

# Effectiveness of Benzodiazepines Used for Oral Sedation in a Pediatric Dentistry Setting

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## Introduction

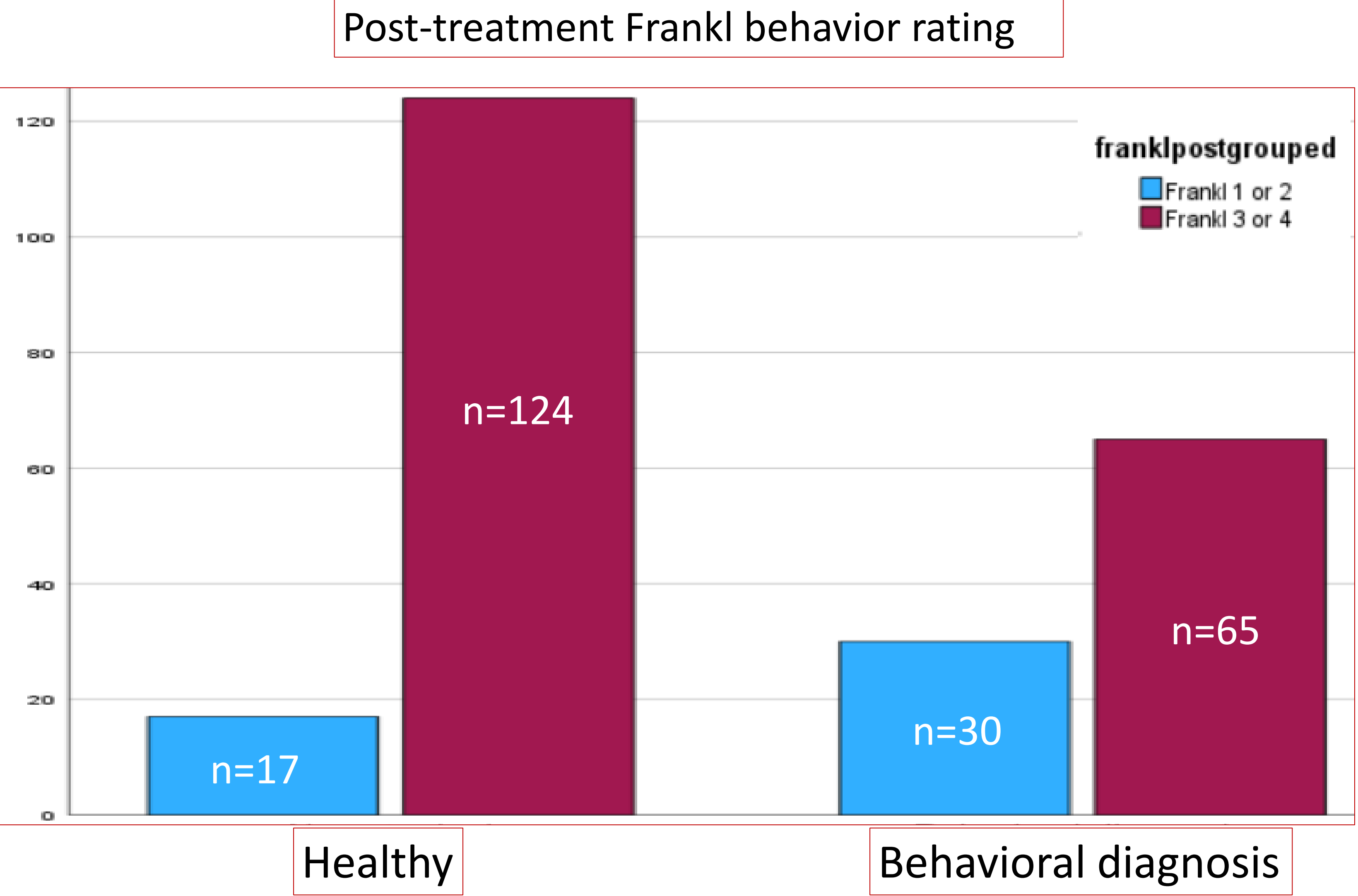
- Many studies have been conducted to determine the appropriate dose of oral midazolam in healthy patients. However, sedation in children with behavioral conditions require specialized and individualized clinical management.
- Some medications such as methylphenidate, amphetamine, and selective serotonin reuptake inhibitors used in the treatment of ADHD/ASD are stimulants and might cancel out the effect of the sedative medications.
- A review conducted by Vallogini et al.<sup>1</sup>, highlighted the need to define appropriate drugs, dosages, sedation level and evaluate patient cooperation in pediatric patients with special needs.
- The aim of this retrospective study was to examine the effectiveness of oral midazolam combined with nitrous oxide inhalation to sedate pediatric dental patients with behavioral diagnosis (ICD-10 codes F84.0, F90.9, F80.9, F41.9, F32.A, F79) compared with healthy children, age and BMI matched.

