Classical pre-processing and quantum search:

Classical Pre-processing: Given the difficulty of quantum computational maintenance and the associated operational costs, it's crucial to perform as many operations as possible under classical computations. During this pre-processing phase, we can perform the non-interruptive tasks, such as establishing the hash tree and creating user transactions.

Quantum Search: After setting up the preliminary components using classical computations, Grover's algorithm, a quantum algorithm known for its efficiency in unstructured search problems, could be deployed. Theoremetically, Grover's algorithm could significantly decrease the time required to find the nonce — a number that miners seek to find and add to the blockchain to complete a block of transactions.

Post-Quantum Validation: After the quantum portion of the process, we can again leverage classical computations. At this stage, the produced nonce from Grover's algorithm could be verified using classical computations to ensure its validity. All nodes in the bitcoin network should be capable of validating the transaction using classical computation resources.

Stricter Difficulty Adjustment: A transition involving quantum mining procedures would necessitate a re-examination of the current Bitcoin difficulty adjustment algorithm. The primary reason is that Grover's algorithm could make mining significantly more efficient and subsequently make miners find blocks much sooner than the anticipated 10 minute block time. As such, an algorithm that can adjust for this increased efficiency without destabilizing the entire network's balance would be required.

Quantum-Proof Transactions: Furthermore, as we navigate into the 'quantum era' it becomes critical to ensure that quantum technology doesn't pose a security risk to Bitcoin transactions. As quantum computers advance, they might pose a threat to current cryptographic functions. Thus, exploring quantum-resistant cryptographic functions will be an essential facet of preserving Bitcoin's integrity in a Quantum world.

Constant reiteration and updating of the approach will be required as we gain a better understanding of both quantum computing's capabilities and its implications for Bitcoin mining. The blend of classical and quantum procedures offers a promising path forward, balancing the advantages of quantum speedup with the stability and established infrastructure of classical computational techniques.

References:
https://link.springer.com/chapter/10.1007/978-3-030-31277-0_19
https://link.springer.com/article/10.1007/s10207-020-00493-9
https://www.sciencedirect.com/science/article/pii/S2096720923000167
https://arxiv.org/abs/2110.00878
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8946996/