

ORP Quantification of PLMs and Sleep Disturbance in Patients with RLS

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Introduction

- Whereas restless legs syndrome (RLS) is primarily a complaint of wakefulness, it is often accompanied by frequent periodic leg movements (PLMs) during sleep which are thought to contribute to sleep disruption and daytime deficits¹.
- Evidence from the Sleep Heart Health Study² (SHHS) revealed that RLS may be a risk factor for cardiovascular disease. A possible mechanism for this may be the frequent disruptions from PLMs which have been shown to vary in both intensity as well as in concomitant changes in heart rate and EEG³.
- Despite the PLMs revisions to the Rechtschaffen and Kales⁴ (R&K) scoring system, little can be said about the role of PLMs in sleep except that they may or may not be associated with arousals. There remains a need to quantify sleep disruption.
- The newly developed Michele Scoring System⁵ (MSS) has been validated to show high inter-rater and inter-laboratory reliability for scoring sleep stages and respiratory disturbance.
- The Michele system generates an elaborate algorithmic value called ORP (odds ratio product) which is the probability that the power spectrum of EEG pattern analyzed on three second interval reflects a waking pattern. The ORP index ranges from 0 to 2.5 with higher values reflecting lighter sleep (Table 1). Average ORP values can be determined over specific times or sleep stages. Thus, unlike R & K, which provides a value for the dominant sleep stage pattern in thirty second epochs, ORP reflects a continuum of sleep depth and disruption that needs to be characterized in a variety of sleep pathologies.
- In an accompanying poster (No. 37), we demonstrated a correlation between non-REM levels of alpha wave intrusion and mean non-REM ORP values.
- The current study was conducted to assess the levels of sleep disruption seen in patients with RLS.

Methods

- Seven patients meeting the International Restless Legs Syndrome (IRLS) rating scale criteria for moderate to severe RLS underwent baseline PSG recordings.
- Records were scored for sleep stages, respiratory parameters and PLMs using MSS. ORP values were established for all sleep stages (lights off to lights on) and non-REM sleep (stages 1-3). Figure 1 shows a sample stage 2 sleep EEG and ORP in RLS with and without PLMs.
- Data was analyzed using the SPSS statistical software, version 20.

Results

- Patients were 4 females and 3 males, mean age 52.7 ± 10.5 years, and mean IRLS score 27.4 ± 6.1.
- Patients averaged 37.1 ± 17.4 PLMs per hour of sleep and mean nightly total PLMs with arousals of 67.1 ± 35.0. Patients showed significant sleep disturbance by objective sleep parameters (Table 2).
- All-stages ORP for the RLS patients was 1.13 ± 0.24 and the non-REM ORP was 0.66 ± 0.23. The all-stages ORP values approximated values previously reported in patients with moderate OSA⁶.
- All-stages ORP correlated with PLMs per hour of sleep with a Pearson correlation coefficient of 0.756 (p= 0.049).
- non-REM ORP correlated with number of PLMs with arousals (r= 0.78, p= 0.039) (Figure 2, A).
- non-REM ORP and the total number of PLMs with arousals correlated with the severity of sleep disturbance (item #4 of the IRLS scale) (r= 0.83, p= 0.020; r= 0.81, p= 0.028 respectively) (Figure 2, B & C).

Table 1. The Odds Ratio Product (ORP) levels and predicted vigilance

ORP	Predicted vigilance
0.0-1.0	Sleep
(0.0-0.5)	deep sleep
(0.5-1.0)	light sleep
1.0-2.0	Unstable sleep
2.0-2.5	Wake

Table 2. PSG-recorded Parameters of subjects with RLS (n=7)

Mean ± SD	
Sleep continuity	
LSO, minutes	40.5 ± 23.4
TST, minutes	359.9 ± 71.0
WASO, minutes	109.4 ± 82.4
NAASO	41.8 ± 15.7
Sleep efficiency, %	70.7 ± 14.5
Arousal index [hr]	34.9 ± 15.5
PLMs index [hr]	37.1 ± 17.4
Sleep architecture	
Stage 1, % of TST	17.1 ± 7.3
Stage 2, % of TST	54.4 ± 5.5
Stage 3, % of TST	8.7 ± 6.0
REM, % of TST	19.6 ± 5.7

Figure 1. Typical stage 2 and Odds Ratio Product (ORP) in RLS with and without PLMs

