
Supervised Exercise Program for People With Bleeding Disorders and Hemophilic Arthritis

Appendix 1.

Strength Training Protocol and Progression

1. Progression to next level only if no adverse reaction to previous week of exercise.
2. Prophylaxis: Factor infusion recommended for people with severe hemophilia; people with mild and moderate hemophilia to have medications available, if needed.
3. Intensity=percent of isometric Nicholas dynamometry muscle test (INDMT) to assess pounds of weight to use or color of Thera-Band exercise band. The Hygenic Corporation^a reports correspondence of colors to weight resistance as the following:

yellow=2.5 lb, red=4.5 lb, green=5.0 lb, blue=7.5 lb, black=9.0 lb, and silver=15 lb
4. Repetition=to be done only in pain-free range.
5. Rate=5-10 seconds concentric with exhale; 5-10 seconds with inhale.

Level 1: Prescribed for the most fragile joints, target joints, previously injured muscle, and joints with painful active range of motion, passive range of motion, or weight bearing. No acute swelling or bleeding within past 2 weeks.

Progression	Intensity	No. of Repetitions	No. of Sets
Week 1	40%	10	1
Week 2	45%–50%	10–20	2
Week 3	50%–60%	10–20	3
Week 4	55%–65%	10–20	3
Week 5	60%–70%	10–20	3
Week 6	65%–75%	10–20	3

Level 2: Prescribed for joints and muscles with history of bleeding and chronic, mild-to-moderate impairment. No bleeding in past 6 months.

Progression	Intensity	No. of Repetitions	No. of Sets
Week 1	50%	10	1
Week 2	55%–60%	10–20	2
Week 3	60%–70%	10–20	3
Week 4	65%–75%	10–20	3
Week 5	70%–75%	10–20	3
Week 6	75%	10–20	3

Level 3: Prescribed for joints and muscles with minimal history of bleeding and no signs of impairment.

Progression	Intensity	No. of Repetitions	No. of Sets
Week 1	60%	10–20	1
Week 2	65%–70%	10–20	2
Week 3	70%–75%	10–20	3
Week 4	75%	10–20	3
Week 5	75%	10–20	3
Week 6	75%	10–20	3

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Appendix 1.

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Example: Participant 4, a 23-year-old man with severe hemophilia.

Right elbow=level 1: Target joints; had 6 episodes of bleeding over past 2 months. Active and passive range of motion painful at end range of flexion and extension. No acute swelling, no bleeding within past 2 weeks. Right biceps muscle isometric Nicholas dynamometry muscle test=5 lb.

Left elbow=level 3: Only 2 episodes of bleeding in past. Last episode of bleeding was 2 years previously. Pain-free motion, no swelling or crepitus. Normal end-feel. Left biceps muscle isometric Nicholas dynamometry muscle test=30 lb.

Week 1:

Right elbow flexion: $40\% \times 5 \text{ lb} = \text{lift } 2 \text{ lb}$ or use yellow Thera-Band for 1 set of 10 repetitions in pain-free range.

Left elbow flexion: $60\% \times 30 \text{ lb} = \text{lift } 18 \text{ lb}$ or double thickness of black Thera-Band for 1 set of 10–20 repetitions in pain-free range.

^a The Hygenic Corporation, 1245 Home Ave, Akron, OH 44310.

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Appendix 2.

Statistical Results When Separating Out Left Versus Right Joint Results for Range of Motion, Manual Muscle Test, and Circumferential Measures

Range of Motion (°) (n=20)	Baseline Measurements			Final Measurements		
	\bar{X}	SD	Range	\bar{X}	SD	Range
Left knee flexion ^a	115.9	29.0	28 to 149	122.5	28.3	43 to 155
Right knee flexion ^a	108.1	35.6	40 to 145	114.3	33.3	40 to 152
Left knee extension ^a	-8.2	12.7	-38 to 14 ^b	-2.0	6.8	-16 to 12 ^b
Right knee extension ^c	-6.0	8.9	-24 to 14 ^b	-2.2	7.4	-18 to 10 ^b
Left ankle dorsiflexion ^a	-4.3	9.5	-20 to 10	1.3	10.2	-20 to 20
Right ankle dorsiflexion ^d	-0.9	11.3	-18 to 18	1.2	11.1	-20 to 26
Left ankle plantar flexion ^a	38.8	11.1	20 to 50	48.7	9.3	36 to 70
Right ankle plantar flexion ^c	40.6	10.2	15 to 60	45.4	10.0	30 to 65
Left elbow flexion ^c	131.3	20.3	80 to 153	136.4	17.9	80 to 154
Right elbow flexion ^c	133.4	14.8	105 to 150	138.0	12.2	110 to 155
Left elbow extension ^a	-12.4	22.6	-87 to 10 ^b	-9.5	20.0	-75 to 10 ^b
Right elbow extension ^c	-12.4	20.2	-52 to 20 ^b	-7.5	16.5	-40 to 14 ^b
Left elbow pronation ^c	60.5	20.0	10 to 85	65.5	18.5	20 to 92
Right elbow pronation ^d	57.5	26.7	5 to 85	63.6	22.4	20 to 90
Left elbow supination ^d	65.3	24.4	0 to 90	68.8	21.9	15 to 90
Right elbow supination ^d	55.3	34.5	-30 to 90	61.7	30.3	-20 to 90

