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Report

Association Between Instability in Triptan Use and Interictal Burden in Migraine: A Cross-Sectional Study

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Triptans are recommended for early use in the treatment of migraine attacks; however, real-world medication-taking behaviors and their relationship with interictal burden remain insufficiently understood. This study investigated the association between triptan use patterns and interictal burden in patients with migraine. A web-based cross-sectional survey was conducted among 302 women aged 20–59 years with migraine. Interictal burden was assessed using the Migraine Interictal Burden Scale (MIBS-4), and participants were classified into high- and low-burden groups. Triptan use, including frequency, timing of administration during migraine attacks, and patterns of medication use, was evaluated. Triptan use days were lower than headache days in both groups, suggesting that triptans were not used for all headache episodes. No significant differences were observed between groups in the type of triptan used or the timing of administration. In contrast, medication-taking behaviors differed significantly between groups. The high-burden group more frequently exhibited underuse behaviors, such as delaying or avoiding medication, as well as overuse behaviors, including early or additional dosing driven by anxiety. Satisfaction with triptan treatment was higher in the low-burden group, whereas the use of preventive medications did not differ between groups. Multivariable logistic regression analysis identified the coexistence of underuse- and overuse-related behaviors and HIT-6 score as independent factors associated with high interictal burden. These findings suggest that medication-taking behaviors characterized by both underuse- and overuse-related tendencies are independently associated with interictal burden in migraine. Future studies should evaluate whether interventions targeting maladaptive medication-taking behaviors are associated with improvements in headache management and disease burden.

Key words migraine, triptans, interictal burden, medication-taking behavior, acute treatment

INTRODUCTION

Migraine is a disorder that substantially affects quality of life and daily functioning, and its burden is not limited to headache episodes or their severity alone.[1,2] It also persists during the interictal period—the time between attacks—including restrictions in work and social activities as well as anxiety about future attacks.[1,2] In recent years, increasing emphasis has been placed on comprehensive migraine management that addresses these interictal effects.[1,2]

As an assessment tool for interictal burden, the Migraine Interictal Burden Scale (MIBS-4) has been proposed, enabling evaluation of the substantial burden experienced by patients, including limitations in daily activities and psychological impact.[1-3] This measure allows for the assessment of aspects of migraine burden that cannot be fully captured by attack frequency or intensity alone. Because MIBS-4 captures psychological and behavioral aspects of migraine burden, factors that influence medication-taking behavior—such as anxiety or hesitation regarding the use of acute migraine medications—may also be associated with interictal burden.[1-3]

Triptans have established efficacy as acute treatment for migraine, and early administration at the onset of an attack is recommended; however, in real-world clinical practice, they are not always used appropriately.[4] In particular, underuse—such as delayed intake or avoidance—represents a significant issue, as it can lead to missed opportunities for effective treatment.[5] In addition, increasing evidence suggests that not only drug selection but also patients' medication-taking behaviors, as well as their perceptions of and concerns about medications, may influence treatment outcomes.[6] These factors may contribute to maladaptive medication-taking behaviors, including delayed or avoidant triptan use. However, the relationship between triptan use behaviors—particularly the coexistence of underuse- and overuse-related behaviors—and interictal burden remains poorly understood. Therefore, this study

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aimed to examine the association between medication-taking behaviors and interictal burden in women with migraine, as assessed using MIBS-4, focusing on real-world triptan use and behaviors suggestive of both underuse and overuse.

MATERIALS AND METHODS

Study Design and Focus of Analysis This study was designed as a cross-sectional web-based survey to evaluate triptan medication-taking behaviors and their association with interictal burden in patients with migraine. In particular, we focused on medication-taking behaviors, particularly those suggestive of underuse and overuse. Variability in these behaviors was also examined descriptively.

Participants and Data Collection Participants were recruited from a large-scale commercial online panel maintained by NEO MARKETING Inc. An invitation email was distributed to 103,546 registered panel members, and 18,372 individuals responded to the survey. After applying the predefined inclusion and exclusion criteria based on migraine screening results, sex, and age, 302 eligible participants were retained for analysis.

