Supplementary Materials:

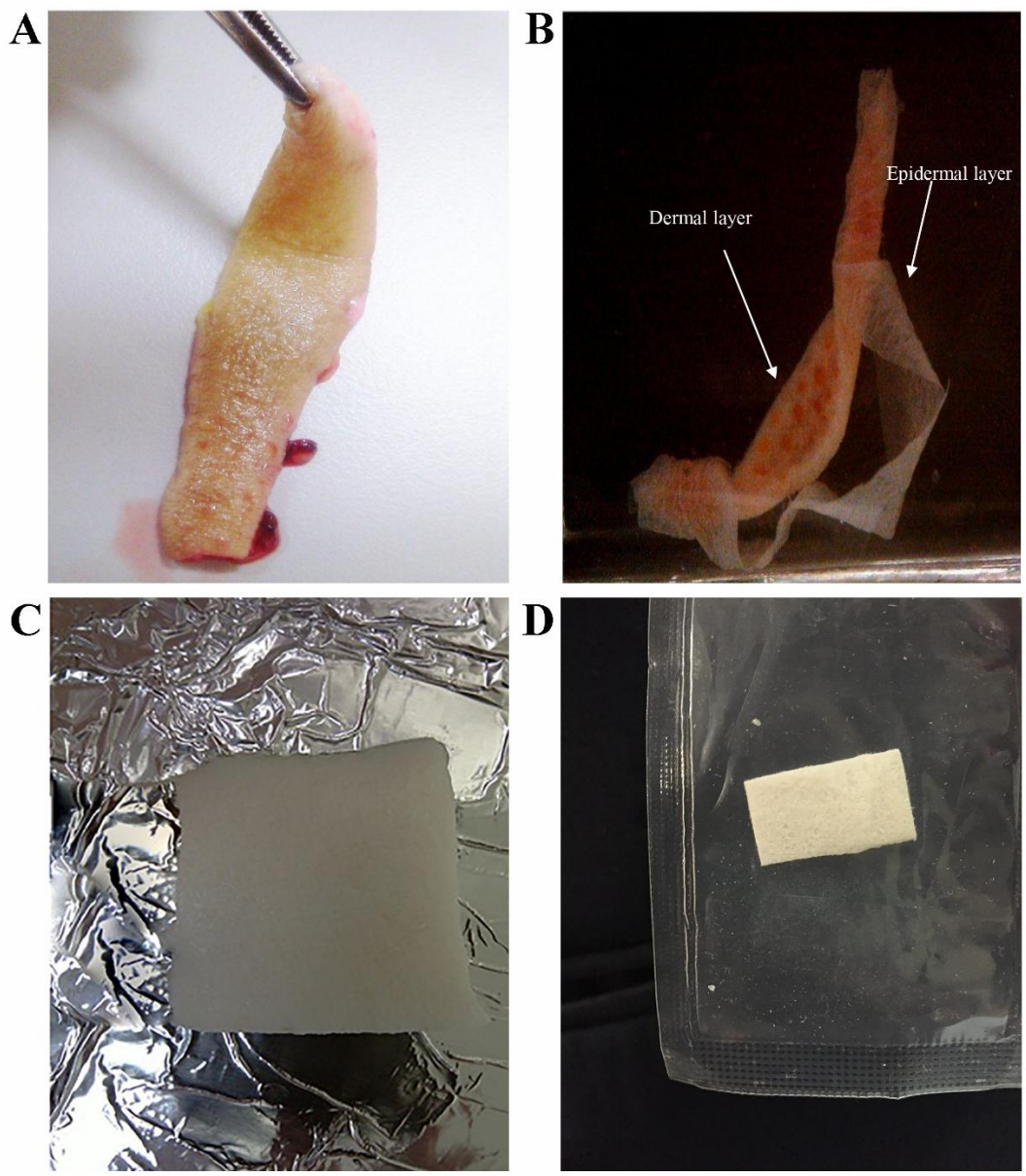


Figure S1. Preparation of the DDM scaffolds. (A) The DDM scaffolds derived from human sources were developed by harvesting split-thickness skin graft from adult donors. The skin samples were subsequently processed to remove epidermal layer, cellular components and leaving the collagen matrix. A hypotonic solution containing antibiotic was used to remove the epidermal layer. (B) As represented, the epidermal layer separated easily from the underlying dermis layer over 24 h. (C) A modified protocol from a combination of physical, enzymatic and chemical treatments used to remove DNA remnants and cellular materials. (D) Finally, the dermis was washed by PBS and sterilized by Gamma radiation to fabricate the DDM scaffolds.

