

**Table 4. Comparison of cognitive function between MMD and healthy controls.**

|                      | HC (n=23)          | MMD (n=49)         | t value | P value     |
|----------------------|--------------------|--------------------|---------|-------------|
| <b>IQ</b>            |                    |                    |         |             |
| GK                   | 9.35 ± 2.328       | 8.45 ± 2.923       | 1.293   | .200        |
| SI                   | 11.13 ± 1.660      | 9.76 ± 2.689       | 2.660   | <b>.010</b> |
| VP                   | 12.70 ± 2.032      | 10.61 ± 2.388      | 3.612   | <b>.001</b> |
| BD                   | 10.65 ± 2.534      | 9.04 ± 3.341       | 2.050   | <b>.044</b> |
| IQ                   | 106.2609 ± 9.44316 | 97.2708 ± 14.36519 | 3.161   | <b>.002</b> |
| <b>PM</b>            |                    |                    |         |             |
| TBPM                 | 12.30 ± 2.704      | 9.06 ± 3.761       | 4.164   | <b>.000</b> |
| EBPM                 | 14.22 ± 2.110      | 12.14 ± 3.208      | 2.823   | <b>.006</b> |
| Total scores         | 26.52 ± 3.860      | 21.20 ± 6.232      | 4.431   | <b>.000</b> |
| <b>RBANS domains</b> |                    |                    |         |             |
| IM                   | 87.43 ± 11.317     | 79.94 ± 15.715     | 2.048   | <b>.044</b> |
| VD                   | 79.26 ± 13.084     | 75.49 ± 10.017     | 1.347   | .182        |
| VF                   | 94.04 ± 8.931      | 83.27 ± 14.319     | 3.896   | <b>.000</b> |
| AT                   | 108.70 ± 8.977     | 93.76 ± 15.625     | 5.129   | <b>.000</b> |
| RM                   | 90.04 ± 10.227     | 81.41 ± 15.381     | 2.820   | <b>.006</b> |
| SS                   | 459.48 ± 34.927    | 413.86 ± 53.027    | 4.341   | <b>.000</b> |
| TSIS                 | 88.57 ± 8.727      | 77.63 ± 12.667     | 3.737   | <b>.000</b> |
| PP                   | .2530 ± .16751     | .1260 ± .13700     | 3.412   | <b>.001</b> |
| <b>Stroop</b>        |                    |                    |         |             |
| Word                 | .13 ± .344         | .29 ± .645         | -1.329  | .188        |
| Time(s)              | 13.7748 ± 1.78760  | 16.7614 ± 5.33025  | -3.523  | <b>.001</b> |

|                    |                   |                    |        |             |
|--------------------|-------------------|--------------------|--------|-------------|
| Color              | .43 ± .788        | .94 ± 1.573        | -1.810 | .075        |
| Time(s)            | 19.4809 ± 4.18185 | 23.2898 ± 7.92940  | -2.664 | <b>.010</b> |
| word interference  | .26 ± .689        | .53 ± 1.043        | -1.128 | .263        |
| Time(s)            | 16.6096 ± 4.21034 | 20.7227 ± 10.94209 | -1.738 | .087        |
| Color interference | 1.83 ± 1.193      | 2.94 ± 3.044       | -2.221 | <b>.030</b> |
| Time(s)            | 36.8770 ± 8.68854 | 47.8300 ± 24.38207 | -2.790 | <b>.007</b> |
| <b>CPT</b>         |                   |                    |        |             |
| Correct numbers    | 76.57 ± 24.654    | 57.53 ± 23.259     | 3.177  | <b>.002</b> |
| Error numbers      | 19.22 ± 15.568    | 17.69 ± 11.497     | .467   | .642        |
| Omission numbers   | 32.70 ± 20.805    | 49.10 ± 26.366     | -2.856 | <b>.006</b> |
| Response time      | 6995.00 ± 754.882 | 7649.45 ± 869.658  | -3.100 | <b>.003</b> |
| <b>WCST</b>        |                   |                    |        |             |
| TA                 | 103.04 ± 22.894   | 109.53 ± 21.264    | -1.178 | .243        |
| CR                 | 64.39 ± 15.447    | 56.69 ± 21.132     | 1.744  | .087        |
| PCR                | .6565 ± .19255    | .5564 ± .25221     | 1.856  | .069        |
| TE                 | 38.65 ± 28.056    | 52.84 ± 35.668     | -1.677 | .098        |
| PE                 | .3435 ± .19255    | .4436 ± .25221     | -1.856 | .069        |
| PR                 | 23.26 ± 25.857    | 35.14 ± 32.033     | -1.555 | .124        |
| PPR                | .1988 ± .19568    | .2875 ± .24130     | -1.540 | .128        |
| PE                 | 6.0455 ± 6.99985  | 7.6383 ± 11.59915  | -.594  | .554        |
| PPE                | .0957 ± .18864    | .1024 ± .19186     | -.140  | .889        |
| NPE                | 27.78 ± 22.306    | 40.73 ± 32.515     | -1.970 | .053        |
| PNPE               | .2478 ± .15897    | .3412 ± .23730     | -1.970 | .053        |
| CLR                | 58.30 ± 17.468    | 51.71 ± 22.365     | 1.360  | .179        |