This study was conducted with the approval of the Teikyo Heisei University Ethics Review Committee (Approval No.: 2025-118).

Participants and Migraine Identification Participants were recruited via an internet research company and consisted of women aged 20–59 years who had experienced headache within the preceding three months. Women were selected because migraine is more prevalent among women and because interictal burden and medication-taking behaviors may be influenced by sex-related factors. Restricting the study population to women was intended to reduce potential heterogeneity related to sex differences.

Participants with migraine were identified using the Japanese version of the ID Migraine screener,[7,8] which evaluates four symptoms: aggravation by daily activity, nausea, photophobia, and osmophobia. Following established criteria,[9] responses indicating occurrence at least occasionally were considered positive, and individuals with ≥2 positive responses were classified as having migraine.

Participants reporting visual aura symptoms were categorized as having migraine with aura, while the remainder were classified as having migraine without aura.[8]

Assessment of Triptan Use and Medication-Taking Behavior The primary exposure of interest was real-world triptan use behavior. Participants were asked about triptan use patterns, including frequency of use (days per month), timing of administration relative to headache onset, treatment satisfaction, and specific medication-taking behaviors. Medication-taking behaviors were assessed using multiple questionnaire items designed to capture real-world patterns of triptan use. These included behaviors suggestive of underuse (e.g., delayed or avoided intake) and overuse (e.g., early or additional dosing). Each behavior was analyzed individually rather than being combined into mutually exclusive categories, and its distribution was compared between interictal burden groups. The questionnaire items assessing triptan use patterns, treatment satisfaction, and medication-taking behaviors were developed specifically for this study. Standardized validated instruments were used to assess interictal burden, headache-related impact, and allodynia.

Coexistence of Underuse- and Overuse-Related Behaviors To evaluate the coexistence of underuse- and overuse-related behaviors, participants were classified according to their responses to the six medication-taking behavior items. Participants who reported at least one underuse-related behavior and at least one overuse-related behavior were classified as having coexistence of underuse- and overuse-related behaviors. This variable was used in the multivariable logistic regression analysis.

Assessment of Interictal Burden Interictal burden was assessed using the Migraine Interictal Burden Scale (MIBS-4), a patient-reported outcome measure assessing the impact of migraine during headache-free periods over the previous four weeks.[3]

The total score ranges from 0 to 12, with higher values indicating greater burden. Based on previous studies, participants were categorized into a low-burden group (MIBS-4 score 0–2) or a high-burden group (MIBS-4 score ≥3) for analysis.[3,8]

Assessment of Allodynia Cutaneous allodynia was assessed using the 12-item Allodynia Symptom Checklist (ASC-12), an established measure of sensory hypersensitivity associated with migraine.[10] Participants reported how often they experienced pain or unpleasant skin sensations during their most severe headache attack in response to 12 normally non-painful daily activities. Responses were scored as 0 ("not applicable," "none," or "rarely"), 1 ("sometimes"), or 2 ("half of the time or more"), and summed to obtain a total score. According to established criteria, participants were categorized as having no allodynia (0–2), mild allodynia (3–5), moderate allodynia (6–8), or severe allodynia (≥9).

Other Clinical Measures Headache-related impact was assessed using the Headache Impact Test-6 (HIT-6), a validated six-item questionnaire yielding total scores ranging from 36 to 78, with higher scores indicating greater impact.[11] In accordance with established criteria, a score of ≥56 was considered indicative of substantial headache-related impact.[8,11]

Statistical Analysis Data were summarized as mean ± standard deviation or frequency (%), as appropriate. Between-group comparisons (high vs. low interictal burden) were performed using the chi-square test for categorical variables. The distributions of monthly headache days and triptan use days were compared using the chi-square test. The relationship between headache days and triptan use days was examined descriptively as an indicator of triptan utilization. Medication-taking behaviors suggestive of underuse and overuse were analyzed individually and compared between groups. To examine factors independently associated with high interictal burden, multivariable logistic regression analysis was performed. Variables considered clinically relevant and significantly associated with interictal burden in the univariate analyses, including headache frequency (<15 vs. ≥15 days/month), HIT-6 score (≤55 vs. ≥56), allodynia severity (none-to-mild vs. moderate-to-severe), and the coexistence of underuse- and overuse-related behaviors, were entered into the model. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. A two-sided p-value < 0.05 was considered statistically significant.

