



Metabolic Responses of Osteochondral Allografts to Re-Warming After MOPSTM Preservation Versus Standard of Care Storage

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Introduction:

Osteoarthritis (OA) affects ~90% of people older than 65, and associated costs top \$100 billion annually in the U.S. One treatment available for large cartilage defects seen in osteoarthritis is osteochondral allograft (OCA) transplantation. Currently, tissue banks store OCAs at 4°C and implantation is recommended within 28 days after procurement due to significant loss in chondrocyte viability after this time. Because mandatory disease screening protocols typically take 14 days to complete, the window for surgical implantation is narrow, which severely limits clinical use. The MOPSTM protocol can maintain OCAs for 56 days. In this study, OCAs stored using MOPSTM and SOC protocol were assessed for cell viability and metabolic biomarker production.

Objective:

- To analyze cell viability and metabolic biomarker production of OCAs stored using the SOC versus the MOPSTM protocol

Hypothesis:

- OCAs stored using the MOPSTM system will have significantly higher cartilage cell viability compared to grafts stored using the current standard of care at the time of clinical transplantation
- OCAs stored using the current SOC will produce significantly lower concentrations of anabolic biomarkers and significantly higher concentrations of inflammatory biomarkers compared to grafts stored using the MOPSTM system

Materials and Methods:

With IRB approval, cartilage tissue was collected from OCAs obtained from tissues banks using the MOPSTM or SOC protocol. For analysis, MOPSTM grafts were split into groups based on the length of time they were stored before they were received: day 0, early (<40 days), intermediate (40-60 days), and late (>60 days). Cartilage was assessed for viability at the time of collection, and cartilage explants were cultured for 7 days at 37°C. Media was collected at days 3 and 7 to assess biomarker concentrations. At day 7 tissues were assessed for collagen and proteoglycan content.

Discussion:

The production of PGE₂, MMP-1, -2, -13, and IL-6 by MOPSTM tissues in culture was significantly lower than SOC tissues. This indicates that storage using MOPSTM significantly reduces the production of inflammatory and degradative enzymes by the tissue. The production of IL-8 and GRO-α for MOPSTM tissues in culture was significantly higher than SOC tissues. Previous studies have found a correlation between increased cartilage viability and production of IL-8 and GRO-α. These data indicate that tissues stored using the MOPSTM protocol maintains a normal metabolic response associated with higher tissue viability. The data from this study indicates that storage using the MOPSTM protocol is superior for maintaining normal tissue metabolism after transplantation.

