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Short Communication

Osteoporosis and Melatonin Hormone

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Osteoporosis (OP), the most prevalent bone disease, is a significant global public health issue. It is of three different forms: post-menopausal OP, which is mostly caused by decreased estrogen; senile OP, which is primarily caused by aging; and secondary OP, which is brought on by illnesses or medications [1]. The key traits include diminished bone quality, aberrant micro-architecture, and reduced bone mass and bone mineral density (BMD). It has been established that OP increases the risk of bone fracture. The callus volume of broken bone and bone defect, BMD, and mechanical strength could all be dramatically reduced by OP, according to studies done on rodents. Previous research demonstrated that patients with OP had significantly longer healing times for bone fractures or bone abnormalities than healthy individuals. Osteoporotic bone regeneration depends on maintaining osteogenesis and angiogenesis [2].

Melatonin (MLT); "N-acetyl-5-methoxy tryptamine"; is an indoleamine that is chiefly secreted by the pineal gland and found in every region of a mammal's body. Additionally, the spleen, gastrointestinal system, testes, retina, thymus, and bone marrow can all make MLT in modest amounts. The creation of MLT is timed with the cycle of light and dark, and it is especially created and secreted in dimly lit or dark areas. Studies have shown that MLT can be used to treat insomnia because it helps in synchronizing peripheral tissues' circadian clocks [3,4]. MLT is a crucial component of the control of energy metabolism, sleep-wake cycles, and seasonal timing because it is an amphiphilic chemical messenger. Additionally, MLT has a wide range of physiological benefits, including the prevention of cancers, oxidation, inflammation, and cardiovascular and neurological protection. It also regulates the immune system [4,5].

Melatonin contributes to the preservation of bones and cartilages; it is directly linked to the maintenance of bone metabolism. It has been discovered that bone marrow tissue produces and secretes MLT and that the femoral bone marrow has a significant amount of it. Researchers have discovered a connection between decreased plasma MLT levels and a high prevalence of bone weakening because there is a relationship between the development of OP with advancing age and menopause, that are associated with a decrease in MLT production. Following a pinealectomy, Egermann., *et al*. found that bone mass dramatically reduces. In addition, bone metabolism indicators, such as serum alkaline phosphatase (ALP), rise following pineal gland removal while falling after exposure to MLT [6-8]. In addition to aging, bone loss and an increased risk of fracture are linked to circadian rhythm disturbances brought on by shift employment or nighttime environmental changes [1].

The membrane-bound MLT receptors; MT1 and MT2; are expressed by both osteoblasts and osteoclasts in bone. According to numerous studies, MLT may help osteoblasts proliferate and differentiate, suppress osteoclast function, sustain the normal metabolism of bone, and so prevent OP [2]. In osteoblasts and mesenchymal stem cells (MSCs), the MT2 receptor of MLT directly controls osteoblastogenesis [1]. Additionally, MLT works independently of receptors to promote osteoblastogenesis, prevent osteoclastogenesis, and increase bone density. It does this

by working as an oxidation inhibitor or scavenger of free radicals [9]. Through increasing the HGF "hepatocyte growth factor", and suppressing PTEN "phosphatase and tensin homolog" which in turn promotes Wnt/beta-catenin axis, Zhang., *et al*. revealed that MLT may improve the osteogenic capability of bone marrow MSCs (BMSCs); that had been compromised by OP; and prevent bone loss, he also revealed that MLT could promote osteogenesis-angiogenesis coupling to speed up the repair of osteoporotic bone [10]. Also, Guan., *et al*. demonstrated that MLT improved bone metabolism and improved bone mass in normal, peri-menopausal, and post-menopausal osteoporotic rats as a result of inducing osteogenic differentiation in BMSCs [6]. Bone loss following a pinealectomy provided evidence that the pineal gland affects bone metabolism [7]. MLT is effectively maintaining bone homeostasis, according to both *in vitro* and *in vivo* research [1].

These studies demonstrate that MLT may be used to treat OP [2,6]. MLT supplementation has been shown to improve peri-menopausal and age-related OP [8]. It is typically safe and inexpensive [6] though, as a few studies have noted negative effects and there is no agreement on the best program for MLT prescription, further studies are needed to determine the ideal dosage methods and safety of long-standing MLT administration [8].

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