**Supplementary Files**

**eFigure 1. Timeline of Intervention**



BLTL: Bright light therapy group; DRL: Dim red light group; TAU: Treatment as usual

**eTable 1. Light therapy and adherence in dim red light (DRL) and bright light therapy (BLT) groups, (mean ± standard deviation)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Time effect | Group effect | Group\*time interaction |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | p-valuea |
| Prescribed LT starttime, HH:MM | DRLBLT | 10:35±02:2710:32±02:17 | 10:30±02:2310:17±02:14 | 10:00±02:2309:53±02:01 | 9:45±02:0909:33±01:52 | 09:32±02:0109:30±01:50 | <0.001 | 0.59 | 0.54 |
| LT Start time recorded by sleep diary, HH:MM | DRLBLT | 10:59±02:2610:31±02:04 | 11:13±02:1409:58±02:04 | 10:38±02:1409:51±02:02 | 10:28±02:0509:43±01:49 | 10:15±02:0509:46±01:47 | <0.001 | 0.069 | 0.028 |
| Weekly total duration of light therapy, min (%) | DRLBLT | 156 (74)161 (76) | 141 (67)162 (77) | 120 (57)158 (75) | 129 (61)147 (70) | 125 (59)137 (65) | 0.021 | 0.16 | 0.14 |
| Weekly appropriately-timed LTb , min (%) | DRLBLT | 99 (47)130 (62) | 96 (46)104 (50) | 70 (33)95 (45) | 84 (40)84 (40) | 74 (35)78 (37) | 0.001 | 0.20 | 0.24 |

a By linear mixed model; b Weekly appropriately-timed LT was defined as “total duration of light therapy carried out over the past treatment week that overlap with or earlier than the prescribed light therapy time”.