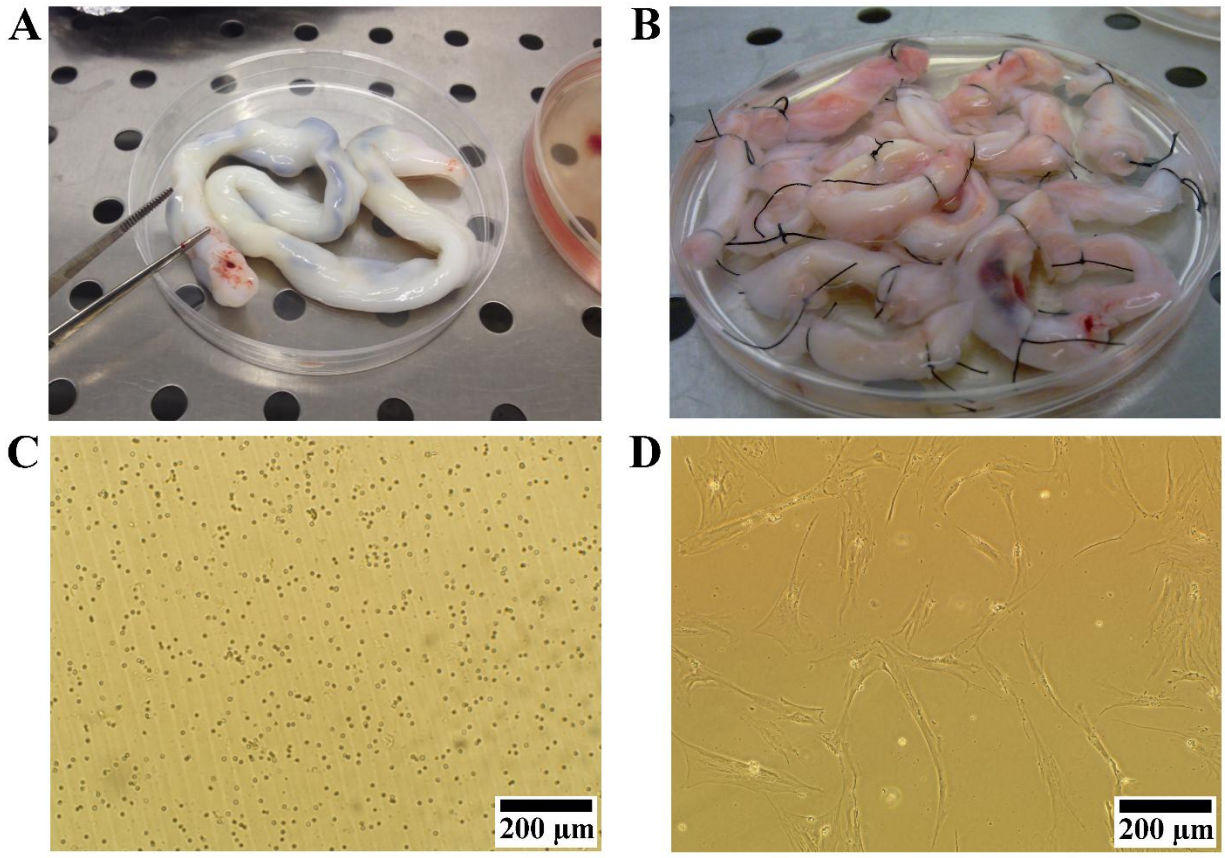
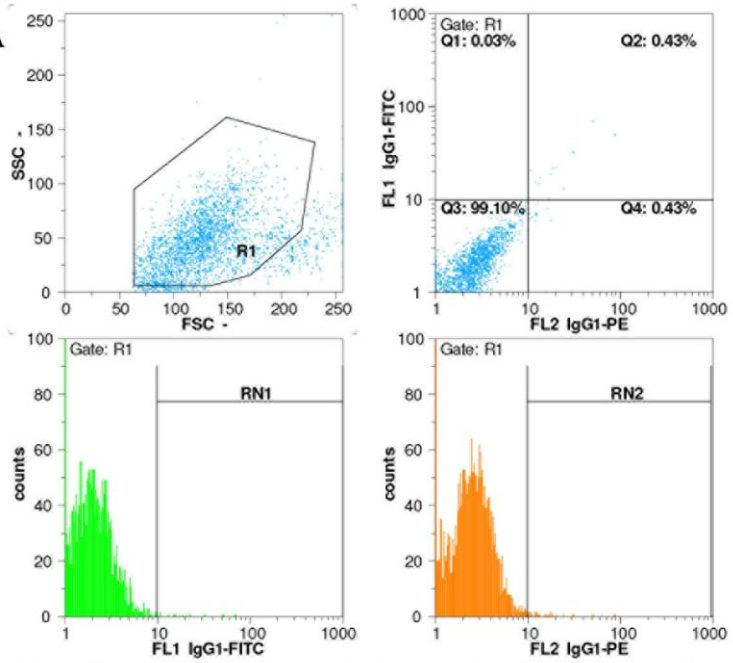