Results

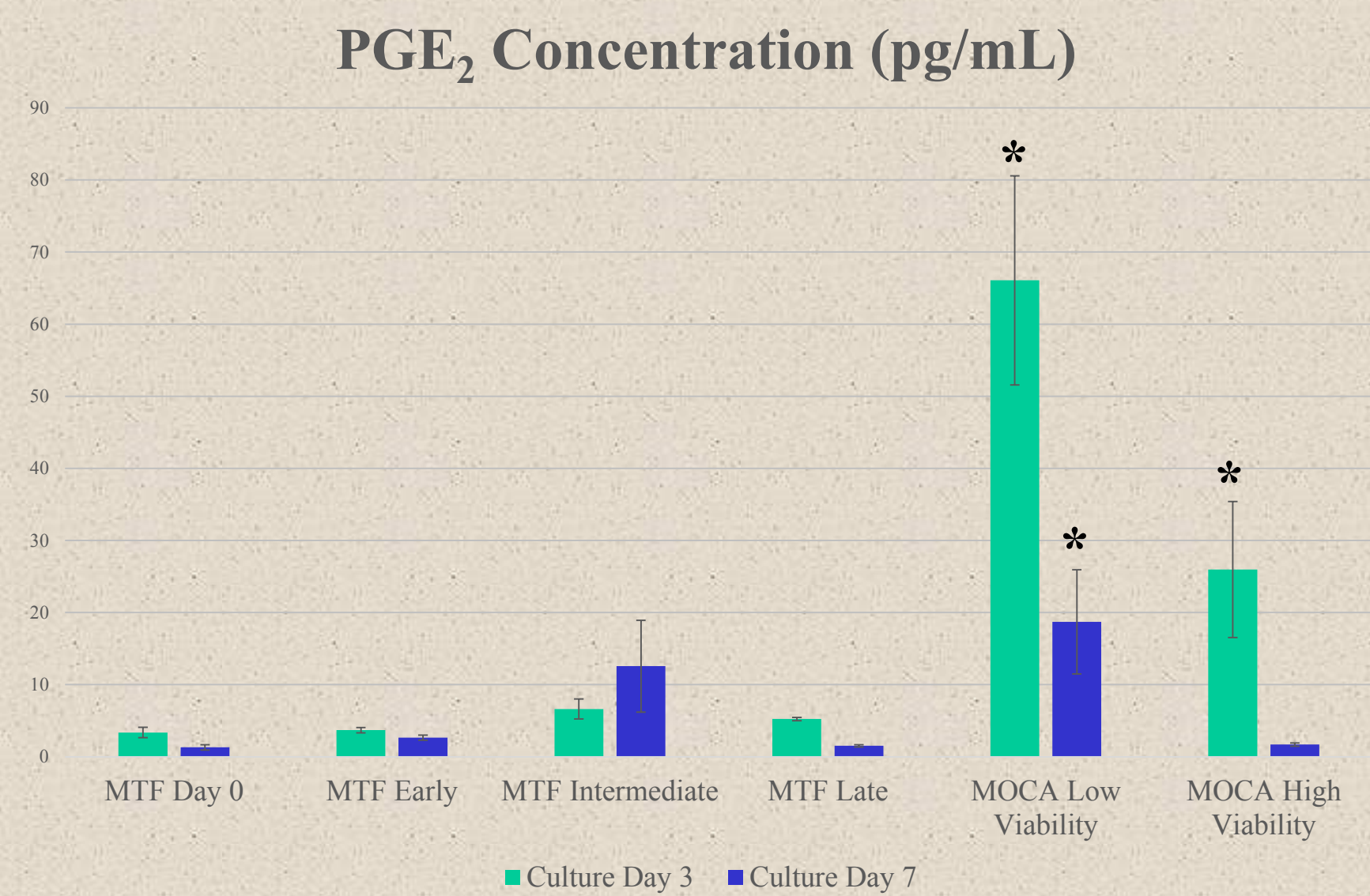


Figure 1: The concentration of PGE₂ in the MOCA-low group was significantly higher than all MTF groups at culture day 3 and all but MTF intermediate at day 7. The concentration of PGE₂ in the MOCA-high group was significantly higher than MTF Day 0 and Intermediate at culture day 3. There was not a significant difference between MOCA-high and any of the MTF groups at day 7.