RESULTS

Participant Characteristics and Clinical Features A total of 302 participants were included in the analysis, comprising

Table 1. Baseline Characteristics of Participants

	High-burden		Low-burden		p-value	
	n = 243	%	n = 59	%		
Age group						
20–29 years	37	15.2	5	8.5	0.108	
30–39 years	60	24.7	20	33.9		
40–49 years	80	32.9	13	22.0		
50–59 years	66	27.2	21	35.6		
Headache-related symptoms during the past 3 months						
Headache aggravated by routine physical activity	202	83.1	52	88.1	0.345	
Nausea	183	75.3	38	64.4	0.090	
Photophobia	200	82.3	48	81.4	0.865	
Osmophobia	180	74.1	35	59.3	0.025	*
Phonophobia	202	83.1	44	74.6	0.130	
Visual aura symptoms	115	47.3	20	33.9	0.063	
Type of migraine						
Migraine with aura	115	47.3	20	33.9	0.063	
Migraine without aura	128	52.7	39	66.1		
Headache frequency (number of headache days per month)						
0–3 days	28	11.5	20	33.9	<0.001	*
4–7 days	85	35.0	16	27.1		
8–14 days	54	22.2	16	27.1		
≥15 days	76	31.3	7	11.9		
Causes of headache (multiple responses allowed)						
Stress	187	77.0	33	55.9	0.001	*
Anxiety	93	38.3	3	5.1	<0.001	*
Lack of sleep	145	59.7	28	47.5	0.089	
Excessive sleep	49	20.2	8	13.6	0.245	
Menstruation	97	39.9	21	35.6	0.541	
Weather changes (changes in atmospheric pressure)	184	75.7	39	66.1	0.132	
Noise	76	31.3	17	28.8	0.713	
Bright light	105	43.2	20	33.9	0.193	
Flickering light	89	36.6	10	16.9	0.004	*
Odors (e.g., bad smells, cigarettes, perfume)	88	36.2	13	22.0	0.038	*
Crowded places	102	42.0	12	20.3	0.002	*
Current treatment for headache (multiple responses allowed)						
Use of prescription medications	197	81.1	50	84.7	0.512	
Use of over-the-counter medications	124	51.0	24	40.7	0.154	
Enduring headache without medication	57	23.5	16	27.1	0.556	
HIT-6 score (range: 36–78)						
Severe impact (≥60)	205	84.4	27	45.8	<0.001	*
Substantial impact (56–59)	25	10.3	16	27.1		
Some impact (50–55)	12	4.9	6	10.2		
Little or no impact (≤49)	1	0.4	10	16.9		
Allodynia score (range: 0–24)						
Severe (≥9)	37	15.2	2	3.4	0.025	*
Moderate (6–8)	23	9.5	2	3.4		
Mild (3–5)	44	18.1	12	20.3		
None (0–2)	139	57.2	43	72.9		
MIBS-4 score (range: 0–12)						
Severe (≥5)	191	78.6	0	0.0	(-)	
Moderate (3–4)	52	21.4	0	0.0		
Mild (1–2)	0	0.0	26	44.1		
None (0)	0	0.0	33	55.9		

* $p < 0.05$, high-burden group vs. low-burden group

243 participants in the high-burden group and 59 in the low-burden group (Table 1). Age distribution did not differ significantly between groups (Table 1). Among migraine-associated symptoms, osmophobia was significantly more frequent in the high-burden group ($p = 0.025$, Table 1). Migraine subtype distribution did not differ significantly between groups, although migraine with aura tended to be more common in the high-burden group (47.3% vs. 33.9%, $p = 0.063$, Table 1). Headache frequency was significantly higher in the high-burden group (Table 1).