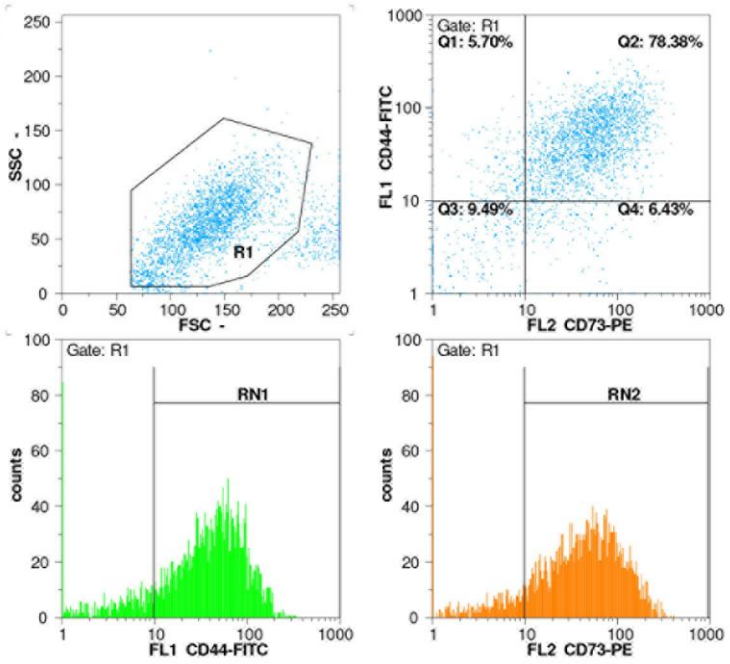
Figure S2. (A) The HUCPVCs were isolated from the surrounded part of human umbilical cord. A scalpel is used to remove all outer epithelium of the umbilical cord and then the vessels are separated from the bulk. (B) The isolated vessels were knotted in a loop using silk sutures. The digestion of vessels were carried out by Type I collagenase treatment and produce cell suspension. (C) The isolated cells were then seeded on a T75 culture flask at a density of 4×10^3 cells/cm^2 in in supplemented medium. (D) The HUCPVCs exhibited a fibroblastic morphology at passages 3 under an inverted microscope.

A



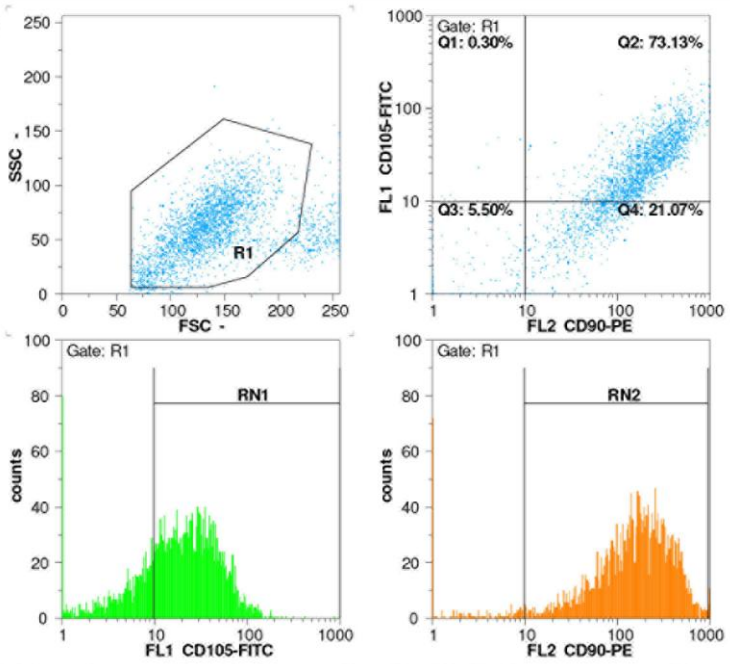
Region	Gate	Ungated	Count	Count/ml	%Gated	Mean-x	CV-x%	Mean-y	CV-y%
R1	<None>	2996	2996	-	85.48	126.95	24.17	48.23	51.11
Q1	R1	1	1	-	0.03	9.44	0.00	10.86	0.00
Q2	R1	21	13	-	0.43	26.25	81.56	26.33	63.93
Q3	R1	3466	2969	-	99.10	2.43	59.14	1.88	59.04
Q4	R1	17	13	-	0.43	17.19	81.35	6.44	42.38
RN1	R1	22	14	-	0.47	25.23	66.17	-	-
RN2	R1	40	28	-	0.93	20.90	85.54	-	-