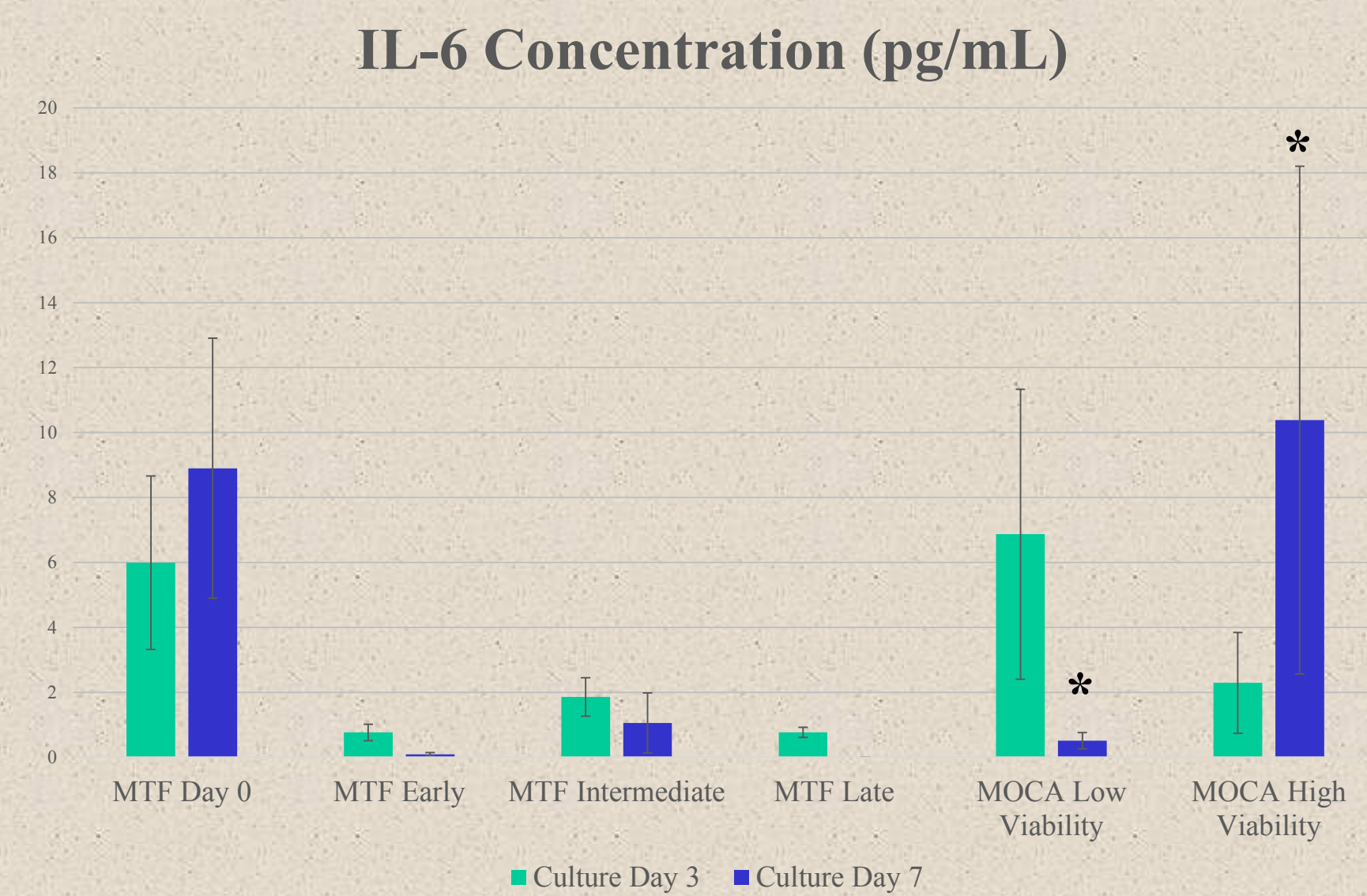


Figure 2: The concentration of IL-6 was not significantly different between the MOCA and MTF groups at day 3 of culture. At day 7 of culture, IL-6 was significantly lower in MOCA Low group compared to the MTF Day 0 group, and significantly higher in MOCA High group compared to the MTF Early group.