Migraine Triggers and Disease Severity Indicators In addition, migraine triggers, including stress, anxiety, flickering lights, odors, and crowded environments, were reported significantly more frequently in the high-burden group (Table 1). In contrast, no significant between-group differences were observed in treatment patterns, including the use of prescribed medications, over-the-counter medications, or no medication (Table 1). Cutaneous allodynia was significantly more prevalent in the high-burden group ($p = 0.025$), and HIT-6 scores were significantly higher than those in the low-burden group ($p < 0.001$, Table 1).

Headache Frequency and Triptan Use Figure 1 compares the distributions of headache-day frequency and triptan-use-day frequency in the high- and low-burden groups. In both

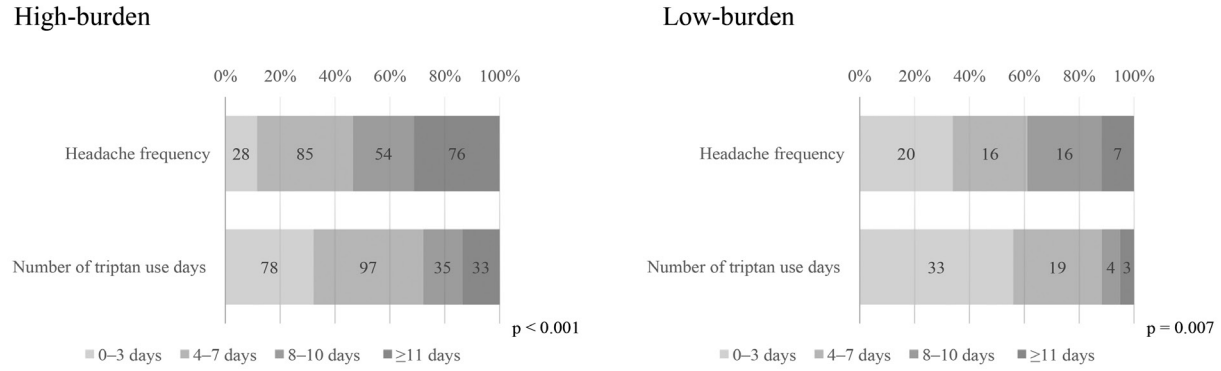

Fig. 1. Comparison of Headache Frequency and Number of Triptan Use Days in the High- and Low-Burden Groups

The distribution of monthly headache frequency and number of triptan use days is shown for each interictal burden group. Data are presented as the number of participants in each category. In both groups, the distribution of triptan use days was shifted toward lower-frequency categories compared with the distribution of headache days ($p < 0.001$ for high-burden group; $p = 0.007$ for low-burden group).

groups, the distribution of triptan use days was shifted toward lower-frequency categories compared with the distribution of headache days ($p < 0.001$ for the high-burden group; $p = 0.007$ for the low-burden group).

No significant differences were observed between the groups in the types of triptans used or the timing of administration (Table 2). There was also no difference in the proportion of appropriate use (defined as triptan use at the onset of mild pain) (Table 2). However, the distribution of monthly triptan use days differed significantly between groups, with the low-burden group more frequently reporting 0–3 days of use per month ($p = 0.005$, Table 2).

Medication-Taking Behaviors Regarding medication-related behaviors, the high-burden group more frequently reported underuse-related behaviors, including using triptans only as a last resort, refraining from use because of cost, and waiting without taking medication when pain was mild (Table 2). Overuse-related behaviors, including anxiety-driven early dosing, additional dosing due to concerns about efficacy, and exceeding the recommended dose, were also significantly more common in the high-burden group (Table 2). Satisfaction with triptan use was significantly higher in the low-burden group ($p = 0.016$, Table 2).

Preventive Treatment Use and Satisfaction The proportion of participants receiving preventive medications did not differ significantly between the high- and low-burden groups (41.2% vs. 37.3%, $p = 0.587$, Table 3). Likewise, satisfaction with preventive treatment did not differ significantly between groups ($p = 0.300$, Table 3). Although not statistically significant, a greater proportion of participants in the low-burden group reported being satisfied with preventive treatment (31.8% vs. 16.0%, Table 3).

