

Supporting Information

Differentiated Activities of Decorin and Biglycan in the Progression of Post-Traumatic Osteoarthritis

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Table S1. Summary of structural and biomechanical analysis outcomes of control, *Dcn^{iKO}*, *Bgn^{iKO}* and *Dcn/Bgn^{iKO}* mice at 8 weeks post-surgery, shown as mean [95% CI] from values averaged by each animal, as well as statistical outcomes between surgeries for each genotype. The *p*-values were calculated for comparisons between Sham and DMM surgeries for each genotype using the linear mixed effect model, except for the *p*-values of von Mises concentration κ , which were calculated using the Mardia and Jupp test of concentration equality, followed by Holm-Bonferroni correction for multiple contrasts amongst the four genotypes.

		Control	<i>Dcn^{iKO}</i>	<i>Bgn^{iKO}</i>	<i>Dcn/Bgn^{iKO}</i>
Mankin Score	Sham	0.63 [0.24 1.03]	1.00 [0.20 1.79]	0.78 [0.09 1.47]	2.17 [1.62 2.71]
	DMM	5.78 [5.35 6.21]	7.17 [6.89 7.44]	6.22 [5.68 6.76]	7.29 [6.87 7.71]
	<i>n</i>	10	6	6	6
	<i>p</i> -value	< 0.001	< 0.001	< 0.001	< 0.001
<i>t</i> _{uncalcified} (μm)	Sham	38 [35 41]	42 [37 46]	38 [33 43]	31 [28 33]
	DMM	24 [22 26]	24 [22 27]	25 [19 31]	16 [14 19]
	<i>n</i>	10	6	6	6
	<i>p</i> -value	< 0.001	< 0.001	< 0.001	< 0.001
<i>t</i> _{total} (μm)	Sham	122 [116 128]	124 [117 132]	111 [106 116]	102 [97 106]
	DMM	105 [97 113]	87 [76 97]	100 [95 104]	81 [73 89]
	<i>n</i>	10	6	6	6
	<i>p</i> -value	< 0.001	< 0.001	0.004	< 0.001
von Mises Concentration, κ	Sham	0.36 [0.27 0.46]	0.24 [0.17 0.32]	0.32 [0.21 0.44]	0.36 [0.24 0.50]
	DMM	0.32 [0.23 0.41]	2.17 [1.96 2.38]	0.34 [0.22 0.46]	2.17 [1.85 2.50]
	<i>n</i>	4	4	4	4
	<i>p</i> -value	0.497	< 0.001	0.125	< 0.001
<i>E</i> _{ind} (MPa)	Sham	1.42 [1.17 1.67]	1.18 [0.94 1.42]	1.20 [0.85 1.54]	0.81 [0.28 1.33]
	DMM	0.43 [0.31 0.54]	0.65 [0.44 0.85]	0.69 [0.27 1.11]	2.37 [1.48 3.27]
	<i>n</i>	9	5	5	5
	<i>p</i> -value	< 0.001	0.009	0.006	< 0.001
%Ca (wt.)	DMM	0.27 [0.17 0.37]	0.47 [0.30 0.63]	0.26 [0.19 0.34]	1.08 [0.59 1.56]
	<i>n</i>	6	6	5	6

Table S2. Summary of the fibril diameter outcomes, d_{col} , on the condyle cartilage surfaces of control, Dcn^{iKO} , Bgn^{iKO} and Dcn/Bgn^{iKO} mice at 8 weeks post-surgery, as well as statistical outcomes between surgeries for each genotype. The p -values were calculated for comparisons between Sham and DMM surgeries for each genotype using the linear mixed effect model, followed by Holm-Bonferroni correction for multiple contrasts amongst the four genotypes. For comparisons between genotypes, no significant differences in d_{col} were detected ($p = 0.314$ amongst the four Sham groups, and $p = 0.431$ amongst the four DMM groups).

Fibril diameter d_{col} (nm)	Control		Dcn^{iKO}		Bgn^{iKO}		Dcn/Bgn^{iKO}	
	Sham	DMM	Sham	DMM	Sham	DMM	Sham	DMM
mean	33.5	33.2	33.8	34.3	34.1	33.1	33.4	33.3
std	7.4	7.6	6.8	8.6	9.2	6.8	5.7	6.4
Q_1	27.3	26.7	28.2	26.5	26.3	27.2	29.3	27.6
Q_2	33.3	33.1	33.8	33.1	34.4	33.3	33.6	33.3
Q_3	39.2	40.0	40.0	42.2	41.9	39.1	38.2	39.1
min	20.2	20.2	22.3	20.2	17.0	21.3	22.8	21.9
max	47.4	46.2	45.4	49.8	49.7	45.2	43.0	44.0
n_{fibril}	300	300	300	300	300	300	300	300
p -value	1.000		0.973		0.967		0.394	

Table S3. Summary of statistical analysis outcomes of structural and biomechanical parameters for pair-wise comparisons between genotypes for each surgery group at 8 weeks post-surgery. The p -values were calculated using the linear mixed effect model followed by Tukey-Kramer multiple comparison correction, except for the p -values of von Mises concentration κ , which were calculated using the Mardia and Jupp test of concentration equality followed by Holm-Bonferroni correction.