|                                  |                        |                        |        |             |
|----------------------------------|------------------------|------------------------|--------|-------------|
| PCLR                             | .6056 ± .22717         | .5162 ± .27181         | 1.368  | .176        |
| CC                               | 4.74 ± 1.912           | 4.10 ± 2.114           | 1.228  | .224        |
| TCFC                             | 19.70 ± 14.775         | 20.78 ± 23.788         | -2.200 | .842        |
| FM                               | 1.17 ± 1.875           | 1.08 ± 1.336           | .239   | .812        |
| L-L                              | -.0691 ± .23560        | -.1708 ± .78249        | .833   | .408        |
| Time(s)                          | 335.74 ± 137.697       | 477.61 ± 267.758       | -2.966 | <b>.004</b> |
| Correct thinking time (ms)       | 196322.13 ± 64230.725  | 222265.80 ± 114539.541 | -1.012 | .315        |
| Error thinking time(ms)          | 139324.65 ± 110373.769 | 256162.35 ± 213687.646 | -3.056 | <b>.003</b> |
| <b>TMT-A</b>                     |                        |                        |        |             |
| Dot symbol (s)                   | 23.8691 ± 7.29140      | 38.4527 ± 21.04506     | -4.329 | <b>.000</b> |
| Maze (s)                         | 31.4122 ± 12.84614     | 55.5337 ± 27.08145     | -5.126 | <b>.000</b> |
| Difference search                |                        |                        |        |             |
| Correct numbers                  | 9.13 ± 1.180           | 8.22 ± 1.735           | 2.266  | <b>.027</b> |
| Time(s)                          | 79.3387 ± 24.64328     | 93.9280 ± 37.33280     | -1.705 | .093        |
| Judging correct and error number |                        |                        |        |             |
| Correct numbers                  | 67.91 ± 23.429         | 45.37 ± 28.223         | 3.327  | <b>.001</b> |
| Error numbers                    | 5.78 ± 3.965           | 5.71 ± 7.208           | .042   | .966        |
| total numbers                    | 73.70 ± 23.908         | 51.08 ± 28.190         | 3.324  | <b>.001</b> |

Data was given as mean ± SD

GK, general knowledge; SI, similarity; VP, visual puzzles; BD, block design; IQ, intelligence quotient; PM prospective memory; TBPM, time based prospective memory; EBPM, event based prospective memory; IM, immediate memory; VB, visual breadth; VF, verbal fluency; AT, attention; RM retrospective memory; SS, scale scores; TSIS, total scale of index scores; PP, percentage of population; CPT, Continuous Performance Test; WCST, Wisconsin Card Classification Test; CR=Total Correct Responses; PCR=Percent Correct Responses; TE=Total Errors; PE=Percent Errors; PR=Perseverative Responses; PPR=Percent Perseverative Responses; PE=Perseverative Errors; PPE=Percent Perseverative Errors; NPE=Nonperseverative Errors; PNPE=Percent Nonperseverative Errors; CLR=Conceptual Level Responses;

PCLR=Percent Conceptual Level Responses; CC=Categories Completed; TCFC=Trials to Compete First Category; FM =Failure to Maintain Set; L-L=Learning to Learn; PE, perseverative errors; CC, categories completed; TMTA, Trail Making Test Part A.

**Table 5. Comparison of cognitive function between ischemic and hemorrhagic adult patients with MMD**

|                      | Ischemic (n=37)    | Hemorrhagic(n=12)  | t value | P value     |
|----------------------|--------------------|--------------------|---------|-------------|
| <b>IQ</b>            |                    |                    |         |             |
| GK                   | 8.46 ± 2.978       | 8.42 ± 2.875       | .044    | .965        |
| SI                   | 9.54 ± 2.755       | 10.42 ± 2.466      | -.980   | .332        |
| VP                   | 10.73 ± 2.256      | 10.25 ± 2.832      | .601    | .551        |
| BD                   | 9.05 ± 3.504       | 9.00 ± 2.923       | .048    | .962        |
| scores               | 97.1230 ± 14.28413 | 97.7267 ± 15.24531 | -.125   | .901        |
| <b>PM</b>            |                    |                    |         |             |
| TBPM                 | 9.68 ± 3.951       | 7.17 ± 2.329       | 2.684   | <b>.011</b> |
| EBPM                 | 12.59 ± 3.370      | 10.75 ± 2.221      | 1.769   | .083        |
| Total scores         | 22.27 ± 6.509      | 17.92 ± 3.895      | 2.805   | <b>.009</b> |
| <b>RBANS domains</b> |                    |                    |         |             |
| IM                   | 82.81 ± 12.447     | 71.08 ± 21.386     | 1.803   | .094        |
| VD                   | 74.92 ± 9.590      | 77.25 ± 11.506     | -.697   | .489        |
| VF                   | 84.78 ± 13.375     | 78.58 ± 16.659     | 1.313   | .195        |
| AT                   | 93.43 ± 16.508     | 94.75 ± 13.116     | -.251   | .803        |
| RM                   | 83.92 ± 14.184     | 73.67 ± 16.951     | 2.074   | <b>.044</b> |
| SS                   | 419.86 ± 49.017    | 395.33 ± 62.536    | 1.407   | .166        |
| TSIS                 | 79.08 ± 11.805     | 73.17 ± 14.671     | 1.420   | .162        |
| PP                   | .1357 ± .14414     | .0961 ± .11230     | .869    | .389        |
| <b>Stroop</b>        |                    |                    |         |             |