**eTable 2. Sensitivity analysis**

**Comparison of secondary outcomes between the dim red light (DRL) and bright light therapy (BLT) group in participants who had total duration of LT performed >50% of the total 5-week treatment duration (mean ± standard deviation)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| N=70 |  | Baseline | Week1 | Week2 | Week3 | Week4 | Week5 | Post-1w | Post-1m | Post-2m | Post-5m | Time effect | Groupeffect | Time x Group interaction |
|  |  |  |  |  |  |  |  |  |  |  |  | p-valuea |
| HAM-A | DRL | 23.2±10.6 | 20.4±11.4 | 17.8±10.4 | 20.5±11.1 | 19.3±10.2 | 18.4±9.8 | 18.5±11.3 | 20.3±10.8 | 20.5±11.9 | 18.3±11.4 | 0.001 | 0.055 | 0.32 |
| BLT | 20.5±11.9 | 19.4±11.2 | 14.4±11.6 | 14.7±10.6 | 15.7±10.8 | 14.8±10.4 | 13.6±9.1 | 13.1±9.0 | 16.4±10.6 | 16.6±10.8 |  |  |  |
| HADS | DRL | 22.6±6.6 | 22.3±6.8 | 22.8±7.2 | 22.1±6.6 | 20.8±7.5 | 20.4±7.2 | 21.6±7.5 | 22.3±8.3 | 21.9±7.6 | 22.2±7.3 | <0.001 | 0.004 | 0.10 |
| BLT | 20.3±5.8 | 19.0±7.7 | 18.5±6.6 | 18.0±7.6 | 16.8±7.8 | 16.8±7.7 | 16.4±7.8 | 15.7±7.5 | 16.2±7.6 | 17.9±8.7 |  |  |  |
| ISI | DRL | 17.7±5.2 | 18.1±6.2 | 17.1±5.4 | 16.6±6.5 | 15.9±6.9 | 16.6±7.0 | 16.3±7.7 | 16.2±6.4 | 15.7±6.5 | 16.1±7.0 | 0.008 | 0.224 | 0.092 |
| BLT | 17.7±5.8 | 17.0±5.8 | 15.8±6.2 | 14.8±5.6 | 15.5±5.5 | 13.7±6.5 | 14.1±6.2 | 13.1±6.2 | 14.7±6.6 | 13.7±5.6 |  |  |  |
| BSSI | DRL | 11.3±7.1 | 10.3±7.0 | 9.7±6.9 | 10.4±6.7 | 9.4±6.2 | 8.5±6.5 | 10.2±6.7 | 8.9±6.6 | 9.4±6.9 | 9.0±6.5 | <0.001 | 0.925 | 0.13 |
|  | BLT | 12.3±5.4 | 10.8±5.7 | 10.4±5.5 | 9.1±5.7 | 8.8±5.8 | 8.6±6.1 | 8.7±5.9 | 8.5±6.6 | 8.6±5.9 | 9.6±5.9 |  |  |  |
| CFS | DRL | 21.2±6.1 | NA | NA | NA | NA | 18.9±7.8 | NA | 19.3±7.2 | 18.7±7.5 | 18.8±7.8 | 0.001 | 0.100 | 0.075 |
|  | BLT | 20.7±6.6 |  |  |  |  | 16.6±7.3 |  | 14.9±6.5 | 17.4±7.4 | 15.6±5.9 |  |  |  |
| SF-36 | DRL | 245±103 | NA | NA | NA | NA | 270±114 | NA | 273±156 | 268±128 | 276±145 | 0.016 | 0.007 | 0.28 |
|  | BLT | 313±108 |  |  |  |  | 367±147 |  | 341±130 | 331±142 | 357±158 |  |  |  |
| YMRS | DRL | 0.8±1.6 | 0.9±1.5 | 0.6±1.3 | 0.8±1.4 | 0.8±1.3 | 0.9±1.7 | 0.9±2.2 | 0.6±1.4 | 1.1±2.6 | 1.1±2.0 | 0.635 | 0.815 | 0.89 |
| BLT | 0.9±1.6 | 0.6±1.1 | 0.7±2.2 | 0.7±1.6 | 0.7±1.3 | 1.1±2.7 | 0.8±1.1 | 0.7±1.2 | 0.8±1.1 | 0.7±1.6 |  |  |  |

a By Linear mixed model

 NA: CFS and SF-36 enquires symptoms over the past 1 month, thus were administered at the baseline, fifth treatment week, P1m, P2m, and P5m only

Abbreviations: HAM-A: Hamilton Anxiety Rating Scale; HADS: Hospital Anxiety Depression Scale; ISI: Insomnia Severity Index; BSSI: Beck Scale for Suicidal Ideation; CFS: Chadler Fatigue Scale; SF-36: 36-item Short Form Health Survey ; YMRS: Young Mania Rating Scale