Regarding preventive medication type, lomerizine and valproate were among the most commonly used agents in both groups, accounting for 36.0% and 28.0% of preventive medication users in the high-burden group and 40.9% and 36.4% in the low-burden group, respectively (Table 3). Amitriptyline and traditional Japanese herbal medicines (e.g., Goreisan) were also used by some participants (Table 3).

Multivariable Analysis of Factors Associated with Interictal Burden A variable representing the coexistence of underuse- and overuse-related behaviors was derived from six questionnaire items assessing medication-taking behaviors. To determine whether medication-taking behavior was independently associated with interictal burden, a multivariable logistic regression analysis was performed. Variables significantly associated with interictal burden in the univariate analyses were entered into the model. The HIT-6 score (≤55 vs. ≥56) and the coexistence of underuse- and overuse-related behaviors remained independently associated with high interictal burden. Participants with a HIT-6 score of ≥56 had a significantly higher likelihood of belonging to the high-burden group (OR = 5.090, 95% CI: 2.137–12.181, $p < 0.001$). In addition, the coexistence of underuse- and overuse-related behaviors was independently associated with high interictal burden (OR = 3.920, 95% CI: 1.868–8.227, $p < 0.001$) (Table 4).

DISCUSSION

Principal Findings In this study, we examined the relationship between real-world triptan use and interictal burden in patients with migraine. The results showed that neither the type of triptan nor the timing of administration was associated with interictal burden. In the present study, medication-use behaviors, including both underuse- and overuse-related behaviors, were associated with greater interictal burden. This finding is consistent with previous reports suggesting that medication-taking behaviors may influence migraine-related outcomes.[12)]

Specifically, patients in the high-burden group more frequently reported underuse-related behaviors, such as avoiding medication or delaying intake. They also reported overuse-related behaviors, including early dosing or additional dosing in response to anxiety.[5)]

Overall, these findings suggest that patients with greater interictal burden may exhibit the coexistence of underuse- and overuse-related medication-taking behaviors. In the present study, satisfaction with triptan treatment was lower in the high-burden group. Our findings also suggest a potential relationship between treatment satisfaction and medication-taking behavior. Similar associations have been reported previously.[12)]

Furthermore, multivariable analysis demonstrated that the coexistence of underuse- and overuse-related behaviors remained independently associated with interictal burden even after adjustment for clinical factors. This finding suggests that