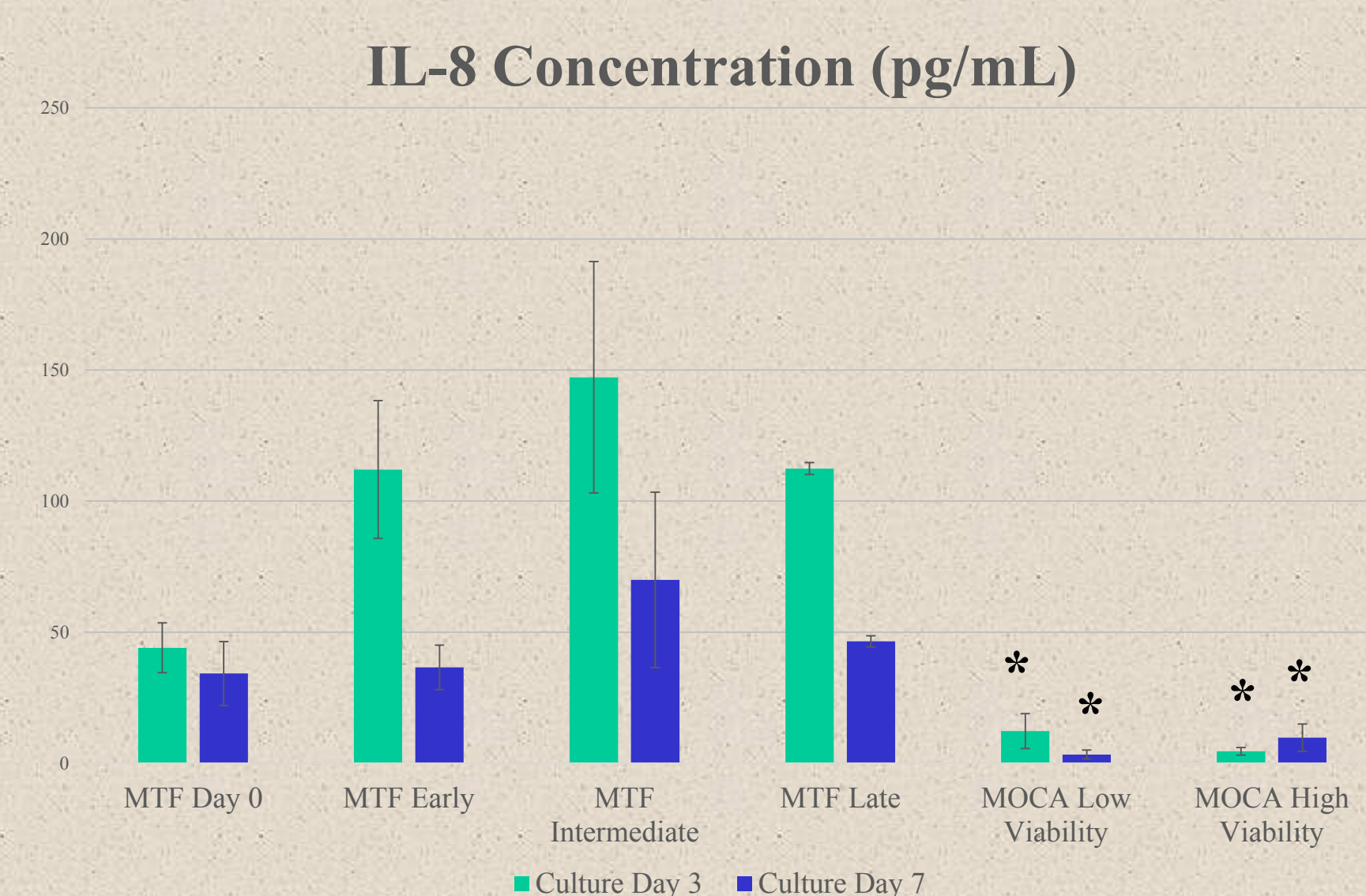


Figure 3: The concentration of IL-8 was significantly lower in MOCA Low and High groups compared to all MTF groups at day 3 of culture. At day 7, IL-8 was significantly lower in MOCA Low group compared to all MTF groups, and in the MOCA High group compared to the MTF Late group.

