom teeth, however the patient woke up during the procedure, and the demonstration was deemed a failure. Two years later, another dentist, T. G. Morton, used “ether” in a successful public demonstration at Massachusetts General Hospital. After this demonstration, sedation in various forms became a common component for general surgery. Starting with 1970 the dental community became interested again in a safe method for conscious sedation.

Conscious oral sedation can be achieved with the Triazolam, a benzodiazepine family drug. The main indication for Triazolam is for short term treatment of transitory insomnia. Triazolam is not recommended for treatment of early morning insomnia. Even though the drug use is not used in England, Brazil, and Norway due to possible strong side effects in long term use, the Food and Drug Administration decided that Triazolam can be used in the United States in small doses for a short treatment course. The use of Triazolam in dentistry is off-label. There have been no fatalities in the United States directly linked to the use of Triazolam in dental offices. In our office patients undergoing oral sedation are constantly monitored with a pulse oxymeter, and are connected to an oxygen source at a rate of 2 l/min.

In our study we observed that occasionally some patients had short term episodes of apnea, which resolved with a simple verbal command instructing the patient to breathe. We started to use an oxygen nasal cannula at 2 liters per minute to avoid oxygen desaturations. Patients with chronic obstructive pulmonary disease were kept at lower than normal oxygen saturations to mitigate their apnea risk.

A detailed medical history is necessary in order to identify patients at high risk for adverse reactions and side effects. The Triazolam metabolism is dependent on CYP3A4 mono-oxygenase. CYP3A4 has a number of inhibitors - Erythromycin, Ketoconazole, other anti-fungal medications, fluvoxamine and other antidepressants in the same class, ritonavir, Verapamil, Diltiazem and other calcium channel blockers, cimetidine, ergotamine, cyclosporine, grapefruit and grapefruit juice. It also has inducers such as Rifampin, Phenytoin, carbamazepine, Phenobarbital, St John’s Wort, cigarette smoke, etc. Knowing what medications patients are taking makes it possible to achieve the proper sedation level with Triazolam. Special care should be taken with diabetic patients so they don’t develop hypoglycemic incidents, due to the length of the dental appointment. Alcohol is a very strong Triazolam augmenter, and was absolutely contraindicated 24 hours before and after the oral sedation appointment. Elderly patients and patients with hepatic conditions require a smaller amount of Triazolam.

The Triazolam contraindications are the same ones for the benzodiazepine class: hypersensitivity to the drug class,
pregnancy, and breastfeeding, patient under treatment with ketoconazole, itraconazole, and nefazodone. If the sedation level goes into the deep sedation, it can be reversed with Flumazenil – a preferred benzodiazepine reversal agent.

Incidentally, it was observed that the patients’ trust level in the dentist increased after the oral sedation, and actually required smaller doses of Triazolam for the subsequent oral sedation appointments. But requires the dentist to have a good understanding of the medication- intended effects, side effects, adverse reactions, complications, and reversal possibilities, to get a very good medical history, and to have the necessary equipment in case of an adverse reaction or complication.(9,10)

CONCLUSIONS

The use of Triazolam leads to a good control of the pre- and post-operative dental anxiety. As a result the dental treatment can be done in a safer manner, allowing the patient an increased level of comfort, with a lack of traumatic memory.

The use of Triazolam in the dental setting is not complicated. Oral conscious sedation with Triazolam can be used in private dental offices in Romania, for outpatient dental procedures. The same sedation can be used in other medical fields for outpatient medical procedures – colonoscopies, uroscopies, small surgical procedures which do not require general anesthesia.

As of today the Triazolam is not on the list of approved drugs of the Romanian Health Department, however a careful assessment of it could suggest the appropriate commission to include it on the list of the approved medications.

REFERENCES