|                    |                    |                    |        |             |
|--------------------|--------------------|--------------------|--------|-------------|
| Word               | .38 ± .721         | .00 ± .000         | 3.193  | <b>.003</b> |
| Time(s)            | 16.3400 ± 4.51900  | 18.0608 ± 7.39627  | -.971  | .336        |
| Color              | .97 ± 1.590        | .83 ± 1.586        | .265   | .792        |
| Time(s)            | 22.4354 ± 6.22634  | 25.9242 ± 11.72453 | -.987  | .342        |
| word interference  | .59 ± 1.166        | .33 ± .492         | .751   | .457        |
| Time(s)            | 20.8889 ± 11.71724 | 20.2100 ± 8.52942  | .185   | .854        |
| Color interference | 3.19 ± 2.923       | 2.17 ± 3.407       | 1.011  | .317        |
| Time(s)            | 48.1170 ± 23.26557 | 46.9450 ± 28.66185 | .143   | .887        |
| <b>CPT</b>         |                    |                    |        |             |
| Correct numbers    | 56.89 ± 25.612     | 59.50 ± 14.425     | -.440  | .662        |
| Error numbers      | 16.14 ± 10.960     | 22.50 ± 12.259     | -1.699 | .096        |
| Omission numbers   | 51.81 ± 26.670     | 40.75 ± 24.595     | 1.271  | .210        |
| Response time      | 7680.81 ± 892.517  | 7552.75 ± 824.450  | .440   | .662        |
| <b>WCST</b>        |                    |                    |        |             |
| TA                 | 108.49 ± 21.830    | 112.75 ± 19.964    | -.600  | .552        |
| CR                 | 56.86 ± 20.975     | 56.17 ± 22.546     | .098   | .922        |
| PCR                | .5652 ± .25574     | .5293 ± .24990     | .425   | .673        |
| TE                 | 51.62 ± 36.114     | 56.58 ± 35.533     | -.415  | .680        |
| PE                 | .4348 ± .25575     | .4707 ± .24992     | -.425  | .672        |
| PR                 | 34.30 ± 32.444     | 37.75 ± 31.980     | -.321  | .749        |
| PPR                | .2808 ± .24491     | .3080 ± .23910     | -.336  | .738        |
| PE                 | 7.03 ± 8.417       | 9.42 ± 18.412      | -.434  | .672        |
| PPE                | .1101 ± .20642     | .0788 ± .14275     | .488   | .628        |
| NPE                | 38.65 ± 32.709     | 47.17 ± 32.434     | -.785  | .436        |
| PNPE               | .3247 ± .23969     | .3920 ± .23232     | -.851  | .399        |
| CLR                | 51.70 ± 22.603     | 51.75 ± 22.600     | -.006  | .995        |

|                                  |                        |                        |       |      |
|----------------------------------|------------------------|------------------------|-------|------|
| PCLR                             | .5235 ± .27860         | .4937 ± .26005         | .327  | .745 |
| CC                               | 4.08 ± 2.191           | 4.17 ± 1.946           | -.121 | .905 |
| TCFC                             | 21.86 ± 26.686         | 17.42 ± 11.066         | .559  | .579 |
| FM                               | 1.03 ± 1.343           | 1.25 ± 1.357           | -.498 | .620 |
| L-L                              | -.1751 ± .85483        | -.1575 ± .52920        | -.067 | .947 |
| Time(s)                          | 483.89 ± 292.379       | 458.25 ± 180.372       | .286  | .777 |
| Correct thinking time (ms)       | 231608.89 ± 123469.481 | 193457.92 ± 78467.405  | 1.003 | .321 |
| Error thinking time(ms)          | 252526.14 ± 226355.334 | 267374.00 ± 177168.513 | -.207 | .837 |
| <b>TMT-A</b>                     |                        |                        |       |      |
| Dot symbol (s)                   | 37.2203 ± 20.36988     | 42.2525 ± 23.53320     | -.716 | .477 |
| Maze (s)                         | 56.4414 ± 28.74754     | 52.7350 ± 22.00784     | .408  | .685 |
| Difference search                |                        |                        |       |      |
| Correct numbers                  | 8.16 ± 1.772           | 8.42 ± 1.676           | -.438 | .664 |
| Time(s)                          | 93.8124 ± 37.62267     | 94.2842 ± 38.06769     | -.038 | .970 |
| Judging correct and error number |                        |                        |       |      |
| Correct numbers                  | 45.27 ± 27.702         | 45.67 ± 31.049         | -.042 | .967 |
| Error numbers                    | 6.24 ± 8.146           | 4.08 ± 2.392           | .900  | .373 |
| total numbers                    | 51.51 ± 27.490         | 49.75 ± 31.494         | .186  | .853 |

Data was given as mean ± SD.

**Table 6. Comparison of cognitive function between ischemic subtypes for adult patients with MMD.**

|           | TIA (n=11)    | infarction (n=21) | headache (n=5) | F value | P value |
|-----------|---------------|-------------------|----------------|---------|---------|
| <b>IQ</b> |               |                   |                |         |         |
| GK        | 8.00 ± 3.194  | 8.67 ± 2.904      | 8.60 ± 3.362   | .179    | .837    |
| SI        | 8.82 ± 2.926  | 9.48 ± 2.750      | 11.40 ± 1.817  | 1.571   | .222    |
| VP        | 11.45 ± 2.806 | 10.43 ± 2.158     | 10.40 ± .894   | .799    | .458    |