**eTable 3. Summary of sleep parameters by sleep diary (mean ± standard deviation)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| N=93 |  | Baseline | Week1 | Week2 | Week3 | Week4 | Week5 | Post-1w | Post-1m | Post-2m | Post-5m | Time effect | Groupeffect | Time x Group interaction |
|  |  |  |  |  |  |  |  |  |  |  |  | p-valuea |
| Bedtime,  | DRL | 01:25±01:58 | 01:27±01:51 | 01:23±01:58 | 01:24±01:58 | 01:19±02:02 | 01:17±01:48 | 01:10±01:49 | 01:03±01:32 | 01:23±02:18 | 00:16±01:30 | 0.003 | 0.42 | 0.25 |
| HH:MM | BLT | 01:18±01:38 | 01:11±01:32 | 01:13±01:47 | 01:07±01:26 | 00:59±01:17 | 00:58±01:06 | 00:59±01:32 | 01:07±01:22 | 01:15±01:34 | 01:13±01:34 |  |  |  |
| Time to fall sleep, HH:MM | DRL | 02:01±01:56 | 02:02±01:47 | 02:04±01:53 | 01:57±01:53 | 01:42 ±01:53 | 01:47±01:50 | 01:41±01:43 | 01:35±01:35 | 02:00±02:10 | 00:53±01:29 | 0.009 | 0.21 | 0.25 |
| BLT | 01:55±01:29 | 01:41±01:25 | 01:41±01:34 | 01:35±01:23 | 01:25±01:25 | 01:20±01:10 | 01:23±01:33 | 01:34±01:32 | 01:39±01:31 | 01:40±01:28 |  |  |  |
| Wake time, HH:MM | DRL | 09:32±02:22 | 09:45±02:31 | 09:33±02:17 | 09:22±02:24 | 09:20±02:15 | 09:22±02:28 | 09:15±02:09 | 09:03±02:00 | 09:04±01:52 | 08:46±01:50 | 0.150 | 0.66 | 0.64 |
| BLT | 09:33±02:20 | 09:22±02:17 | 09:21±02:05 | 09:21±02:03 | 09:13±01:39 | 09:09±01:36 | 09:32±01:47 | 09:39±01:58 | 09:39±01:42 | 09:19±01:56 |  |  |  |
| Rise time, HH:MM | DRL | 10:24±02:03 | 10:19±02:25 | 09:57±02:08 | 09:52±02:17 | 09:46±02:19 | 09:45±02:23 | 09:36±02:08 | 09:32±01:51 | 09:25±01:50 | 09:14±01:45 | 0.009 | 0.97 | 0.66 |
| BLT | 10:25±02:04 | 10:07±02:00 | 09:57±01:50 | 09:51±01:53 | 09:34±01:33 | 09:35±01:27 | 10:06±01:39 | 10:13±01:52 | 10:11±01:34 | 09:59±01:49 |  |  |  |
| Time in bed,  | DRL | 08:58±01:36 | 08:51±01:57 | 08:33±01:37 | 08:27±01:32 | 08:26±01:25 | 08:31±01:38 | 08:26±01:32 | 08:30±01:35 | 08:01±02:12 | 08:58±02:04 | 0.057 | 0.16 | 0.57 |
| HH:MM | BLT | 09:07±01:44 | 08:55±01:27 | 08:44±01:27 | 08:44±01:30 | 08:35±01:06 | 08:36±01:10 | 09:09±01:39 | 09:05±01:57 | 08:55±01:19 | 08:47±01:32 |  |  |  |
| WASO,  | DRL | 00:32±00:38 | 00:27±00:29 | 00:21±00:30 | 00:21±00:28 | 00:18±00:23 | 00:15±00:17 | 00:17±00:18 | 00:19±00:20 | 00:16±00:19 | 00:16±00:21 | 0.001 | 0.99 | 0.85 |
| HH:MM | BLT | 00:32±00:38 | 00:26±00:36 | 00:26± 00:34 | 00:25±00:39 | 00:19±00:38 | 00:22±00:34 | 00:19±00:25 | 00:15±00:15 | 00:16±00:22 | 00:16±00:17 |  |  |  |
| Actual sleep  | DRL | 07:31±01:38 | 07:51±01:52 | 07:38±01:42 | 07:30±01:38 | 07:34±01:25 | 07:38±01:46 | 07:37±01:29 | 07:31±01:37 | 07:37±01:31 | 07:58±02:21 | 0.008 | 0.48 | 0.36 |
| duration, HH:MM | BLT | 07:43±01:36 | 07:45±01:26 | 07:46±01:28 | 07:49±01:34 | 07:54±01:19 | 07:47±01:24 | 08:14±01:16 | 08:13±02:00 | 08:03± 01:13 | 07:40± 01:25 |  |  |  |
| Sleep efficiency | DRL | 0.84 ± 0.12 | 0.89 ± 0.12 | 0.89 ± 0.11 | 0.88 ± 0.09 | 0.90 ± 0.08 | 0.89 ± 0.08 | 0.91 ±0.12 | 0.89 ± 0.10 | 0.87± 0.13 | 0.89 ± 0.07 | 0.001 | 0.60 | 0.54 |
| BLT | 0.85 ± 0.11 | 0.87 ± 0.11 | 0.90 ± 0.15 | 0.89 ± 0.11 | 0.92 ± 0.10 | 0.90 ± 0.10 | 0.91 ±0.16 | 0.91 ± 0.12 | 0.90± 0.09 | 0.88 ± 0.12 |  |  |  |
| Sleep  | DRL | 05:46±02:01 | 05:50±01:58 | 05:44±01:51 | 05:38±02:00 | 05:22±01:48 | 05:25±01:47 | 05:17±01:46 | 05:16±01:37 | 05:27±01:48 | 04:46±01:14 | 0.021 | 0.61 | 0.59 |
| midpoint,HH:MM | BLT | 05:44±01:47 | 05:28±01:42 | 05:29±01:47 | 05:27±01:34 | 05:17±01:23 | 05:14±01:13 | 05:25±01:33 | 05:33±01:24 | 05:42±01:36 | 05:31±01:39 |  |  |  |