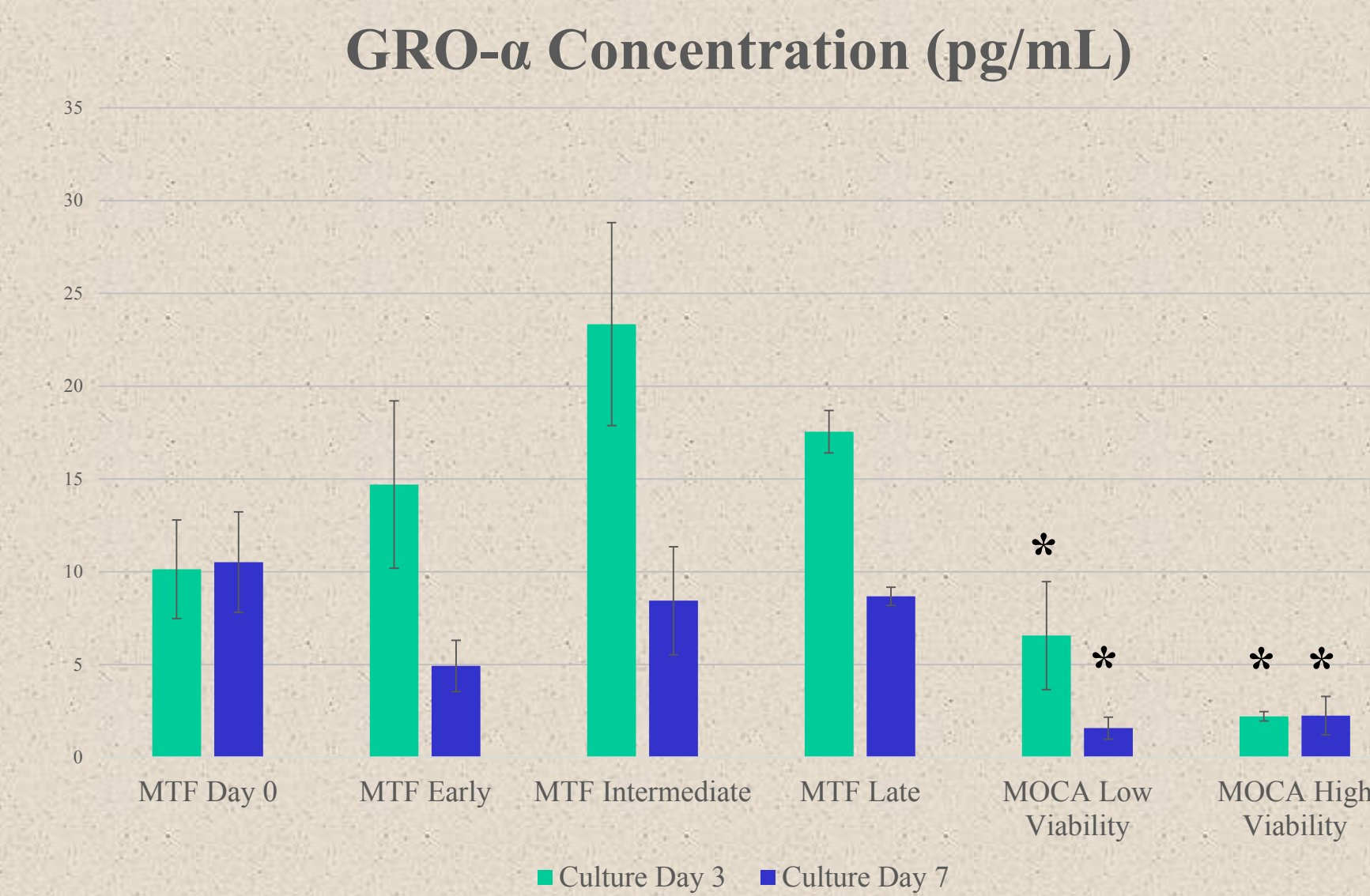


Figure 4: The concentration of GRO-α was significantly lower in MOCA Low group than in the MTF Early and Intermediate groups, and in the MOCA High group compared to all MTF groups, at day 3 of culture. At day 7, GRO-α was significantly lower in the MOCA Low group compared to all MTF groups except for MTF Early, and the MOCA High group was significantly lower than the MTF Late group.