|                      |                    |                    |                     |       |             |
|----------------------|--------------------|--------------------|---------------------|-------|-------------|
| BD                   | 9.00 ± 4.266       | 8.33 ± 2.852       | 12.20 ± 3.033       | 2.693 | .082        |
| scores               | 97.3609 ± 18.13119 | 95.5610 ± 12.98353 | 103.1600 ± 10.63454 | .560  | .577        |
| <b>PM</b>            |                    |                    |                     |       |             |
| TBPM                 | 10.27 ± 4.839      | 8.67 ± 3.136       | 12.60 ± 3.975       | 2.342 | .111        |
| EBPM                 | 13.09 ± 3.048      | 12.00 ± 3.521      | 14.00 ± 3.464       | .875  | .426        |
| Total scores         | 23.36 ± 7.606      | 20.67 ± 5.808      | 26.60 ± 5.273       | 2.005 | .150        |
| <b>RBANS domains</b> |                    |                    |                     |       |             |
| IM                   | 83.00 ± 10.469     | 81.43 ± 12.620     | 88.20 ± 16.664      | .586  | .562        |
| VD                   | 77.36 ± 12.801     | 73.48 ± 8.232      | 75.60 ± 7.162       | .594  | .558        |
| VF                   | 89.36 ± 11.457     | 80.90 ± 14.515     | 91.00 ± 6.595       | 2.207 | .126        |
| AT                   | 98.64 ± 13.374     | 88.10 ± 16.413     | 104.40 ± 16.861     | 3.062 | .060        |
| RM                   | 80.00 ± 18.488     | 84.62 ± 12.675     | 89.60 ± 8.234       | .839  | .441        |
| SS                   | 428.36 ± 52.024    | 408.52 ± 46.930    | 448.80 ± 43.877     | 1.657 | .206        |
| TSIS                 | 81.27 ± 12.729     | 76.33 ± 11.137     | 85.80 ± 10.941      | 1.623 | .212        |
| PP                   | .1718 ± .18384     | .0982 ± .08079     | .2140 ± .22634      | 1.882 | .168        |
| <b>Stroop</b>        |                    |                    |                     |       |             |
| Word                 | .27 ± .647         | .48 ± .814         | .20 ± .447          | .450  | .641        |
| Time(s)              | 14.7136 ± 2.66886  | 17.7995 ± 5.13410  | 13.7880 ± 2.75537   | 2.877 | .070        |
| Color                | 1.09 ± 1.814       | 1.05 ± 1.627       | .40 ± .894          | .365  | .697        |
| Time(s)              | 21.6318 ± 5.51272  | 23.9190 ± 6.66682  | 17.9720 ± 3.53039   | 2.092 | .139        |
| word interference    | .64 ± .809         | .67 ± 1.426        | .20 ± .447          | .321  | .728        |
| Time(s)              | 19.2745 ± 6.73829  | 23.1719 ± 14.33820 | 14.8520 ± 3.75847   | 1.178 | .320        |
| Color interference   | 2.82 ± 2.714       | 3.67 ± 3.276       | 2.00 ± 1.225        | .772  | .470        |
| Time(s)              | 40.4964 ± 13.66912 | 55.4705 ± 27.00374 | 33.9980 ± 8.10484   | 2.818 | .074        |
| <b>CPT</b>           |                    |                    |                     |       |             |
| Correct numbers      | 72.00 ± 26.386     | 46.43 ± 22.750     | 67.60 ± 15.159      | 5.019 | <b>.012</b> |

|                            |                        |                        |                        |       |             |
|----------------------------|------------------------|------------------------|------------------------|-------|-------------|
| Error numbers              | 16.45 ± 14.152         | 14.90 ± 8.848          | 20.60 ± 12.482         | .538  | .589        |
| Omission numbers           | 39.55 ± 22.792         | 61.95 ± 26.149         | 36.20 ± 20.632         | 4.159 | <b>.024</b> |
| Response time              | 7239.91 ± 906.613      | 8012.86 ± 850.651      | 7256.20 ± 396.967      | 3.904 | <b>.030</b> |
| <b>WCST</b>                |                        |                        |                        |       |             |
| TA                         | 107.45 ± 25.843        | 109.62 ± 20.106        | 106.00 ± 24.094        | .069  | .933        |
| CR                         | 59.36 ± 19.221         | 55.33 ± 22.464         | 57.80 ± 21.959         | .132  | .877        |
| PCR                        | .6001 ± .25952         | .5425 ± .26245         | .5837 ± .26341         | .189  | .828        |
| TE                         | 48.09 ± 36.115         | 54.29 ± 37.222         | 48.20 ± 38.258         | .126  | .882        |
| PE                         | .3999 ± .25952         | .4575 ± .26245         | .4163 ± .26342         | .189  | .828        |
| PR                         | 30.45 ± 28.186         | 37.05 ± 35.635         | 31.20 ± 32.337         | .167  | .847        |
| PPR                        | .2470 ± .21341         | .3032 ± .26945         | .2612 ± .23812         | .199  | .820        |
| PE                         | 5.18 ± 5.344           | 6.53 ± 8.296           | 13.00 ± 12.884         | .712  | .498        |
| PPE                        | .0471 ± .04773         | .1417 ± .26562         | .1160 ± .09376         | .750  | .480        |
| NPE                        | 42.91 ± 35.235         | 37.24 ± 33.673         | 35.20 ± 27.941         | .134  | .875        |
| PNPE                       | .3528 ± .25813         | .3158 ± .24882         | .3003 ± .19398         | .110  | .896        |
| CLR                        | 53.27 ± 20.684         | 50.29 ± 24.942         | 54.20 ± 19.817         | .093  | .911        |
| PCLR                       | .5524 ± .29144         | .5017 ± .28794         | .5515 ± .25672         | .142  | .868        |
| CC                         | 3.91 ± 2.166           | 4.00 ± 2.345           | 4.80 ± 1.789           | .305  | .739        |
| TCFC                       | 31.18 ± 32.899         | 19.00 ± 25.677         | 13.40 ± 5.941          | 1.046 | .362        |
| FM                         | 1.27 ± 1.794           | 1.05 ± 1.161           | .40 ± .894             | .720  | .494        |
| L-L                        | .0264 ± .79340         | -.1162 ± .53646        | -.8660 ± 1.68448       | 2.111 | .137        |
| Time(s)                    | 498.09 ± 396.925       | 506.10 ± 257.278       | 359.40 ± 148.406       | .512  | .604        |
| Correct thinking time (ms) | 231505.55 ± 131165.966 | 242704.48 ± 130714.895 | 185234.80 ± 73652.259  | .423  | .658        |
| Error thinking time(ms)    | 267041.18 ± 301761.861 | 263446.48 ± 201476.713 | 174727.60 ± 147460.230 | .330  | .721        |