Table 2. Triptan Use and Treatment Satisfaction

	High-burden		Low-burden		p-value	
	n = 243	%	n = 59	%		
Triptan formulations used (multiple responses allowed)						
Sumatriptan tablets (e.g., Imigran®)	63	25.9	21	35.6	0.137	
Sumatriptan nasal spray (e.g., Imigran®)	10	4.1	2	3.4	1.000	
Sumatriptan oral solution (e.g., Sumatriptan oral solution)	5	2.1	2	3.4	0.626	
Sumatriptan self-injection kit (e.g., Imigran®)	9	3.7	2	3.4	1.000	
Zolmitriptan tablets (e.g., Zomig®)	29	11.9	7	11.9	0.988	
Zolmitriptan orally disintegrating tablets (e.g., Zomig® OD)	30	12.3	5	8.5	0.405	
Eletriptan tablets (e.g., Relpax®)	50	20.6	13	22.0	0.805	
Rizatriptan tablets (e.g., Maxalt®)	33	13.6	5	8.5	0.289	
Rizatriptan orally disintegrating tablets (e.g., Maxalt® OD)	30	12.3	4	6.8	0.225	
Naratriptan tablets (e.g., Amerge®)	39	16.0	10	16.9	0.867	
Timing of triptan use (multiple responses allowed)						
At the prodromal stage (before pain onset)	75	30.9	24	40.7	0.150	
Immediately after pain onset (while pain is still mild)	140	57.6	34	57.6	0.998	
After pain becomes moderate	94	38.7	18	30.5	0.244	
After pain becomes severe	48	19.8	7	11.9	0.159	
After the peak of pain has passed	16	6.6	3	5.1	1.000	
Do not take medication during some attacks	45	18.5	11	18.6	0.982	
Appropriate use (selection of “immediately after pain onset” only)	59	24.3	15	25.4	0.855	
Number of triptan use days per month						
0–3 days	78	32.1	33	55.9	0.005	*
4–7 days	97	39.9	19	32.2		
8–10 days	35	14.4	4	6.8		
≥11 days	33	13.6	3	5.1		
Perceptions of triptan use						
I reserve triptans as a last resort because they are strong medications						
Never	49	20.2	24	40.7	0.002	*
Rarely	59	24.3	17	28.8		
Sometimes	84	34.6	13	22.0		
Often	51	21.0	5	8.5		
I refrained from taking triptans because I felt they were expensive						
Never	75	30.9	37	62.7	<0.001	*
Rarely	65	26.7	8	13.6		
Sometimes	70	28.8	10	16.9		
Often	33	13.6	4	6.8		
I did not take triptans because I thought the pain was mild and waited instead						
Never	20	8.2	14	23.7	0.005	*
Rarely	40	16.5	12	20.3		
Sometimes	126	51.9	23	39.0		
Often	57	23.5	10	16.9		
I took triptans early even when the pain was mild because I felt anxious without them						
Never	43	17.7	23	39.0	<0.001	*
Rarely	70	28.8	23	39.0		
Sometimes	89	36.6	8	13.6		
Often	41	16.9	5	8.5		
I took additional doses of triptans because I was concerned about their effectiveness						
Never	102	42.0	39	66.1	0.008	*
Rarely	76	31.3	13	22.0		
Sometimes	53	21.8	6	10.2		
Often	12	4.9	1	1.7		
I have taken triptans more frequently than instructed by a doctor or pharmacist						
Never	152	62.6	52	88.1	0.001	*
Rarely	38	15.6	6	10.2		
Sometimes	45	18.5	1	1.7		
Often	8	3.3	0	0.0		
Satisfaction with triptan treatment						
Satisfied	45	18.5	21	35.6	0.016	*
Somewhat satisfied	149	61.3	32	54.2		
Somewhat dissatisfied	38	15.6	6	10.2		
Dissatisfied	11	4.5	0	0.0		
Coexistence of underuse- and overuse-related behaviors[1)]						
No	94	38.7	48	81.4	<0.001	*
Yes	149	61.3	11	18.6		

* $p < 0.05$, high-burden group vs. low-burden group

[1)] Participants reporting at least one underuse-related behavior and at least one overuse-related behavior were classified as "Yes".

Table 3. Use of Preventive Medications and Treatment Satisfaction

	High-burden		Low-burden		p-value
	n = 243	%	n = 59	%	
Current use of preventive medication					
Yes	100	41.2	22	37.3	0.587
No	143	58.8	37	62.7	
Satisfaction with preventive medication	(n = 100)		(n = 22)		
Satisfied	16	16.0	7	31.8	0.300
Somewhat satisfied	52	52.0	11	50.0	
Somewhat dissatisfied	21	21.0	3	13.6	
Dissatisfied	11	11.0	1	4.5	
Types of preventive medications used (multiple responses allowed)	(n = 100)		(n = 22)		
Lomerizine (e.g., Migsis®)	36	36.0	9	40.9	(-)
Dimetotiazine (e.g., Migristen®)	7	7.0	1	4.5	(-)
Valproate (e.g., Depakene®, Selenica-R®)	28	28.0	8	36.4	(-)
Propranolol (e.g., Inderal®)	10	10.0	1	4.5	(-)
Amitriptyline (e.g., Tryptanol®)	21	21.0	1	4.5	(-)
Topiramate (e.g., Topina®)	3	3.0	0	0.0	(-)
Clonazepam (e.g., Rivotril®, Landosen®)	11	11.0	2	9.1	(-)
Anti-CGRP pathway monoclonal antibodies (galcanezumab, fremanezumab, erenumab)	8	8.0	1	4.5	(-)
Goreisan	18	18.0	3	13.6	(-)
Goshuyuto	8	8.0	2	9.1	(-)
Others	8	8.0	3	13.6	

Statistical comparisons were performed only where appropriate; no statistical comparison was conducted for variables with small sample sizes.