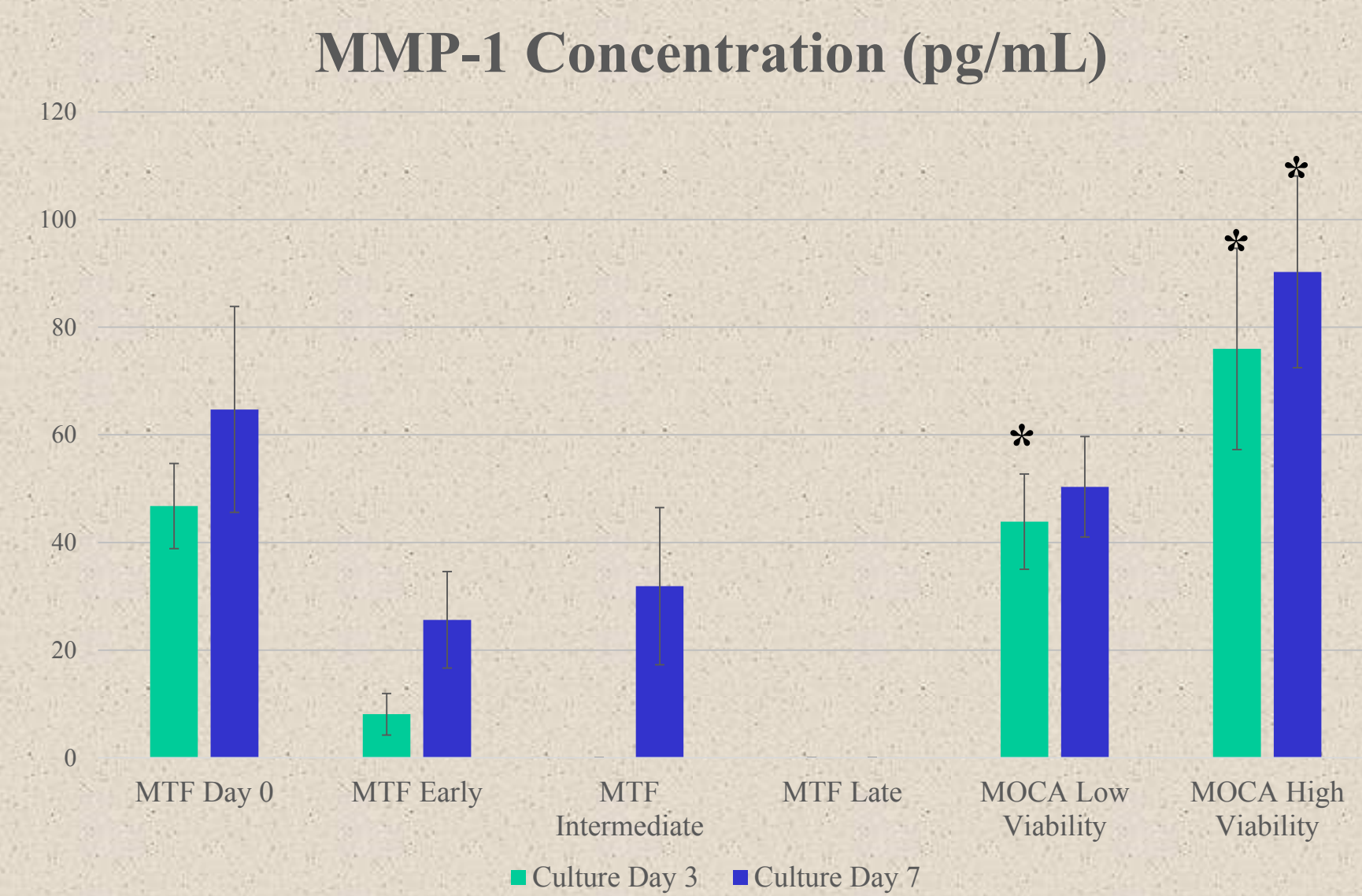


Figure 5: The concentration of MMP-1 was significantly higher in MOCA Low group compared to all MTF groups, except the MTF Day 0 group, at day 3 of culture. The concentration of MMP-1 was significantly higher in MOCA High group compared to the MTF Early and Intermediate groups at days 3 and 7 of culture.

