Table S1. Comparison of Bone Volume, Trabecular Bone Volume Fraction (Bone Volume over Tissue Volume (BV/TV)), Bone Surface Area (BSA), Trabecular Number (Tb.N), Trabecular Thickness (Tb.Th), Trabecular Bone Mineral Content (BMC), Trabecular Bone Mineral Density (BMD), from femora of young (2 month old) and adult (7-9 month old) wild type and *Bmal1*$^{-/-}$ mice. Results given as mean ± standard deviation for groups of mice (sample size indicated in parentheses).

Trabecular Bone Morphology and BMD - Femur				
Genotype	**Young Wild Type**	**Adult Wild Type**	**Young *Bmal1*$^{-/-}$**	**Adult B*mal1*$^{-/-}$**
Bone Volume (mm^3)	**, †0.51 ± 0.07 (4)	††0.14 ± 0.02 (4)	**0.34 ± 0.08 (4)	0.06 ± 0.009 (3)
BV/TV (mm^3/mm^3)	**, †0.18 ± 0.03 (3)	0.04 ± 0.01 (4)	**0.12 ± 0.02 (3)	0.03 ± 0.01 (3)
BSA (mm^2)	**, †27.43 ± 3.86 (3)	†11.36 ± 4.8 (5)	*18.0 ± 3.97 (3)	3.55 ± 0.73 (3)
Tb.N (1/mm)	**, †3.11 ± 0.18 (3)	†1.15 ± 0.74 (5)	**2.28 ± 0.37 (3)	0.42 ± 0.16 (3)
Tb.Th (µm)	59.05 ± 6.27 (3)	51.89 ± 5.97 (7)	52.12 ± 1.14 (3)	61.44 ± 6.9 (3)
Trabecular BMC (mg)	*, †3.16 ± 0.89 (4)	1.22 ± 1.67 (7)	*1.63 ± 0.57 (4)	0.34 ± 0.05 (3)
Trabecular BMD (mg/cm^3)	†1.06 ± 0.18 (4)	†1.11 ± 0.2 (7)	*0.8 ± 0.08 (4)	0.91 ± 0.05 (3)

Significance when compared to same genotype of different age group. * ($p < 0.05$), ** ($p < 0.01$).
Significance when compared to different genotype of same age group † ($p < 0.05$), †† ($p < 0.01$).

Table S2. Comparison of Bone Volume, Trabecular Bone Volume Fraction (Bone Volume over Tissue Volume (BV/TV)), Bone Surface Area (BSA), Trabecular Number (Tb.N), Trabecular Thickness (Tb.Th), Trabecular Bone Mineral Content (BMC), Trabecular Bone Mineral Density (BMD), from tibiae of young (2 month old) and adult (7-9 month old) wild type and *Bmal1*$^{-/-}$ mice. Results given as mean ± standard deviation for groups of mice (sample size indicated in parentheses).

Trabecular Bone Morphology and BMD - Tibia				
Genotype	**Young Wild Type**	**Adult Wild Type**	**Young *Bmal1*$^{-/-}$**	**Adult *Bmal1*$^{-/-}$**
Bone Volume (mm^3)	0.64 ± 0.25 (3)	††0.16 ± 0.03 (5)	0.17 ± 0.07 (7)	0.08 ± 0.02 (7)
BV/TV (mm^3/mm^3)	0.16 ± 0.09 (4)	†0.05 ± 0.01 (5)	0.08 ± 0.03 (4)	0.04 ± 0.004 (6)
BSA (mm^2)	**24.57 ± 4.86 (3)	†10.31 ± 5.4 (6)	*15.16 ± 6.21 (3)	4.86 ± 0.92 (3)
Tb.N (1/mm)	*, †3.22 ± 0.75 (3)	1.61 ± 1.25 (5)	*1.53 ± 0.42 (3)	0.82 ± 0.13 (5)
Tb.Th (μm)	55.92 ± 11.09 (4)	†56.38 ± 2.8 (6)	**45.99 ± 0.75 (4)	51.58 ± 3.04 (5)
Trabecular BMC (mg)	3.41 ± 2.0 (3)	1.57 ± 1.5 (6)	0.72 ± 0.33 (3)	0.43 ± 0.07 (6)
Trabecular BMD (mg/cm^3)	††0.88 ± 0.12 (4)	††1.02 ± 0.06 (7)	*0.6 ± 0.08 (4)	0.73 ± 0.07 (6)

Significance when compared to same genotype of different age group. * ($p < 0.05$), ** ($p < 0.01$).
Significance when compared to different genotype of same age group † ($p < 0.05$), †† ($p < 0.01$).

Table S3. Comparison of Cortical Volume, Cortical Bone Fraction, Cortical Bone Thickness, Cortical Bone Mineral Content (BMC) and Cortical Bone Mineral Density (BMD) from femora of young (2 month old) and adult (7-9 month old) wild type and *Bmal1*$^{-/-}$ mice. Results given as mean ± standard deviation for groups of mice (sample size indicated in parentheses).