^a P≤.01.

^b Hypertension.

^c P≤.05.

^d Not significant.

Muscle Strength (N) (n=17)	Baseline Measurements			Final Measurements		
	\bar{X}	SD	Range	\bar{X}	SD	Range
Left hip extension ^{a,b}	15.9	6.8	4.3 to 26.6	22.9	8.5	7.1 to 39.0
Right hip extension ^{a,b}	15.4	6.9	0.0 to 24.1	22.8	8.6	4.3 to 33.5
Left hip flexion ^{a,b}	18.6	5.6	8.1 to 32.6	23.4	6.3	13.0 to 36.3
Right hip flexion ^{a,b}	17.7	6.5	6.3 to 30.2	21.3	7.0	9.5 to 30.7
Left hip abduction ^b	16.2	5.6	7.2 to 29.1	21.6	7.8	11.4 to 38.0
Right hip abduction ^c	16.7	6.4	6.1 to 25.9	20.7	8.4	10.9 to 36.5
Left knee extension ^b	14.4	7.2	1.0 to 23.8	19.9	9.2	4.3 to 28.5
Right knee extension ^b	15.6	8.5	2.1 to 29.7	21.0	10.8	3.8 to 40.6
Left knee flexion ^c	12.1	5.4	0.8 to 21.6	15.6	6.7	4.6 to 28.6
Right knee flexion ^b	13.5	6.8	4.0 to 27.2	17.0	6.3	6.6 to 29.0
Left elbow flexion ^c	13.6	7.6	1.6 to 30.1	16.7	7.6	2.3 to 28.4
Right elbow flexion ^c	15.1	7.5	0.0 to 29.6	17.4	8.1	0.8 to 31.6
Left elbow extension ^b	11.2	6.4	0.3 to 16.6	13.6	7.4	0.4 to 26.0
Right elbow extension ^c	12.2	6.5	0.0 to 24.8	14.8	7.2	0.5 to 28.8

^a n=16.

^b P≤.01.

^c P≤.05.

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Appendix 2.

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Circumferential Measure (cm) (n=20)	Baseline Measurement			Final Measurement		
	\bar{X}	SD	Range	\bar{X}	SD	Range
Left knee 6 in above joint line ^a	45.0	6.8	33.5 to 60.0	47.0	8.3	33.0 to 69.0
Right knee 6 in above joint line ^a	45.0	7.7	32.0 to 66.5	47.0	8.1	33.0 to 68.5
Left knee at joint line ^b	37.9	3.6	31.0 to 46.0	38.3	3.2	32.5 to 44.0
Right knee at joint line ^b	37.7	3.1	32.5 to 43.0	37.9	2.9	32.5 to 43.5
Left knee 4 in below joint line ^b	28.6	4.4	28.0 to 43.5	32.9	4.4	28.0 to 42.5
Right knee 4 in below joint line ^b	28.6	4.3	28.0 to 45.0	32.4	4.2	28.0 to 45.0
Left elbow 6 in above joint line ^c	29.0	5.4	21.0 to 38.0	30.0	5.8	19.8 to 37.5
Right elbow 6 in above joint line ^b	30.0	5.5	19.5 to 40.0	31.0	5.8	20.0 to 42.0
Left elbow at joint line ^b	27.7	3.3	21.5 to 33.0	27.3	3.2	22.0 to 31.5
Right elbow at joint line ^b	28.2	3.4	22.5 to 33.0	27.8	3.3	22.0 to 32.0
Left elbow 4 in below joint line ^a	25.3	3.6	19.0 to 32.0	26.2	4.0	19.5 to 34.0
Right elbow 4 in below joint line ^b	25.9	3.7	21.0 to 33.5	26.4	3.7	19.5 to 32.0

^a $P \leq .01$.

^b Not significant.

^c $P \leq .05$.