**TMT-A**

|                                  |                    |                    |                    |       |             |
|----------------------------------|--------------------|--------------------|--------------------|-------|-------------|
| Dot symbol (s)                   | 37.0245 ± 26.85668 | 38.7367 ± 18.89114 | 31.2820 ± 9.51605  | .260  | .773        |
| Maze (s)                         | 49.9973 ± 19.85881 | 63.9224 ± 33.06713 | 39.1980 ± 14.31791 | 1.991 | .152        |
| Difference search                |                    |                    |                    |       |             |
| Correct numbers                  | 8.18 ± 1.940       | 7.90 ± 1.814       | 9.20 ± .837        | 1.085 | .349        |
| Time(s)                          | 85.9418 ± 30.01821 | 98.7805 ± 41.77051 | 90.2620 ± 38.03805 | .432  | .653        |
| Judging correct and error number |                    |                    |                    |       |             |
| Correct numbers                  | 47.27 ± 28.260     | 38.00 ± 25.322     | 71.40 ± 23.713     | 3.368 | <b>.046</b> |
| Error numbers                    | 6.18 ± 6.145       | 6.43 ± 9.600       | 5.60 ± 6.427       | .020  | .980        |
| total numbers                    | 53.45 ± 26.778     | 44.43 ± 26.390     | 77.00 ± 20.988     | 3.230 | .052        |

Data was given as mean ± SD.

Table 7. Comparison of cognitive function between headache patients with MMD and healthy controls.

|                      | Headache (n=5)      | HC (n=23)          | t value | P value     |
|----------------------|---------------------|--------------------|---------|-------------|
| <b>IQ</b>            |                     |                    |         |             |
| GK                   | 8.60 ± 3.362        | 9.35 ± 2.328       | -.603   | .552        |
| SI                   | 11.40 ± 1.817       | 11.13 ± 1.660      | .324    | .748        |
| VP                   | 10.40 ± .894        | 12.70 ± 2.032      | -2.446  | <b>.022</b> |
| BD                   | 12.20 ± 3.033       | 10.65 ± 2.534      | 1.199   | .241        |
| scores               | 103.1600 ± 10.63454 | 106.2609 ± 9.44316 | -.652   | .520        |
| <b>PM</b>            |                     |                    |         |             |
| TBPM                 | 12.60 ± 3.975       | 12.30 ± 2.704      | .204    | .840        |
| EBPM                 | 14.00 ± 3.464       | 14.22 ± 2.110      | -.186   | .854        |
| Total scores         | 26.60 ± 5.273       | 26.52 ± 3.860      | .039    | .970        |
| <b>RBANS domains</b> |                     |                    |         |             |
| IM                   | 88.20 ± 16.664      | 87.43 ± 11.317     | .126    | .901        |

|                    |                   |                   |       |      |
|--------------------|-------------------|-------------------|-------|------|
| VD                 | 75.60 ± 7.162     | 79.26 ± 13.084    | -.600 | .554 |
| VF                 | 91.00 ± 6.595     | 94.04 ± 8.931     | -.716 | .480 |
| AT                 | 104.40 ± 16.861   | 108.70 ± 8.977    | -.823 | .418 |
| RM                 | 89.60 ± 8.234     | 90.04 ± 10.227    | -.090 | .929 |
| SS                 | 448.80 ± 43.877   | 459.48 ± 34.927   | -.594 | .558 |
| TSIS               | 85.80 ± 10.941    | 88.57 ± 8.727     | -.616 | .543 |
| PP                 | .2140 ± .22634    | .2530 ± .16751    | -.445 | .660 |
| <b>Stroop</b>      |                   |                   |       |      |
| Word               | .20 ± .447        | .13 ± .344        | .389  | .700 |
| Time(s)            | 13.7880 ± 2.75537 | 13.7748 ± 1.78760 | .014  | .989 |
| Color              | .40 ± .894        | .43 ± .788        | -.088 | .931 |
| Time(s)            | 17.9720 ± 3.53039 | 19.4809 ± 4.18185 | -.748 | .461 |
| word interference  | .20 ± .447        | .26 ± .689        | -.188 | .853 |
| Time(s)            | 14.8520 ± 3.75847 | 16.6096 ± 4.21034 | -.860 | .398 |
| Color interference | 2.00 ± 1.225      | 1.83 ± 1.193      | .294  | .771 |
| Time(s)            | 33.9980 ± 8.10484 | 36.8770 ± 8.68854 | -.678 | .504 |
| <b>CPT</b>         |                   |                   |       |      |
| Correct numbers    | 67.60 ± 15.159    | 76.57 ± 24.654    | -.775 | .445 |
| Error numbers      | 20.60 ± 12.482    | 19.22 ± 15.568    | .185  | .855 |
| Omission numbers   | 36.20 ± 20.632    | 32.70 ± 20.805    | .342  | .735 |
| Response time      | 7256.20 ± 396.967 | 6995.00 ± 754.882 | .744  | .464 |
| <b>WCST</b>        |                   |                   |       |      |
| TA                 | 106.00 ± 24.094   | 103.04 ± 22.894   | .260  | .797 |
| CR                 | 57.80 ± 21.959    | 64.39 ± 15.447    | -.804 | .429 |
| PCR                | .5837 ± .26341    | .6565 ± .19255    | -.720 | .478 |
| TE                 | 48.20 ± 38.258    | 38.65 ± 28.056    | .648  | .523 |