B

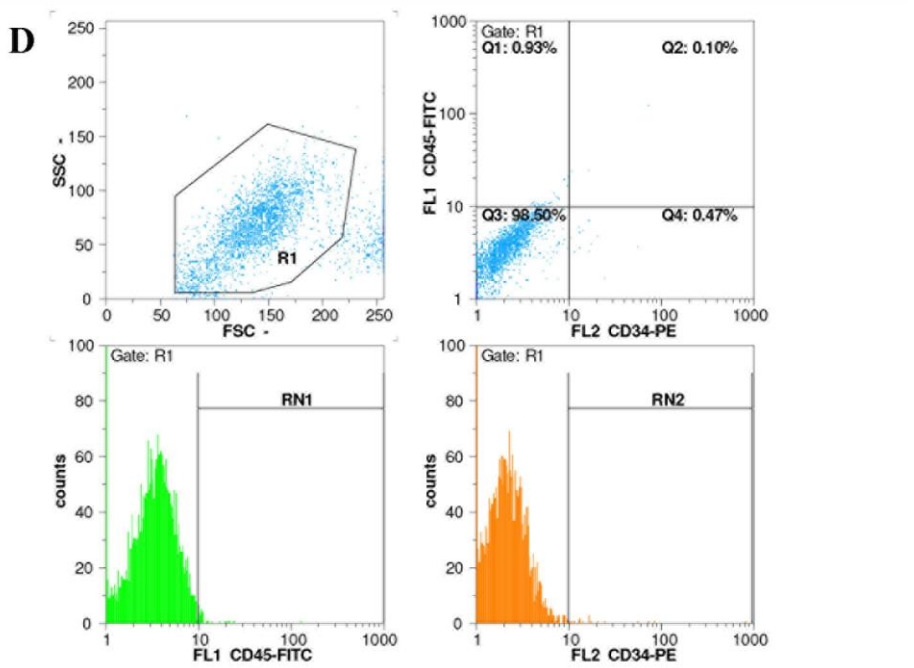


Region	Gate	Ungated	Count	Count/ml	%Gated	Mean-x	CV-x%	Mean-y	CV-y%
R1	<None>	3002	3002	-	82.36	135.15	23.50	63.76	41.95
Q1	R1	193	171	-	5.70	6.25	42.58	29.93	79.30
Q2	R1	2879	2353	-	78.38	69.45	78.47	60.69	69.67
Q3	R1	351	285	-	9.49	3.43	77.66	3.59	71.27
Q4	R1	222	193	-	6.43	47.62	110.28	5.41	52.92
RN1	R1	3072	2524	-	84.08	58.60	71.68	-	-
RN2	R1	3106	2549	-	84.91	67.73	80.69	-	-

C



Region	Gate	Ungated	Count	Count/ml	%Gated	Mean-x	CV-x%	Mean-y	CV-y%
R1	<None>	3000	3000	-	85.45	132.45	23.57	61.01	42.77
Q1	R1	10	9	-	0.30	3.11	83.99	23.84	70.08
Q2	R1	2591	2194	-	73.13	261.35	64.95	35.70	93.63
Q3	R1	218	165	-	5.50	3.44	88.85	1.93	73.77
Q4	R1	692	632	-	21.07	61.69	58.27	6.15	40.94
RN1	R1	2601	2203	-	73.43	35.65	93.63	-	-
RN2	R1	3271	2815	-	93.83	212.68	77.01	-	-



