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Brain connectivity alternation analysis reveals important insights of pathologies for a wide range of neurological disorders. It calls development of rigorous statistical inferential tools, which can both provide an explicit statistical significance quantification as well as a rigid false discovery control. We formulate the problem as partial correlation hypothesis testing under matrix normal distribution. We develop inferential procedures for testing equality of individual entries of partial correlation matrices across multiple groups. We derive the asymptotic properties and show the procedures can control the false discovery at the pre-specified level. We also compare our proposal with alternative testing procedures, both analytically and numerically, and demonstrate clear advantages of the new method. We illustrate with a functional connectivity analysis of an attention deficit hyperactivity disorder dataset.