|                                  |                        |                        |        |      |
|----------------------------------|------------------------|------------------------|--------|------|
| PE                               | .4163 ± .26342         | .3435 ± .19255         | .720   | .478 |
| PR                               | 31.20 ± 32.337         | 23.26 ± 25.857         | .597   | .556 |
| PPR                              | .2612 ± .23812         | .1988 ± .19568         | .624   | .538 |
| PE                               | 13.00 ± 12.884         | 6.05 ± 7.000           | .190   | .851 |
| PPE                              | .1160 ± .09376         | .0957 ± .18864         | .233   | .818 |
| NPE                              | 35.20 ± 27.941         | 27.78 ± 22.306         | .646   | .524 |
| PNPE                             | .3003 ± .19398         | .2478 ± .15897         | .645   | .524 |
| CLR                              | 54.20 ± 19.817         | 58.30 ± 17.468         | -.466  | .645 |
| PCLR                             | .5515 ± .25672         | .6056 ± .22717         | -.472  | .641 |
| CC                               | 4.80 ± 1.789           | 4.74 ± 1.912           | .065   | .949 |
| TCFC                             | 13.40 ± 5.941          | 19.70 ± 14.775         | -.925  | .363 |
| FM                               | .40 ± .894             | 1.17 ± 1.875           | -.891  | .381 |
| L-L                              | -.8660 ± 1.68448       | -.0691 ± .23560        | -1.056 | .350 |
| Time(s)                          | 359.40 ± 148.406       | 335.74 ± 137.697       | .344   | .734 |
| Correct thinking time (ms)       | 185234.80 ± 73652.259  | 196322.13 ± 64230.725  | -.342  | .735 |
| Error thinking time(ms)          | 174727.60 ± 147460.230 | 139324.65 ± 110373.769 | .614   | .545 |
| TMT-A                            |                        |                        |        |      |
| Dot symbol (s)                   | 31.2820 ± 9.51605      | 23.8691 ± 7.29140      | 1.957  | .061 |
| Maze (s)                         | 39.1980 ± 14.31791     | 31.4122 ± 12.84614     | 1.206  | .239 |
| Difference search                |                        |                        |        |      |
| Correct numbers                  | 9.20 ± .837            | 9.13 ± 1.180           | .124   | .902 |
| Time(s)                          | 90.2620 ± 38.03805     | 79.3387 ± 24.64328     | .816   | .422 |
| Judging correct and error number |                        |                        |        |      |
| Correct numbers                  | 71.40 ± 23.713         | 67.91 ± 23.429         | .301   | .766 |
| Error numbers                    | 5.60 ± 6.427           | 5.78 ± 3.965           | -.083  | .934 |
| total numbers                    | 77.00 ± 20.988         | 73.70 ± 23.908         | .285   | .778 |

Data was given as mean  $\pm$  SD.

**Table 8. Comparison of cognitive function between male and female adult patients with MMD.**

|                      | Male(n=24)             | Female(n=25)           | t value | P value     |
|----------------------|------------------------|------------------------|---------|-------------|
| <b>IQ</b>            |                        |                        |         |             |
| GK                   | 8.75 $\pm$ 2.418       | 8.16 $\pm$ 3.363       | .707    | .483        |
| SI                   | 9.21 $\pm$ 2.085       | 10.28 $\pm$ 3.116      | -1.409  | .165        |
| VP                   | 9.96 $\pm$ 1.853       | 11.24 $\pm$ 2.697      | -1.931  | .060        |
| BD                   | 8.54 $\pm$ 3.203       | 9.52 $\pm$ 3.466       | -1.025  | .311        |
| scores               | 94.8763 $\pm$ 10.73203 | 99.5696 $\pm$ 17.06170 | -1.157  | .254        |
| <b>PM</b>            |                        |                        |         |             |
| TBPM                 | 7.79 $\pm$ 3.078       | 10.28 $\pm$ 4.005      | -2.431  | <b>.019</b> |
| EBPM                 | 11.13 $\pm$ 3.026      | 13.12 $\pm$ 3.127      | -2.268  | <b>.028</b> |
| Total scores         | 18.92 $\pm$ 4.916      | 23.40 $\pm$ 6.652      | -2.674  | <b>.010</b> |
| <b>RBANS domains</b> |                        |                        |         |             |
| IM                   | 73.75 $\pm$ 14.789     | 85.88 $\pm$ 14.466     | -2.902  | <b>.006</b> |
| VD                   | 74.04 $\pm$ 7.926      | 76.88 $\pm$ 11.677     | -.991   | .327        |
| VF                   | 79.63 $\pm$ 15.444     | 86.76 $\pm$ 12.471     | -1.783  | .081        |
| AT                   | 89.58 $\pm$ 15.973     | 97.76 $\pm$ 14.481     | -1.879  | .066        |
| RM                   | 77.71 $\pm$ 15.716     | 84.96 $\pm$ 14.478     | -1.681  | .099        |
| SS                   | 394.71 $\pm$ 53.052    | 432.24 $\pm$ 46.986    | -2.624  | <b>.012</b> |
| TSIS                 | 73.04 $\pm$ 12.509     | 82.04 $\pm$ 11.385     | -2.635  | <b>.011</b> |
| PP                   | .0823 $\pm$ .08313     | .1680 $\pm$ .16481     | -2.314  | <b>.027</b> |
| <b>Stroop</b>        |                        |                        |         |             |
| Word                 | .33 $\pm$ .761         | .24 $\pm$ .523         | .502    | .618        |
| Time(s)              | 18.1638 $\pm$ 5.82931  | 15.4152 $\pm$ 4.51706  | 1.849   | .071        |