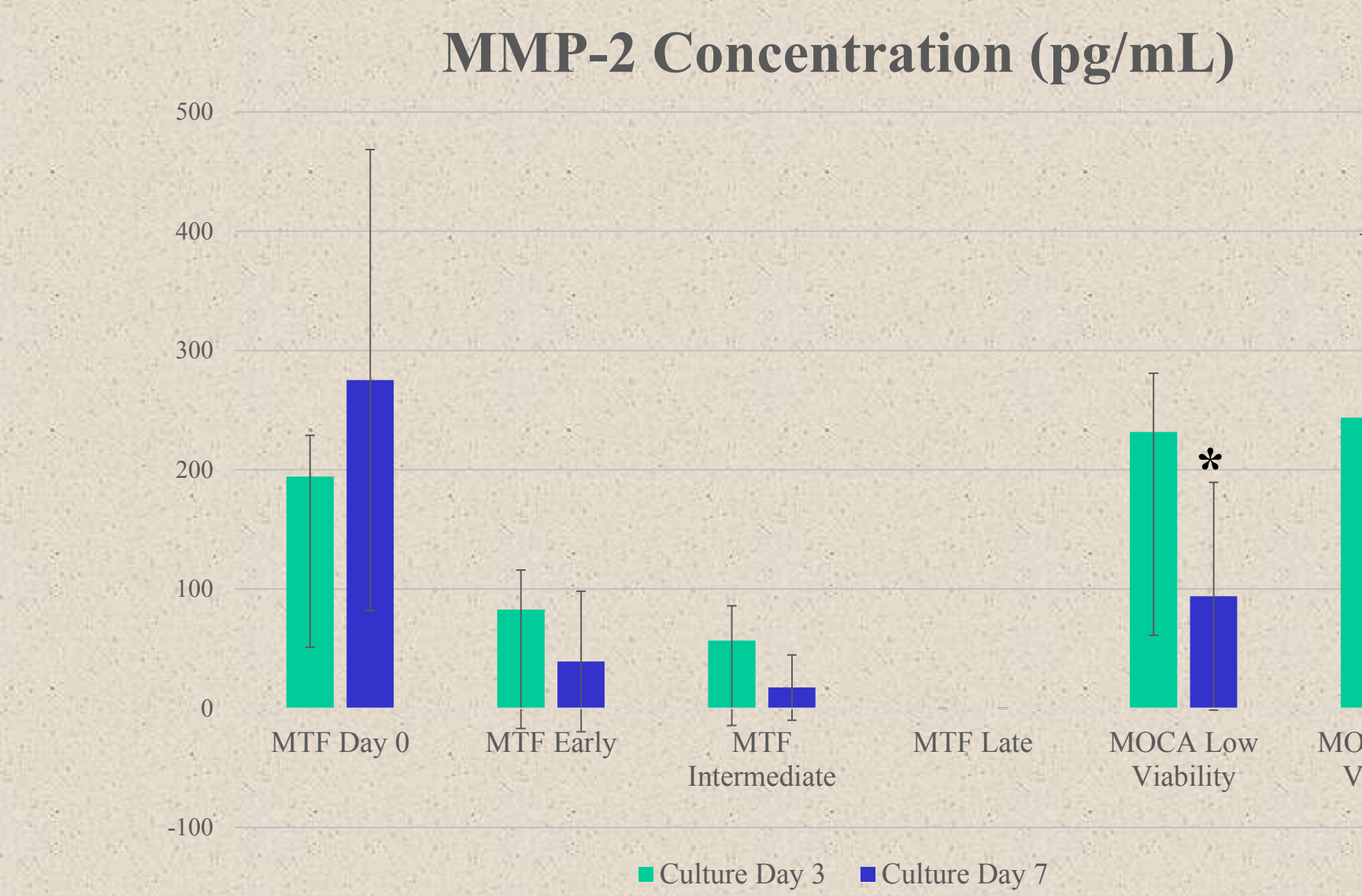


Figure 6: The concentration of MMP-2 was significantly higher in MOCA Low group compared to the MTF Early and Intermediate groups at day 3 of culture. At day 7 of culture, the concentration of MMP-2 was significantly lower in MOCA Low group compared to the MTF Day 0 group and significantly higher than MTF Late group. The MOCA High group was significantly higher than the MTF Early and Intermediate groups at day 7 of culture.