Region	Gate	Ungated	Count	Count/ml	%Gated	Mean-x	CV-x%	Mean-y	CV-y%
R1	<None>	2999	2999	-	81.36	138.25	22.15	68.30	39.52
Q1	R1	45	28	-	0.93	6.00	31.35	12.25	26.30
Q2	R1	9	3	-	0.10	32.94	102.16	58.82	102.05
Q3	R1	3618	2954	-	98.50	2.12	54.22	3.48	54.19
Q4	R1	14	14	-	0.47	79.58	263.47	3.93	46.25
RN1	R1	54	31	-	1.03	16.75	125.98	-	-
RN2	R1	23	17	-	0.57	71.35	266.66	-	-

Figure S3. Flow cytometry graphs show both histogram Dot Plot and histogram graph of primary culture of HUCPVCs at passage 3. The histogram Dot Plot represents FL1-FITC on the *x* axis and FL2-PE on the *y* axis. Here, MSCs were isolated from human umbilical cord and then characterized for the expression of MSC markers including the CD90, CD105, CD 73, CD45, CD44 and CD34 expression by flow cytometry. (A) The control sample. (B) The expression of CD44 and CD73 were upregulated in the cells with 84.08 % and 84.91%, respectively. (C) A high level of CD90 (93.83%) and CD105 (73.43%) expression were observed. (D) CD45 (1.03%) and CD34 (0.57%) expression were downregulated in the HUCPVCs.

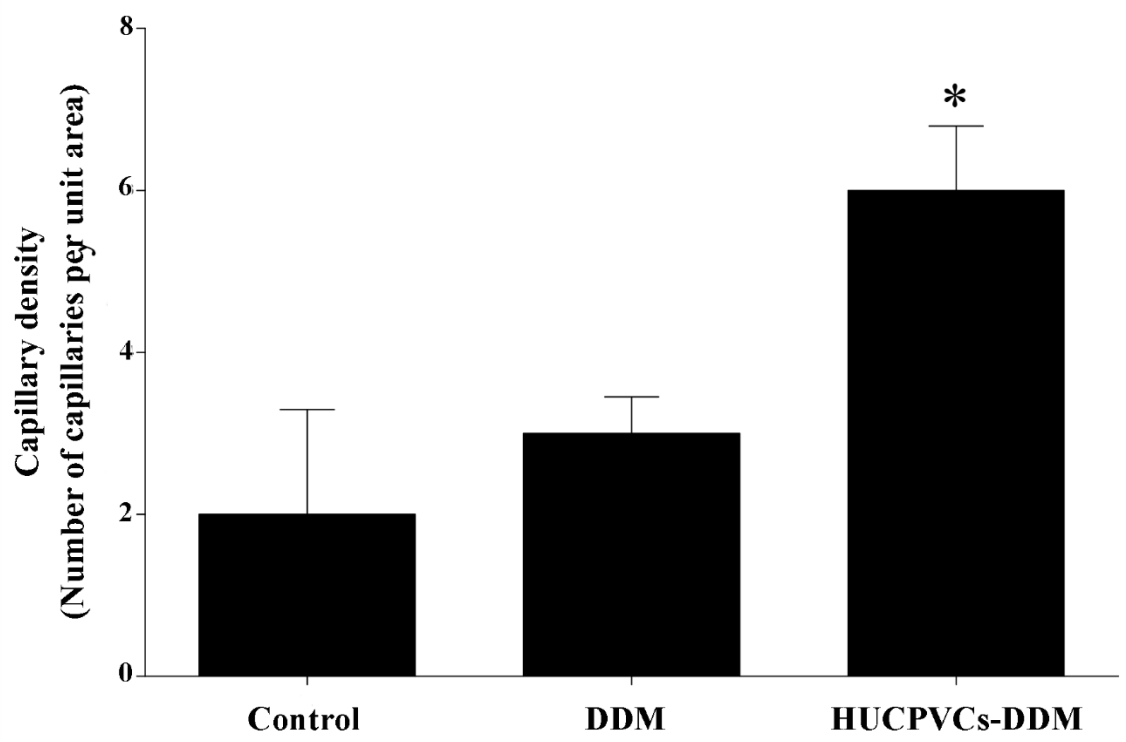


Figure S4. Capillary density test shows the relationship between the presence of stem cells and capillary density. The blood vessels were immunohistochemically stained for VEGFR-2. Capillary density was measured in different experimental groups by counting of VEGFR-2 positive blood vessels in three random fields/sections. High number of capillary was detected in HUCPVCs-loaded DDM treated groups at the day 7. There were no statistically significant differences between DDM and control groups (*P<0.05).