|                    |                    |                    |        |             |
|--------------------|--------------------|--------------------|--------|-------------|
| Color              | 1.46 ± 1.933       | .44 ± .917         | 2.340  | <b>.026</b> |
| Time(s)            | 26.9267 ± 8.68960  | 19.7984 ± 5.24056  | 3.460  | <b>.001</b> |
| word interference  | .54 ± .833         | .52 ± 1.229        | .072   | .943        |
| Time(s)            | 21.2058 ± 7.10919  | 20.2588 ± 13.80458 | .300   | .766        |
| Color interference | 3.63 ± 3.373       | 2.28 ± 2.590       | 1.569  | .123        |
| Time(s)            | 52.8229 ± 24.26224 | 43.0368 ± 23.99959 | 1.419  | .162        |
| <b>CPT</b>         |                    |                    |        |             |
| Correct numbers    | 56.50 ± 20.741     | 58.52 ± 25.838     | -.301  | .765        |
| Error numbers      | 20.38 ± 12.384     | 15.12 ± 10.163     | 1.627  | .110        |
| Omission numbers   | 48.00 ± 27.236     | 50.16 ± 26.020     | -.284  | .778        |
| Response time      | 7621.67 ± 783.433  | 7676.12 ± 960.678  | -.217  | .829        |
| <b>WCST</b>        |                    |                    |        |             |
| TA                 | 117.63 ± 18.490    | 101.76 ± 21.172    | 2.789  | <b>.008</b> |
| CR                 | 54.46 ± 23.474     | 58.84 ± 18.847     | -.722  | .474        |
| PCR                | .4887 ± .24380     | .6214 ± .24755     | -1.889 | .065        |
| TE                 | 63.17 ± 34.023     | 42.92 ± 35.013     | 2.052  | <b>.046</b> |
| PE                 | .5113 ± .24380     | .3786 ± .24756     | 1.889  | .065        |
| PR                 | 43.38 ± 31.476     | 27.24 ± 31.143     | 1.803  | .078        |
| PPR                | .3474 ± .23707     | .2299 ± .23569     | 1.739  | .089        |
| PE                 | 8.65 ± 14.714      | 6.67 ± 7.744       | .582   | .563        |
| PPE                | .1072 ± .20517     | .0978 ± .18231     | .170   | .866        |
| NPE                | 50.00 ± 31.255     | 31.84 ± 31.780     | 2.016  | <b>.050</b> |
| PNPE               | .4041 ± .23039     | .2808 ± .23241     | 1.863  | .069        |
| CLR                | 47.42 ± 24.020     | 55.84 ± 20.281     | -1.328 | .190        |
| PCLR               | .4324 ± .25690     | .5966 ± .26600     | -2.197 | <b>.033</b> |
| CC                 | 3.33 ± 2.099       | 4.84 ± 1.886       | -2.645 | <b>.011</b> |

|                                  |                        |                        |        |             |
|----------------------------------|------------------------|------------------------|--------|-------------|
| TCFC                             | 26.33 ± 30.473         | 15.44 ± 13.466         | 1.607  | .118        |
| FM                               | 1.33 ± 1.633           | .84 ± .943             | 1.288  | .206        |
| L-L                              | -.2438 ± 1.08677       | -.1008 ± .28686        | -.624  | .538        |
| Time(s)                          | 527.08 ± 312.605       | 430.12 ± 211.994       | 1.275  | .208        |
| Correct thinking time (ms)       | 211123.21 ± 125323.203 | 232962.68 ± 104612.486 | -.663  | .510        |
| Error thinking time(ms)          | 318934.71 ± 239493.741 | 195900.88 ± 169216.811 | 2.084  | <b>.043</b> |
| <b>TMT-A</b>                     |                        |                        |        |             |
| Dot symbol (s)                   | 40.2954 ± 22.99045     | 36.6836 ± 19.30276     | .597   | .554        |
| Maze (s)                         | 52.6692 ± 26.06112     | 58.2836 ± 28.28152     | -.722  | .474        |
| Difference search                |                        |                        |        |             |
| Correct numbers                  | 7.79 ± 1.933           | 8.64 ± 1.440           | -1.737 | .090        |
| Time(s)                          | 90.3654 ± 32.86059     | 97.3480 ± 41.56650     | -.651  | .519        |
| Judging correct and error number |                        |                        |        |             |
| Correct numbers                  | 40.75 ± 28.751         | 49.80 ± 27.551         | -1.125 | .266        |
| Error numbers                    | 5.46 ± 4.314           | 5.96 ± 9.271           | -.241  | .810        |
| total numbers                    | 46.21 ± 30.116         | 55.76 ± 25.954         | -1.191 | .240        |

Data was given as mean ± SD.

**Table 9. Comparison of cognitive function between male and female for healthy controls.**

|           | Male(n=9)           | Female(n=14)       | t value | P value |
|-----------|---------------------|--------------------|---------|---------|
| <b>IQ</b> |                     |                    |         |         |
| GK        | 9.78 ± 2.279        | 9.07 ± 2.401       | .702    | .490    |
| SI        | 11.44 ± 1.333       | 10.93 ± 1.859      | .719    | .480    |
| VP        | 12.67 ± 1.000       | 12.71 ± 2.525      | -.063   | .950    |
| BD        | 9.78 ± 2.863        | 11.21 ± 2.225      | -1.352  | .191    |
| scores    | 105.4833 ± 10.35100 | 106.7607 ± 9.18078 | -.310   | .760    |

**PM**

|              |       |   |       |  |       |   |       |  |       |      |
|--------------|-------|---|-------|--|-------|---|-------|--|-------|------|
| TBPM         | 12.00 | ± | 3.162 |  | 12.50 | ± | 2.473 |  | -.425 | .675 |
| EBPM         | 13.89 | ± | 1.453 |  | 14.43 | ± | 2.472 |  | -.659 | .517 |
| Total scores | 25.89 | ± | 3.621 |  | 26.93 | ± | 4.085 |  | -.622 | .541 |

**RBANS domains**

|      |        |   |        |  |        |   |        |  |       |      |
|------|--------|---|--------|--|--------|---|--------|--|-------|------|
| IM   | 91.78  | ± | 11.065 |  | 84.64  | ± | 10.952 |  | 1.519 | .144 |
| VD   | 76.11  | ± | 12.604 |  | 81.29  | ± | 13.442 |  | -.923 | .367 |
| VF   | 92.00  | ± | 5.477  |  | 95.36  | ± | 10.573 |  | -.875 | .391 |
| AT   | 110.44 | ± | 8.443  |  | 107.57 | ± | 9.436  |  | .741  | .467 |
| RM   | 94.00  | ± | 6.837  |  | 87.50  | ± | 11.420 |  | 1.533 | .140 |
| SS   | 464.33 | ± | 30.972 |  | 456.36 | ± | 38.044 |  | .526  | .605 |
| TSIS | 89.56  | ± | 8.233  |  | 87.93  | ± | 9.277  |  | .428  | .673 |
| PP   | .2633  | ± | .18835 |  | .2464  | ± | .15979 |  | .231  | .819 |