## Results

Behavioral conditions	
ICD-10 codes	Diagnosis
F84.0	Autistic disorder
F90.9	Attention-deficit hyperactivity disorder, unspecified type
F80.9	Developmental disorder of speech and language
F41.9	Anxiety disorder
F32.A	Depression
F79	Intellectual disabilities

Patient characteristics, n (%)			Total
Gender	Male	144 (61.02%)	236
	Female	92 (38.98%)	
Age (years) ± SD		7.10 ± 2.10	
Average BMI %		59.58%	
Behavioral condition	Healthy	141 (59.7%)	
	Behavioral diagnosis	95 (40.3%)	
Complexity of procedure	1 tooth treated	157 (66.5%)	
	>1 tooth treated	79 (33.5%)	
Overall behavior	Excellent/Good	119 (50.4%)	
	Fair/Poor/Prohibitive	117 (49.6%)	
Ability to complete treatment	Yes	205 (86.9%)	236
	No	31 (13.1%)	
Overall effectiveness	Effective	200 (84.7%)	236
	Ineffective	36 (15.3%)	

Assessment factor	Overall behavior (P value)	Overall effectiveness (P value)	Ability to complete treatment (P value)
Gender	0.92	0.32	0.11
Age in years	0.46	0.05	0.27
BMI %	0.51	0.60	0.26
Healthy versus Behavioral condition	0.86	0.16	0.67
One tooth versus multiple teeth treated	0.02	0.29	0.43



Children with behavioral diagnosis had 3.4 times the odds of having Frankl rating 1-2 post-sedation vs. healthy controls (95% CI 1.73-6.56, **p = 0.0004**)

## Methods

### Study population:

- A retrospective chart review of electronic dental records was conducted of patients at the Franciscan Children’s Pediatric Dentistry Clinic between January 1st, 2021 and December 31st, 2022.
- Inclusion criteria: 1) Healthy children (ASA I) or children with behavioral diagnosis 2) Ages 3-12 years old 3) Had oral sedation with 0.5 mg/kg midazolam (adjusted for patients with high BMI) for a dental procedure.
- Effectiveness was evaluated through the following variables: pre- and post-sedation Frankl behavior rating, Houpt behavior rating scale during sedation (overall behavior), ability to complete the treatment and overall effectiveness.

### Data analysis:

- Data was imported in Excel and statistically analyzed in IBM SPSS Statistics 29.0.2.0. Post-sedation Frankl rating in healthy versus children with behavioral conditions was evaluated with Odds ratio.
- Chi-square was used to evaluate the differences in overall behavior, ability to complete the treatment and overall effectiveness between the two groups.
- Logistic regression was used to analyze the effect of co-variables on the primary outcome.

## Discussion

- 0.3 and 0.5 mg/kg midazolam has been found to be safe and effective in providing operative treatment to physically and neurologically compromised pediatric dental patients<sup>2,3</sup>.
- This retrospective study allowed comparison between healthy and children with behavioral diagnosis in 3 clinically important aspects - overall behavior, ability to complete treatment, and overall effectiveness with no significant differences between the two groups.
- However, children with behavioral diagnosis showed significantly higher odds of negative behavior during the recovery period. Cortical inhibition and decrease in serotonin concentration may precipitate aggressive behaviors after administration of midazolam. This could be related to the dose of midazolam, severity of the behavioral diagnosis or age. For children undergoing multiple sedation, increasing the dose of midazolam based on the judgment that its effect was insufficient, may worsen the situation. There may be an increased need of flumazenil in these patients to reduce the effect of paradoxical reaction on the children and distress in parents during recovery period<sup>4</sup>.
- A statistically significant difference was seen in the overall behavior with increase in complexity of the treatment (one tooth versus multiple teeth treated). A retrospective study suggested the use of midazolam be restricted to simple restorations and extractions over a maximum of two visits in children with behavior problems<sup>5</sup>.
- Behavior can change intraoperatively with midazolam over the course of the visit. Behavior rating could affect the measure of effectiveness as the ability to complete treatment which often has the clinician completing the treatment even if behavior is a problem intra-operatively.
- Finally, the small sample size and use of varying concentrations of nitrous oxide, selecting patients who are anxious but not very aggressive and needing minor dental procedures increases the ability to complete treatment in a greater number of patients.

## References

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