a By Linear mixed model

**eTable 4. Treatment-emergent adverse events from dim red light (DRL) and bright light therapy (BLT) groups** **(Percentages)**

|  |  |  |
| --- | --- | --- |
| Side effect | Group | Intervention Period |
|  |  | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 |
| Eye irritation | DRL | 0 | 0 | 6 | 6 | 6 |
| BLT | 0 | 0 | 5 | 0 | 0 |
| Excessive tears | DRL | 0 | 6 | 11 | 9 | 9 |
| BLT | 0 | 0 | 3 | 3 | 3 |
| Eye grittiness | DRL | 0 | 6 | 11 | 6 | 9 |
| BLT | 0 | 0 | 3 | 0 | 6 |
| Blurring of vision | DRL | 5 | 14 | 6 | 14 | 18\* |
| BLT | 2 | 3 | 5 | 3 | 3 |
| Dry eye | DRL | 5 | 6 | 8 | 3 | 6 |
| BLT | 2 | 0 | 3 | 3 | 0 |
| Nausea | DRL | 0 | 3 | 3 | 6 | 3 |
| BLT | 0 | 5 | 5 | 3 | 6 |
| Vomiting | DRL | 2 | 0 | 3 | 0 | 0 |
| BLT | 2 | 3 | 0 | 3 | 0 |
| Headache | DRL | 7 | 14 | 6 | 9 | 9 |
| BLT | 7 | 8 | 3 | 3 | 9 |
| Fatigue | DRL | 17 | 11 | 11 | 11 | 18 |
| BLT | 7 | 5 | 8 | 8 | 6 |
| Loss of appetite | DRL | 7 | 8 | 6 | 6 | 6 |
| BLT | 2 | 5 | 5 | 5 | 3 |
| Chest discomfort | DRL | 12 | 8 | 6 | 0 | 3 |
| BLT | 2 | 5 | 8 | 5 | 6 |
| Anxiety | DRL | 5 | 8 | 6 | 9 | 12 |
| BLT | 2 | 0 | 3 | 3 | 6 |
| Restlessness | DRL | 12\* | 11 | 11 | 6 | 9 |
| BLT | 0 | 5 | 5 | 5 | 6 |
| Sleepiness | DRL | 10 | 8 | 11 | 9 | 6 |
| BLT | 14 | 8 | 11 | 11 | 6 |
| Dizziness | DRL | 8 | 5 | 6 | 6 | 12 |
| BLT | 2 | 2 | 11 | 5 | 6 |

\* p<0.05 by Fisher exact test or Chi Square test

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Chan W.Y.J., Zhang J., Li X.S., Lam S.P, Chan N.Y., Yu W.M.M., Wing Y.K. Adjunctive light treatment in major depressive disorder patients with evening chronotype – a randomized controlled trial. Sleep Medicine, Volume 64, Supplement 12019, Pages S61-S62.