**Stroop**

|                    |         |   |         |  |         |   |          |  |        |      |
|--------------------|---------|---|---------|--|---------|---|----------|--|--------|------|
| Word               | .11     | ± | .333    |  | .14     | ± | .363     |  | -.211  | .835 |
| Time(s)            | 13.8822 | ± | 1.59162 |  | 13.7057 | ± | 1.95850  |  | .226   | .823 |
| Color              | .33     | ± | .500    |  | .50     | ± | .941     |  | -.487  | .632 |
| Time(s)            | 18.4156 | ± | 3.21347 |  | 20.1657 | ± | 4.68502  |  | -.979  | .339 |
| word interference  | .00     | ± | .000    |  | .43     | ± | .852     |  | -1.883 | .082 |
| Time(s)            | 14.7767 | ± | 3.30301 |  | 17.7879 | ± | 4.41189  |  | -1.751 | .095 |
| Color interference | 1.89    | ± | 1.167   |  | 1.79    | ± | 1.251    |  | .198   | .845 |
| Time(s)            | 38.9489 | ± | 5.09175 |  | 35.5450 | ± | 10.34004 |  | .914   | .371 |

**CPT**

|                  |       |   |        |  |       |   |        |  |        |      |
|------------------|-------|---|--------|--|-------|---|--------|--|--------|------|
| Correct numbers  | 72.89 | ± | 30.743 |  | 78.93 | ± | 20.775 |  | -.564  | .578 |
| Error numbers    | 11.78 | ± | 12.498 |  | 24.00 | ± | 15.845 |  | -1.951 | .064 |
| Omission numbers | 38.56 | ± | 27.460 |  | 28.93 | ± | 15.148 |  | 1.088  | .289 |

|                            |                        |                        |       |      |
|----------------------------|------------------------|------------------------|-------|------|
| Response time              | 7007.44 ± 960.843      | 6987.00 ± 629.322      | .062  | .951 |
| <b>WCST</b>                |                        |                        |       |      |
| TA                         | 100.00 ± 20.827        | 105.00 ± 24.689        | -.502 | .621 |
| CR                         | 68.22 ± 10.060         | 61.93 ± 18.023         | .952  | .352 |
| PCR                        | .7055 ± .14931         | .6250 ± .21515         | .978  | .339 |
| TE                         | 31.78 ± 22.560         | 43.07 ± 31.067         | -.940 | .358 |
| PE                         | .2945 ± .14933         | .3750 ± .21515         | -.978 | .339 |
| PR                         | 17.56 ± 17.664         | 26.93 ± 30.040         | -.843 | .409 |
| PPR                        | .1560 ± .12965         | .2262 ± .22886         | -.833 | .414 |
| PE                         | 5.11 ± 3.257           | 6.69 ± 8.807           | -.512 | .614 |
| PPE                        | .0514 ± .03335         | .1241 ± .23940         | -.898 | .380 |
| NPE                        | 26.67 ± 21.366         | 28.50 ± 23.657         | -.188 | .853 |
| PNPE                       | .2430 ± .14718         | .2509 ± .17150         | -.113 | .911 |
| CLR                        | 61.78 ± 17.598         | 56.07 ± 17.666         | .757  | .457 |
| PCLR                       | .6519 ± .22286         | .5758 ± .23310         | .777  | .446 |
| CC                         | 5.22 ± 1.716           | 4.43 ± 2.027           | .970  | .343 |
| TCFC                       | 17.67 ± 8.846          | 21.00 ± 17.794         | -.519 | .609 |
| FM                         | 1.22 ± 1.093           | 1.14 ± 2.282           | .097  | .924 |
| L-L                        | -.0267 ± .13757        | -.0964 ± .28327        | .685  | .501 |
| Time(s)                    | 364.67 ± 175.137       | 317.14 ± 110.722       | .801  | .432 |
| Correct thinking time (ms) | 226116.67 ± 65380.847  | 177168.50 ± 57806.148  | 1.884 | .073 |
| Error thinking time(ms)    | 138405.89 ± 128413.507 | 139915.29 ± 102311.516 | -.031 | .975 |
| <b>TMT-A</b>               |                        |                        |       |      |
| Dot symbol (s)             | 25.9867 ± 10.03686     | 22.5079 ± 4.78309      | .971  | .353 |
| Maze (s)                   | 30.9700 ± 10.06666     | 31.6964 ± 14.72026     | -.129 | .898 |
| Difference search          |                        |                        |       |      |

|                                  |         |   |          |         |   |          |        |      |
|----------------------------------|---------|---|----------|---------|---|----------|--------|------|
| Correct numbers                  | 8.78    | ± | 1.202    | 9.36    | ± | 1.151    | -1.159 | .260 |
| Time(s)                          | 80.1533 | ± | 24.32608 | 78.8150 | ± | 25.74509 | .124   | .902 |
| Judging correct and error number |         |   |          |         |   |          |        |      |
| Correct numbers                  | 60.89   | ± | 22.436   | 72.43   | ± | 23.728   | -1.162 | .258 |
| Error numbers                    | 5.89    | ± | 4.137    | 5.71    | ± | 4.008    | .101   | .921 |
| total numbers                    | 66.78   | ± | 22.191   | 78.14   | ± | 24.695   | -1.119 | .276 |

Data was given as mean ± SD.