

## A Case of Well-Managed Fibromyalgia with Autonomic Dysfunction during Dental Therapy: Analysis of Heart Rate Variability

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**Abstract:** This is the first case report of dental therapy performed on a patient with well-managed fibromyalgia (FM). FM is characterized by autonomic dysfunction (AD). Heart rate variability (HRV) analysis is useful for detecting AD. In this study, we assessed the significance of HRV analysis for FM in a dental practice. The patient was a 51-year-old Japanese female. A tooth extraction procedure was safely performed with the diagnosis of an impacted wisdom tooth. Although the dental therapy did not induce AD, it increased the scores of HRV variables related to sympathetic activity. HRV analysis revealed the latent autonomic change and proved valuable for dental management of our FM patient.

**Keywords:** Fibromyalgia, Autonomic dysfunction, Dental therapy, Heart rate variability

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### I. Introduction

Fibromyalgia (FM) is an idiopathic disease characterized by widespread musculoskeletal pain, fatigue, insomnia, irritable bowel, depression, and so on [1,2]. FM is associated with autonomic dysfunction (AD) [1-4], including neurogenic hypotension, tachycardia, and bradycardia [4-6]. Dental therapies can induce neurogenic hypotension, tachycardia, or bradycardia, potentially leading to hemodynamic instability. However, most dental practices haven't realized the importance of managing FM. Heart rate variability (HRV) analysis is useful in assessing autonomic activity and can detect AD because HRV is a biosignal for the functions of the autonomic nervous system (ANS) [7-10]. An HRV analyzer (SA-3000P, Tokyo Iken Co. Ltd., Tokyo, Japan) looks just like a pulse oximeter and analyzes pulse-to-pulse variations in pulse rate by a built-in HRV analyzing system; thus, it enables real-time monitoring of autonomic activity without subjecting patients to extra stress. However, autonomic activity in FM during dental therapy has not previously been measured or elucidated by HRV analysis. In this study, we performed dental therapy on a case of well-managed FM and assessed the value of HRV analysis for FM in dental practice.

### II. Case report

The patient was a 51-year-old Japanese female. She visited the Department of Oral Medicine, Tokushima University Hospital because of a lower left impacted wisdom tooth. She had been treated for FM with oral betamethasone (0.5 mg/day) at the Department of Internal Medicine of Tokushima University Hospital. She had experienced heart palpitations before the treatment with betamethasone. The dental therapy proceeded according to our recommended method for dental management of patients with AD (Table 1). Under the diagnosis of an impacted wisdom tooth, the dental procedure to extract the tooth was safely performed. The patient did not develop neurogenic hypotension, tachycardia, or bradycardia during dental therapy, including the local anesthesia, namely, infiltration of 1.8 ml of propitocaine hydrochloride containing 0.054 IU of felypressin and 0.9 ml of lidocaine containing 0.08% adrenaline (Table 2). HRV analysis was performed with an HRV analyzer during dental therapy. Under the intravenous sedation with midazolam (1.5 mg), normalized low-frequency (LF norm) signals decreased to 36.3 nu, whereas normalized high-frequency (HF norm) signals increased up to 63.7 nu (Table 2). Accordingly, the low-frequency/high-frequency (LF/HF) ratio decreased to 0.57 (Table 2). On bone cutting, LF norm signals increased up to 64.0 nu, whereas HF norm signals decreased

to 36.0 nu (Table 2). Accordingly, the LF/HF ratio increased to 1.78 (Table 2). It continued to rise during tooth extraction, reaching 2.56.

In advance of this study, the procedure for HRV analysis was explained to the patient. Then, her informed consent was obtained.

**Table 1** Recommended methods for dental management of patients with AD

1. Specifically inquire about the presence of AD.
2. Contact the patient’s physician as appropriate.
3. Apply real-time HRV analysis for dental management of the patients.
4. Refrain from sudden changes to the patient’s posture during dental therapy.
5. After dental therapy, slowly return the patients from the supine to upright position and then assist them to gradually stand up.

AD, autonomic dysfunction; HRV, heart rate variability.

**Table 2** Scores of HRV variables during dental therapy

	Therapy onset	Intravenous sedation	Local anesthesia	Bone cutting	Tooth extraction	Therapy end
S/DBP (mmHg)	151/90	148/86	141/86	117/73	132/79	130/77
HR (bpm)	81	80	80	89	89	90
LF (ms <sup>2</sup> )	96.8	44.7	32.3	134.8	154.0	94.1
HF (ms <sup>2</sup> )	49.6	78.3	65.3	75.9	60.1	76.5
LF norm (nu)	66.1	36.3	33.1	64.0	71.9	55.2
HF norm (nu)	33.9	63.7	66.9	36.0	28.1	44.8
LF/HF ratio	1.95	0.57	0.50	1.78	2.56	1.23

HRV, heart rate variability; S/DBP, systolic/diastolic blood pressure; HR, heart rate; LF, low frequency; HF, high frequency; LF norm, normalized low-frequency; HF norm, normalized high-frequency; LF/HF ratio, low-frequency/high-frequency ratio.

### III. Discussion

To our knowledge, this is the first case report of dental therapy performed on a patient with well-managed FM. The etiology of FM is unknown; FM has been reported in conjunction with small-fiber neuropathy (SFN) [11-13], and may be associated with AD. For the treatment of FM, pharmacotherapies that have proven beneficial include pregabalin, duloxetine, and milnacipran hydrochloride. Although steroid therapies are generally recognized as having little effect on FM, betamethasone succeeded in stabilizing autonomic function in our case. HRV variables are as follows: low frequency (LF), high frequency (HF), LF norm, HF norm, and LF/HF ratio. The LF ranges from 0.04 to 0.15 Hz and reflects sympathetic activity, whereas HF ranges from 0.15 to 0.4 Hz and reflects parasympathetic activity [14-16]; LF norm and HF norm are the proportion of sympathetic and parasympathetic activity, respectively. The LF/HF ratio is an index of autonomic balance and should be maintained between 0.5 and 2.0; higher values reflect sympathetic dominance, while lower ones reflect parasympathetic dominance. In FM patients, LF norm and HF norm are recognized to be elevated and lowered, respectively [2,17]. In our patient, LF norm and HF norm were maintained within the normal range. In this study, although the dental therapy did not induce AD, it did increase scores of HRV variables related to sympathetic activity such as LF, LF norm, and the LF/HF ratio; in short, the patient’s autonomic activity resulted in sympathetic dominance. Our experience emphasizes the importance of real-time HRV analysis with respect to secure and safe dental management of FM patients.

### IV. Conclusion

We performed dental therapy on a patient with well-managed FM. Our experience emphasizes the importance of real-time HRV analysis with respect to secure and safe dental management of FM patients.

#### Competing interests

The authors have no conflict of interests to declare regarding this study or the publication of this paper.

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