Table 4. Multivariate Analysis of Factors Associated with Interictal Burden

Variable	β	OR	95% Confidence interval	p-value
HIT-6 score	1.623	5.090[1)]	2.127 - 12.181	<0.001
Coexistence of underuse- and overuse-related behaviors	1.366	3.920[2)]	1.868 - 8.227	<0.001

OR, odds ratio = exp(β)
[1)] ≦ 55 vs. ≧ 56
[2)] No vs. Yes

medication-taking behaviors may be associated with interictal burden beyond the effect of headache-related impact alone.

In contrast, neither the use of preventive medications nor satisfaction with preventive treatment differed significantly between the high- and low-burden groups. Although preventive therapy is an important component of migraine management, these findings suggest that the association between medication-taking behavior and interictal burden was not simply attributable to differences in preventive treatment status.

Discrepancy Between Headache Frequency and Triptan Use In addition, the comparison between headache days and triptan use days revealed that triptan use was lower than headache frequency in both groups (Fig. 1). This discrepancy indicates that triptans were not used for every headache episode. However, because some headache days may not require triptan treatment, this finding alone should not be interpreted as direct evidence of underuse. Nevertheless, the underuse-related behaviors identified in Table 2, including delaying or avoiding triptan use, support the possibility that underuse may contribute to this discrepancy in at least a subset of patients. Notably, this tendency was observed regardless of burden level, suggesting that underuse-related medication-taking behaviors may be a common issue in migraine management.[4,13)]

Limitations of Timing-Based Indicators Although early use of triptans is generally recommended,[14)] this study found no significant association between dosing timing and interictal burden. This finding suggests that a single indicator, such as early medication use, may be insufficient to fully explain differences in interictal burden. Rather, underuse behaviors, including delayed intake and avoidance of medication, may be associated with missed opportunities for appropriate treatment.[5)] Previous studies have suggested that such behaviors may be related to poorer headache control and greater interictal burden.[2)]

Influence of Patient Perceptions and Underuse Behaviors In the present study, underuse-related behaviors, such as reserving triptans as a last resort because they are perceived as strong medications and refraining from use because of cost, were significantly more common in the high-burden group. These findings suggest that patients' perceptions and beliefs about medications, as well as economic factors, may influence medication-taking behavior.[6,15)]

Instability in Medication-Taking Behavior (Underuse and Overuse) At the same time, overuse-related behaviors, such as anxiety-driven early dosing and additional dosing because of concerns about insufficient efficacy, were also more frequently observed in the high-burden group. This pattern suggests that the issue is not limited to underuse alone. Rather, patients with greater interictal burden may exhibit the coexistence of both underuse- and overuse-related medication-taking behaviors.

Based on previous reports, medication-taking behaviors characterized by both underuse- and overuse-related tendencies may be associated with missed opportunities for appropriate treatment and excessive medication use.[5)]

These findings may reflect the complexity of real-world

medication-taking behaviors, in which delayed and excessive use can coexist.

Study Limitations Several limitations of this study should be noted. First, as this was a cross-sectional study, causal relationships cannot be established. Second, because medication-taking behaviors were based on self-reported data, the possibility of information bias cannot be excluded. Furthermore, as this was a web-based survey limited to female participants, the study population may have been biased toward specific characteristics, which may restrict the generalizability of the findings.[16] In addition, the background factors influencing the selection of triptans and detailed histories of their prior use may not have been fully captured. Furthermore, the coexistence of underuse- and overuse-related behaviors was used as a proxy indicator of behavioral instability and was not assessed using a validated measure specifically designed to evaluate behavioral instability. Future longitudinal studies are warranted to clarify the temporal relationship between medication-taking behaviors and interictal burden and to determine whether interventions targeting unstable medication-use behaviors can improve headache outcomes.

Conflict of interest The authors declare no conflict of interest.

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