Mankin Score							
Sham				DMM			
	Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}		Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}
<i>Dcn</i> ^{ikO}	0.581			<i>Dcn</i> ^{ikO}	< 0.001		
<i>Bgn</i> ^{ikO}	0.958	0.899		<i>Bgn</i> ^{ikO}	0.428	0.025	
<i>Dcn/Bgn</i> ^{ikO}	< 0.001	0.004	< 0.001	<i>Dcn/Bgn</i> ^{ikO}	< 0.001	0.980	0.009
<i>t</i> _{uncalcified} (μm)							
Sham				DMM			
	Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}		Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}
<i>Dcn</i> ^{ikO}	0.183			<i>Dcn</i> ^{ikO}	0.984		
<i>Bgn</i> ^{ikO}	0.995	0.378		<i>Bgn</i> ^{ikO}	0.919	0.994	
<i>Dcn/Bgn</i> ^{ikO}	0.005	< 0.001	0.008	<i>Dcn/Bgn</i> ^{ikO}	0.003	0.003	0.002
<i>t</i> _{total} (μm)							
Sham				DMM			
	Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}		Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}
<i>Dcn</i> ^{ikO}	0.963			<i>Dcn</i> ^{ikO}	< 0.001		
<i>Bgn</i> ^{ikO}	0.050	0.035		<i>Bgn</i> ^{ikO}	0.612	0.048	
<i>Dcn/Bgn</i> ^{ikO}	< 0.001	< 0.001	0.220	<i>Dcn/Bgn</i> ^{ikO}	< 0.001	0.642	0.002
von Mises Concentration, κ							
Sham				DMM			
	Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}		Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}
<i>Dcn</i> ^{ikO}	1.000			<i>Dcn</i> ^{ikO}	< 0.001		
<i>Bgn</i> ^{ikO}	0.447	0.342		<i>Bgn</i> ^{ikO}	0.683	< 0.001	
<i>Dcn/Bgn</i> ^{ikO}	0.902	1.000	0.433	<i>Dcn/Bgn</i> ^{ikO}	< 0.001	0.950	< 0.001
<i>E</i> _{ind} (MPa)							
Sham				DMM			
	Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}		Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}
<i>Dcn</i> ^{ikO}	0.614			<i>Dcn</i> ^{ikO}	0.682		
<i>Bgn</i> ^{ikO}	0.670	1.000		<i>Bgn</i> ^{ikO}	0.547	0.997	
<i>Dcn/Bgn</i> ^{ikO}	0.017	0.341	0.301	<i>Dcn/Bgn</i> ^{ikO}	< 0.001	< 0.001	< 0.001
%Ca (wt.)							
DMM							
	Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}		Control	<i>Dcn</i> ^{ikO}	<i>Bgn</i> ^{ikO}
<i>Dcn</i> ^{ikO}	0.558						
<i>Bgn</i> ^{ikO}	1.000	0.570					
<i>Dcn/Bgn</i> ^{ikO}	< 0.001	0.003	< 0.001				

Table S4. Summary of micro-computed tomography (μ CT) analysis outcomes of control, *Dcn^{iKO}*, *Bgn^{iKO}* and *Dcn/Bgn^{iKO}* mice at 8 weeks post-surgery, shown as mean [95% CI] from values averaged by each animal, as well as statistical outcomes between surgeries for each genotype. The *p*-values were calculated for comparisons between Sham and DMM surgeries for each genotype using the linear mixed effect model, followed by Holm-Bonferroni correction for multiple contrasts amongst the four genotypes.