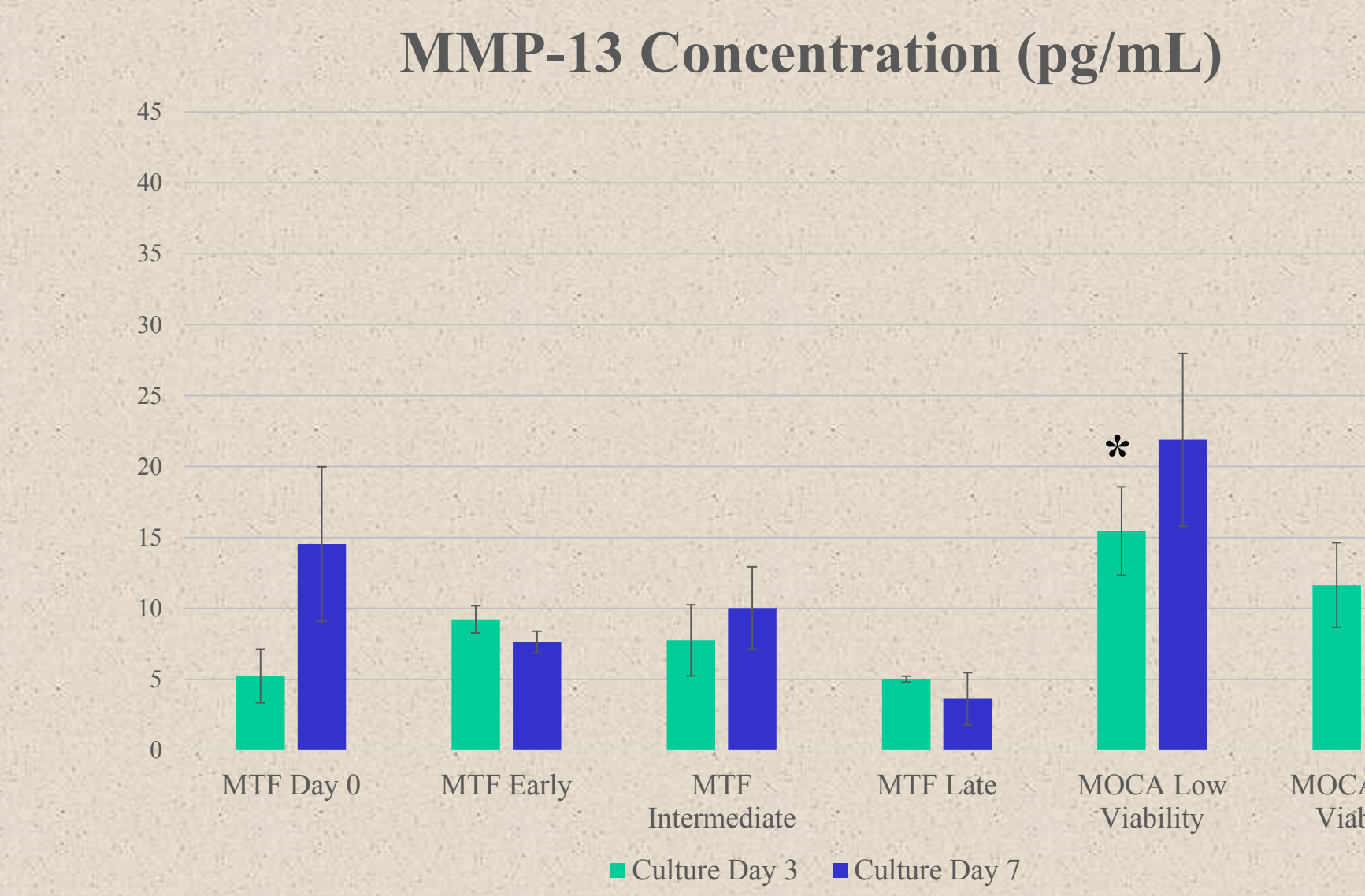


Figure 7: The concentration of MMP-13 was significantly higher in MOCA Low and MOCA High groups compared to the MTF Day 0 group at culture day 3. At day 7 of culture, the concentration of MMP-13 was significantly higher in MOCA High group compared to all MTF groups except MTF Day 0 group. There was no significant difference between the MOCA Low group and MTF groups at 7 days.

Conclusions

- These data indicate that tissues stored using the MOPSTM protocol maintains a normal metabolic response associated with higher tissue viability.
- The data from this study indicates that storage using the MOPSTM protocol is superior for maintaining normal tissue metabolism after transplantation.