Cortical Bone Morphology and BMD - Femur				
Genotype	**Young Wild Type**	**Adult Wild Type**	**Young *Bmal1*$^{-/-}$**	**Adult *Bmal1*$^{-/-}$**
Cortical Volume (mm^3)	*, ††1.56 ± 0.1 (4)	†1.74 ± 0.05 (4)	1.27 ± 0.13 (4)	1.48 ± 0.16 (3)
Cortical Bone Fraction	0.74 ± 0.05 (4)	†0.76 ± 0.03 (7)	0.72 ± 0.07 (4)	0.72 ± 0.01 (3)
Cortical Bone Thickness (µm)	†188.14 ± 6.3 (3)	†193.3 ± 5.29 (5)	167.88 ± 8.33 (3)	177.67 ± 9.19 (3)
Cortical BMC (mg)	**, †† 0.55 ± 0.01 (4)	††0.89 ± 0.12 (7)	**0.37 ± 0.04 (4)	0.59 ± 0.03 (3)
Cortical BMD (mg/cm^3)	**, ††0.56 ± 0.03 (4)	††0.85 ± 0.14 (7)	*0.44 ± 0.05 (4)	0.61 ± 0.06 (3)

Significance when compared to same genotype of different age group. * ($p < 0.05$), ** ($p < 0.01$).
Significance when compared to different genotype of same age group † ($p < 0.05$), †† ($p < 0.01$).

Table S4. Comparison of Cortical Volume, Cortical Bone Fraction, Cortical Bone Thickness, Cortical Bone Mineral Content (BMC) and Cortical Bone Mineral Density (BMD) from tibiae of young (2 month old) and adult (7-9 month old) wild type and *Bmal1*$^{-/-}$ mice. Results given as mean ± standard deviation of groups of mice (sample size indicated in parentheses).

Cortical Bone Morphology and BMD – Tibia				
Genotype	**Young Wild Type**	**Adult Wild Type**	**Young *Bmal1*$^{-/-}$**	**Adult *Bmal1*$^{-/-}$**
Cortical Volume (mm^3)	*, †1.85 ± 0.03 (4)	2.09 ± 0.21 (6)	1.03 ± 0.24 (3)	1.13 ± 0.73 (3)
Cortical Bone Fraction	†0.93 ± 0.01 (3)	†0.89 ± 0.06 (7)	0.87 ± 0.03 (3)	0.83 ± 0.02 (3)
Cortical Bone Thickness (µm)	††153.85 ± 11.02 (3)	††169.7 ± 7.73 (5)	*112.55 ± 3.63 (3)	125.94 ± 7.27 (3)
Cortical BMC (mg)	**, ††0.61 ± 0.02 (4)	†0.91 ± 0.16 (6)	0.34 ± 0.09 (4)	0.39 ± 0.26 (3)
Cortical BMD (mg/cm^3)	**, ††0.71 ± 0.02 (3)	††0.88 ± 0.11 (7)	**0.59 ± 0.02 (3)	0.63 ± 0.02 (3)

Significance when compared to same genotype of different age group. * ($p < 0.05$), ** ($p < 0.01$).
Significance when compared to different genotype of same age group † ($p < 0.05$), †† ($p < 0.01$).

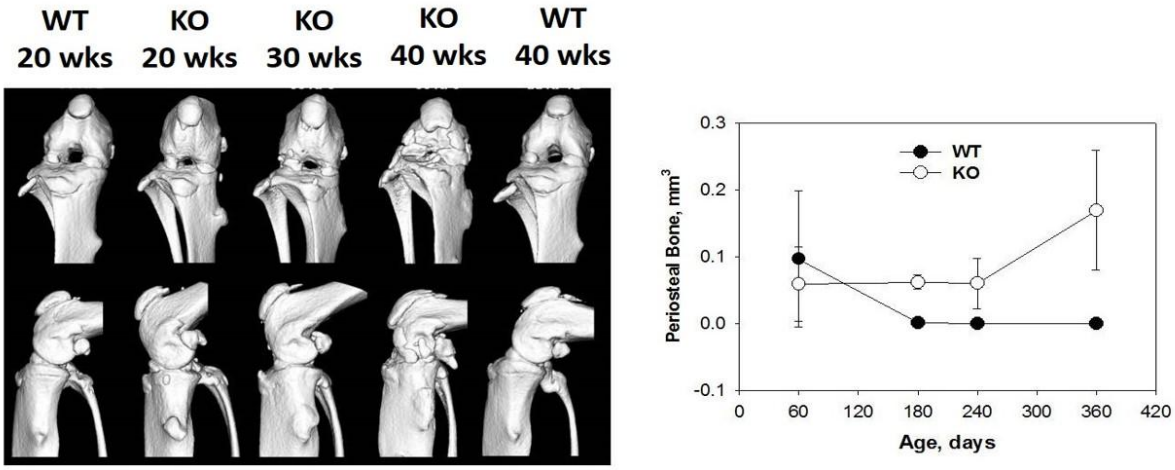

Figure S1. Abnormal Periosteal Growth and Ectopic Calcification. Left: Micro-CT images of the knee of wild type (WT) BMAL1 knock out (KO) mice at 20, 30 and 40 weeks (wks) of age. At 20 weeks of age, there are abnormal ossifications along the periosteal surface of the bone as evidenced by outgrowths occurring where the tibia meets the femur at the knee joint. By 30 weeks of age, the abnormal periosteal ossifications have become more pronounced and the occurrence of isolated ectopic calcification at the knee becomes visible. By 40 weeks of age, the abnormal periosteal ossification and ectopic calcification is readily visible. Right: Quantification of bone along the periosteal surface. Periosteal surface bone was measured by micro-CT scanning at day 60, 180, 240, and 360. There is a slight increase of periosteal bone at days 180 and 240 in *Bmal1*$^{-/-}$ mice, but a large increase occurs at the knee by day 360.