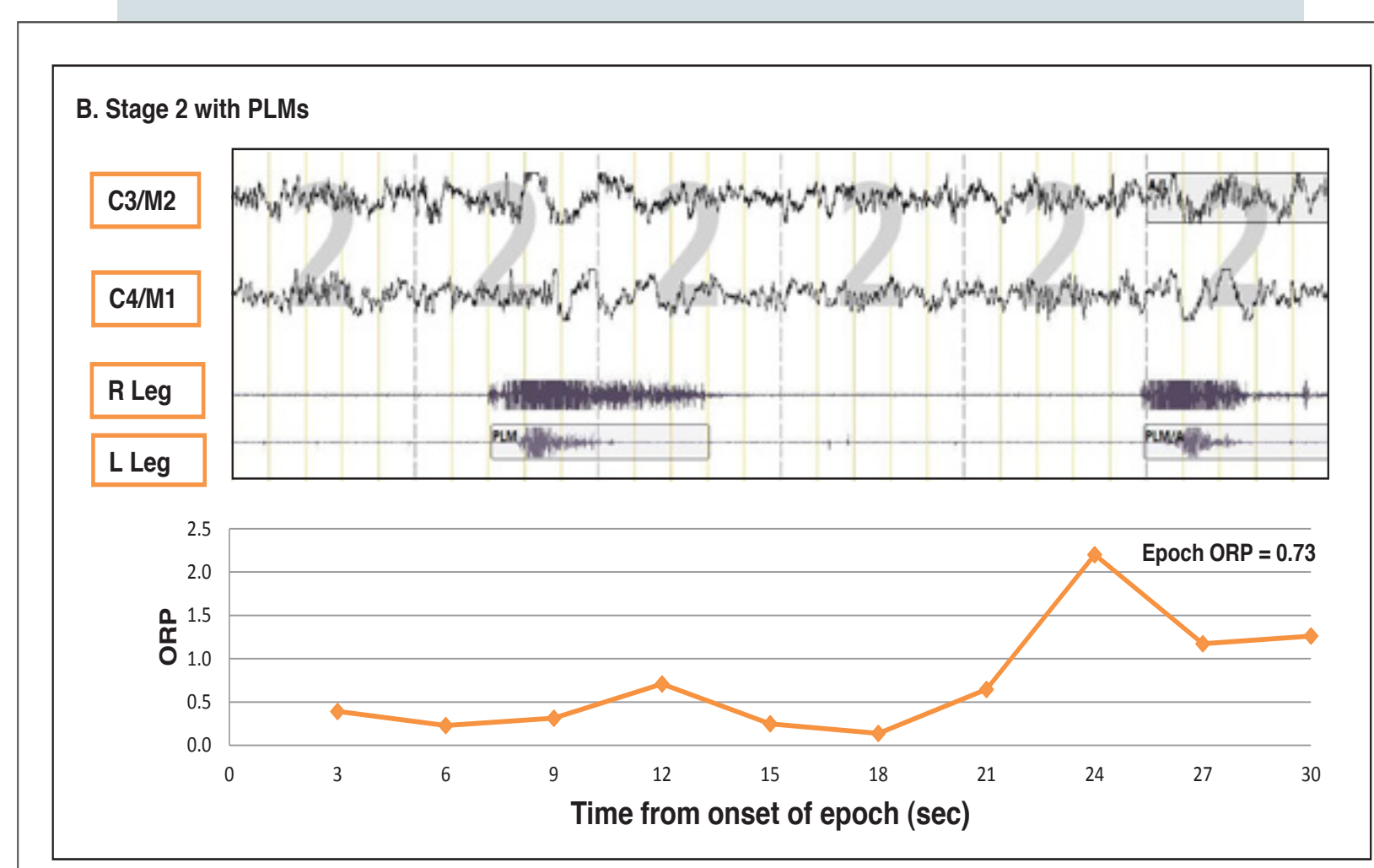
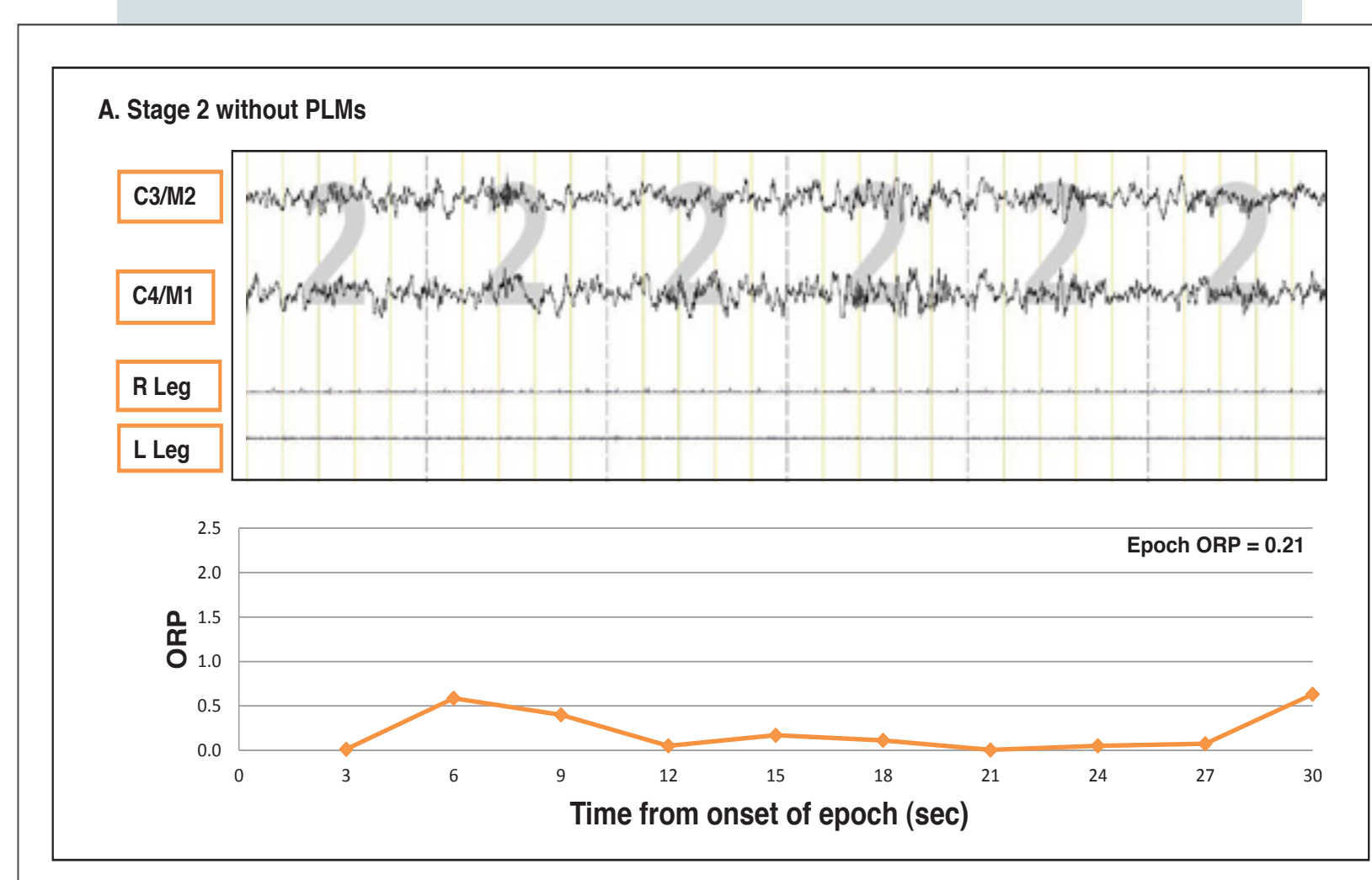
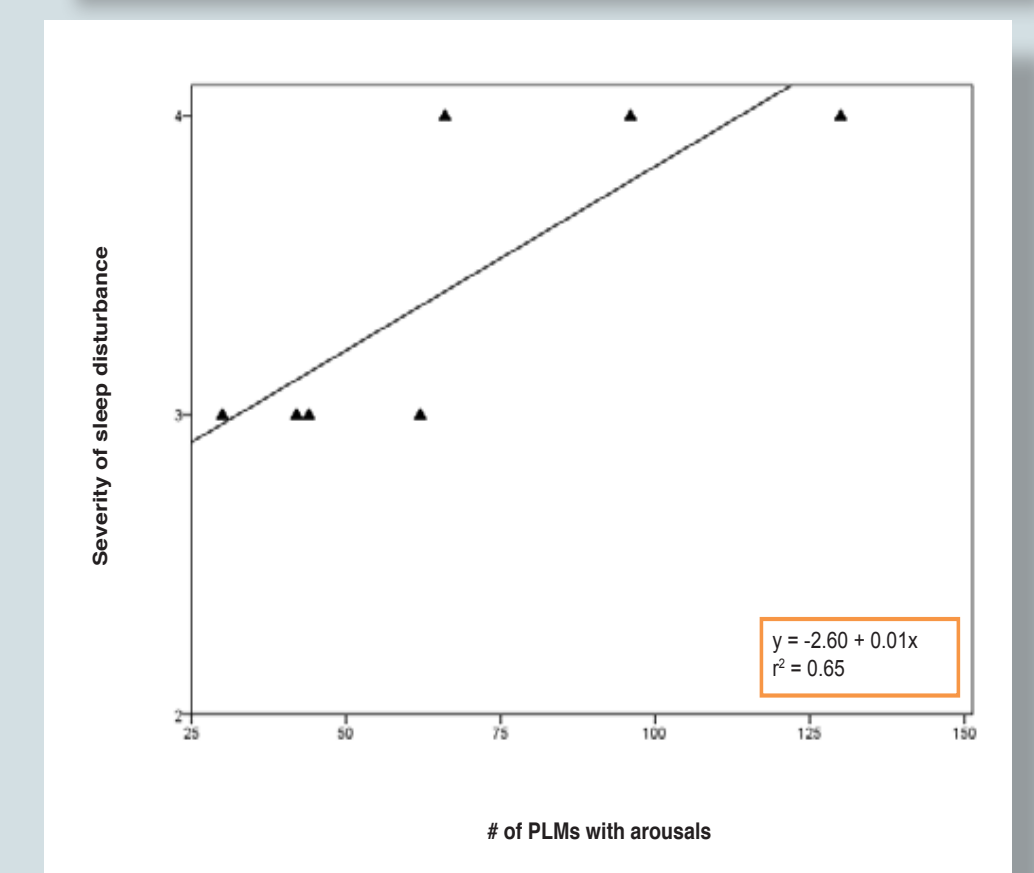
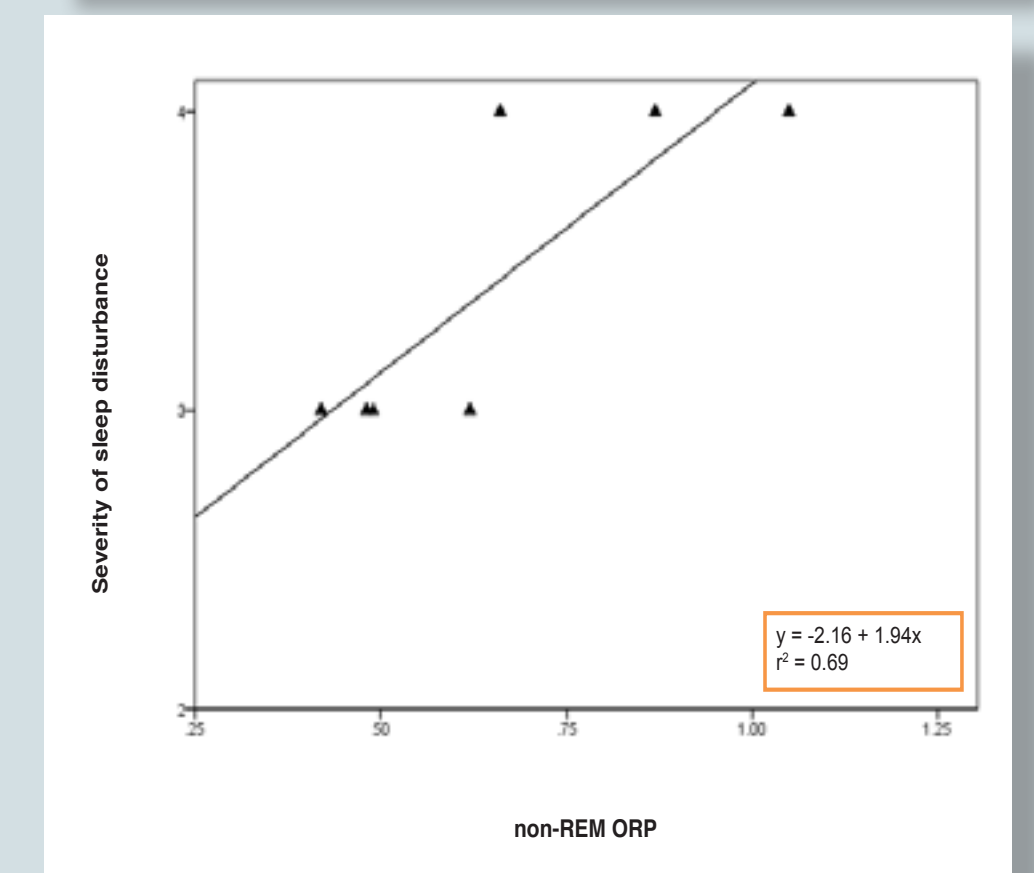
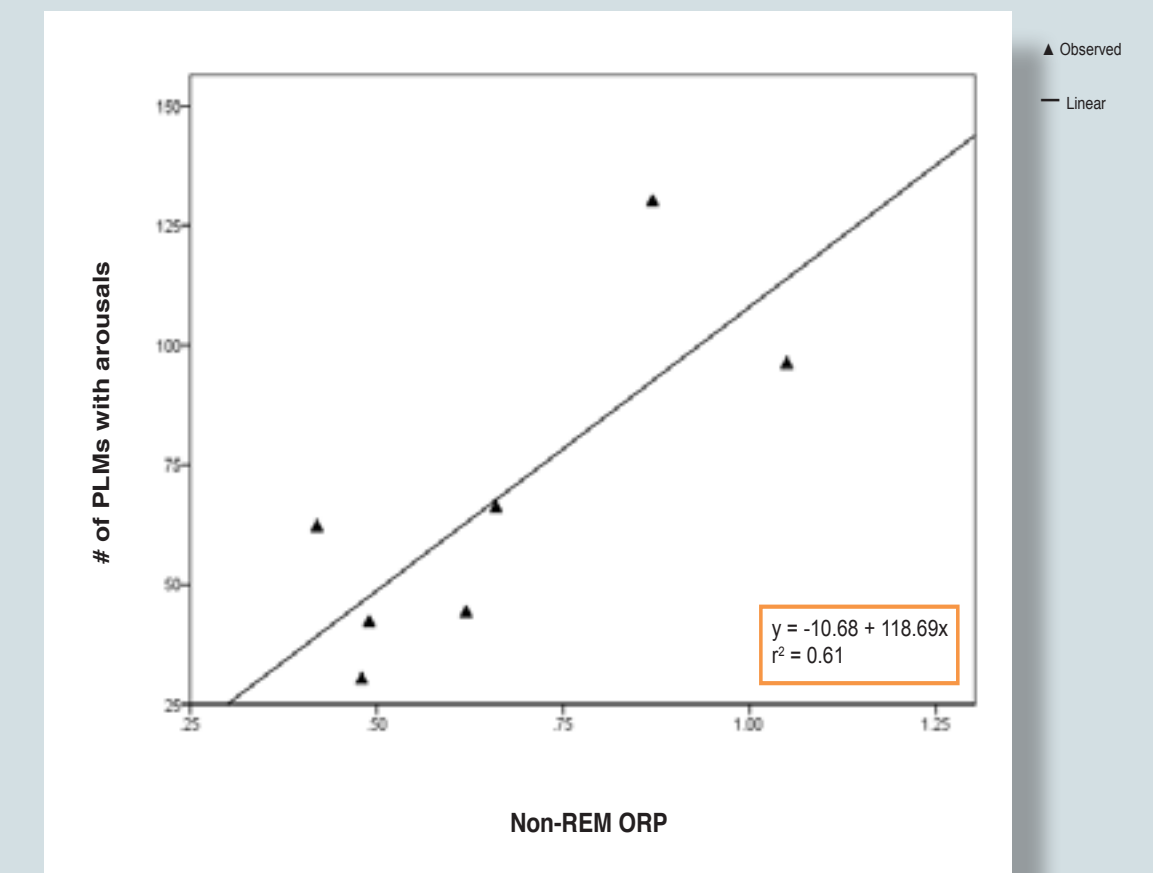


Figure 2. Correlation between non-REM ORP, PLMs with arousals and severity of sleep disturbance in patients * with RLS



*Item #4 of the International Restless Legs Scale (IRLS) - severity of sleep disturbance due to RLS symptoms in the past week *0= none, 4 = very severe.* ORP = Odds Ratio Product.

Conclusion

- ORP predicted both subjective and objective severity of sleep disturbance in patients with RLS.
- Sleep disruptions and ORP values associated with PLMs may be similar to levels previously reported for OSA.
- Future studies comparing patients with PLMs with and without RLS may shed light on the morbidity of RLS reported in the SHHS.
- Future studies should also clarify the relationship between objectively derived ORP and subjective assessments of sleep quality.

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