		Control	<i>Dcn^{iKO}</i>	<i>Bgn^{iKO}</i>	<i>Dcn/Bgn^{iKO}</i>
SBP. Th (μ m)	Sham	136 [108 163]	134 [125 144]	111 [102 119]	121 [107 134]
	DMM	130 [108 151]	150 [133 168]	130 [113 147]	129 [120 137]
	<i>n</i>	5	5	5	5
	<i>p</i> -value	0.337	0.063	0.027	0.448
STB BV/TV (%)	Sham	56 [45 66]	53 [42 65]	37 [35 40]	38 [31 44]
	DMM	57 [51 63]	64 [55 74]	39 [35 43]	42 [32 51]
	<i>n</i>	5	5	5	5
	<i>p</i> -value	0.467	0.001	0.765	0.317
STB Tb.N (mm^{-1})	Sham	7.0 [6.2 7.8]	7.6 [6.5 8.8]	6.1 [6.0 6.2]	5.7 [5.1 6.2]
	DMM	7.7 [7.2 8.3]	8.7 [7.8 9.7]	6.2 [5.7 6.7]	5.8 [5.1 6.5]
	<i>n</i>	5	5	5	5
	<i>p</i> -value	0.002	< 0.001	0.551	0.745
STB Tb.Th (μ m)	Sham	89 [68 110]	82 [73 91]	62 [56 68]	73 [62 85]
	DMM	95 [78 112]	102 [96 108]	73 [59 87]	85 [69 102]
	<i>n</i>	5	5	5	5
	<i>p</i> -value	0.053	< 0.001	0.002	0.001
Men. OV _{ant.} ($\times 10^{-3} \text{mm}^3$)	Sham	93 [91 96]	86 [69 102]	80 [60 100]	80 [60 100]
	DMM	216 [141 291]	165 [126 203]	151 [110 192]	154 [126 183]
	<i>n</i>	5	5	5	5
	<i>p</i> -value	< 0.001	< 0.001	0.001	< 0.001
Men. OV _{post.} ($\times 10^{-3} \text{mm}^3$)	Sham	30 [13 47]	39 [21 56]	16 [11 20]	60 [44 76]
	DMM	54 [17 92]	103 [45 162]	75 [33 117]	107 [80 134]
	<i>n</i>	5	5	5	5
	<i>p</i> -value	0.167	0.002	0.005	0.020

Table S5. Summary of statistical analysis outcomes of micro-computed tomography (μ CT) parameters for pair-wise comparisons between genotypes for each surgery group at 8 weeks post-surgery. The p -values were calculated using the linear mixed effect model followed by Tukey-Kramer multiple comparison correction.

SBP. Th (μ m)							
Sham				DMM			
	Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}		Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}
<i>Dcn</i> ^{iKO}	1.000			<i>Dcn</i> ^{iKO}	0.093		
<i>Bgn</i> ^{iKO}	0.032	0.046		<i>Bgn</i> ^{iKO}	1.000	0.108	
<i>Dcn/Bgn</i> ^{iKO}	0.300	0.381	0.663	<i>Dcn/Bgn</i> ^{iKO}	1.000	0.071	1.000
STB BV/TV (%)							
Sham				DMM			
	Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}		Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}
<i>Dcn</i> ^{iKO}	0.957			<i>Dcn</i> ^{iKO}	0.321		
<i>Bgn</i> ^{iKO}	0.001	0.003		<i>Bgn</i> ^{iKO}	0.001	< 0.001	
<i>Dcn/Bgn</i> ^{iKO}	0.001	0.004	1.000	<i>Dcn/Bgn</i> ^{iKO}	0.005	< 0.001	0.940
STB Tb.N							
Sham				DMM			
	Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}		Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}
<i>Dcn</i> ^{iKO}	0.322			<i>Dcn</i> ^{iKO}	0.052		
<i>Bgn</i> ^{iKO}	0.105	0.002		<i>Bgn</i> ^{iKO}	0.003	< 0.001	
<i>Dcn/Bgn</i> ^{iKO}	0.008	< 0.001	0.632	<i>Dcn/Bgn</i> ^{iKO}	< 0.001	< 0.001	0.719
STB Tb.Th (μ m)							
Sham				DMM			
	Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}		Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}
<i>Dcn</i> ^{iKO}	0.767			<i>Dcn</i> ^{iKO}	0.719		
<i>Bgn</i> ^{iKO}	0.005	0.042		<i>Bgn</i> ^{iKO}	0.026	0.003	
<i>Dcn/Bgn</i> ^{iKO}	0.135	0.560	0.412	<i>Dcn/Bgn</i> ^{iKO}	0.538	0.108	0.313
Men. OV _{ant.} ($\times 10^{-3}$ mm ³)							
Sham				DMM			
	Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}		Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}
<i>Dcn</i> ^{iKO}	0.970			<i>Dcn</i> ^{iKO}	0.024		
<i>Bgn</i> ^{iKO}	0.873	0.990		<i>Bgn</i> ^{iKO}	0.003	0.863	
<i>Dcn/Bgn</i> ^{iKO}	0.877	0.990	1.000	<i>Dcn/Bgn</i> ^{iKO}	0.005	0.936	0.997
Men. OV _{post.} ($\times 10^{-3}$ mm ³)							
Sham				DMM			
	Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}		Control	<i>Dcn</i> ^{iKO}	<i>Bgn</i> ^{iKO}
<i>Dcn</i> ^{iKO}	0.960			<i>Dcn</i> ^{iKO}	0.034		
<i>Bgn</i> ^{iKO}	0.844	0.557		<i>Bgn</i> ^{iKO}	0.651	0.370	
<i>Dcn/Bgn</i> ^{iKO}	0.338	0.632	0.068	<i>Dcn/Bgn</i> ^{iKO}	0.021	0.998	0.273