Decreased Incidence of ACL Injuries in Females by Selective Use of Hormonal Contraceptives

Sydney Anne Fry¹, Ankit Hirpara, Kaitlyn E. Whitney², Carson Keeter, Evangelia Constantine, Kyle Williams, Jason L Dragoo³

¹University of Colorado School of Medicine, ²Steadman Philippon Research Institute, ³University of Colorado / Dept of Orthopaedics

INTRODUCTION: Females are more likely to experience anterior cruciate ligament (ACL) injuries compared to males. Relaxin, a collagenolytic hormone, among other biomechanical factors may play a role in weakening the ACL, consequently increasing the risk of ACL tears in females. Oral contraceptive pills (OCPs) have been found to decrease relaxin in serum and increase ACL strength. The purpose of this study is to investigate the incidence of ACL injuries among females using different formulations of hormonal contraceptives.

METHODS: In this retrospective cohort study, de-identified data were obtained from female patients from 15 to 35 years of age between 2011 to 2023 from the Colorado Health Data Compass database. 17,512 females who sustained an ACL injury, treated by arthroscopic ACL reconstruction, and 15,740,767 females without a history of ACL injury were included. Among these groups, non-contraceptive users, hormonal systemic contraceptive (including pill, implant, injection, ring, and patch) users, OCP users (including formulations norethindrone (NE) only, drospirenone (DS) + ethinyl estradiol (EE), (NE + EE), norgestimate (NG + EE)), and levonorgestrel (a progestin found in intra-uterine devices) users were included in the analysis. Statistical analysis was completed using RStudio.

RESULTS: Systemic hormonal contraceptive use had a lower ACL injury incidence (0.079%; CI: 0.075 to 0.083) compared to no contraceptive use (0.12%; CI: 0.118 to 0.121). OCP use also had a lower ACL injury incidence (0.088%; CI: 0.081 to 0.095) compared to no contraceptive use, suggesting a protective association between contraceptive use and ACL injuries (Table 1). Additionally, different contraceptive formulations showed similar injury incidence, with a lower proportion of ACL injuries in progestin-only NE only (0.03%) users and levonorgestrel users (0.057%) compared to NG+EE (0.093%), NE+EE (0.099%), and DS+EE users (0.096%) (Table 2). The average age was similar across groups.

DISCUSSION AND CONCLUSION: Hormonal contraceptive use may be associated with a lower incidence of ACL injuries compared to no contraceptive use in females. Hormonal contraceptive formulations, specifically progestin containing, may play a protective role against ACL injuries in females. Further research is warranted to explore confounding variables that impact the association between hormonal contraceptive use and ACL injury. This association could indicate future hormonal contraceptive use as a protective intervention against ACL injuries in females.

Association Between ACL Injury Incidence and Systemic Hormonal Contraceptives or OCP Use							Association Betwee		
Cohort name	ACL Inj. Freq.	No ACL Inj. Freq	Proportion ACL Inj.	95% CI	Row Overlap	Cohort name	Α		
Systemic Hormonal Contraceptives	1669	2118959	0.079%	[0.075, 0.083]	No Overlap	NG+EE	27		
OCP use, total	654	744408	0.088%	[0.081, 0.095]	No Overlap	NETEE	2'		
No Contraceptive Use	15253	12750885	0.12%	[0.118, 0.121]	No Overlap	DETEE	2.		
						DOTEE	0.		
						NE only	2		

Cohort name	ACL Inj. Freq.	No ACL Inj. Freq	Proportion ACL Inj.	95% CI	Row Overlap	
NG+EE	271	291621	0.093%	[0.082, 0.105]	No Overlap	
NE+EE	275	276817	0.099%	[0.088, 0.112]	No Overlap	
DS+EE	81	84781	0.096%	[0.076, 0.119]	Row 6	
NE only	27	91189	0.03%	[0.02, 0.043]	No Overlap	
Levonorgestrel	119	207007	0.057%	[0.048, 0.069]	No Overlap	
No Contraceptive Use	15253	12750885	0.12%	[0.118, 0.121]	Row 3	