



Incidence of ACL Injuries in Females by Selective Use of Oral Contraceptive Pills



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BACKGROUND

Females are more likely to experience anterior cruciate ligament (ACL) injuries compared to males. Relaxin, a collagenolytic hormone, among other biomechanical factors 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:

1. Investigate the incidence of ACL injuries among females using OCPs compared to those who do not.
2. Determine if OCP formulations with different progesterone levels affect ACL injury incidence in females.

METHODS

- This retrospective cohort study utilized de-identified data from 14,664,162 female patients ages 15-34 using Colorado Health Data Compass database.
- ACL injury was filtered by arthroscopic ACL reconstruction treatment.
- OCP formulations included were norethindrone (NE) only, drospirenone (DS) + ethinyl estradiol (EE), NE + EE, and norgestimate (NG) + EE.
- Statistical analysis was completed using Rstudio.

RESULTS

Table 1. Incidence of ACL injuries in female OCP users compared to non-contraceptive users

Cohort Name	ACL Inj. Freq.	No ACL Inj. Freq.	Proportion ACL Inj.	95% CI
Birth Control Use	633	732507	0.086%	[0.08, 0.093]
No Birth Control Use	14937	12145997	0.123%	[0.121, 0.125]

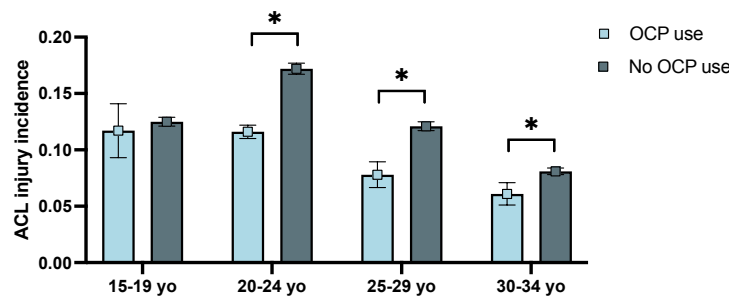


Figure 1. Incidence of ACL injuries in females separated by age. Females ages 15-19 years old (yo) had no difference between ACL injury incidence in OCP use (0.117%; CI: [0.095, 0.143]) compared to no OCP use (0.125%; CI: [0.121, 0.129]). ACL injury incidence in OCP users (0.116%; CI: [0.101, 0.133]) was less than no OCP use (0.175%; CI: [0.167, 0.177]) in females ages 20-24 yo. ACL injury incidence in OCP users (0.078%; CI: [0.067, 0.09]) was less than no OCP use in females ages 25-29 yo (0.121%; CI: [0.117, 0.125]). ACL injury incidence in OCP users (0.061%; CI: [0.052, 0.072]) was less than no OCP use (0.081%; CI: [0.078, 0.084]) in females ages 30-34 yo.

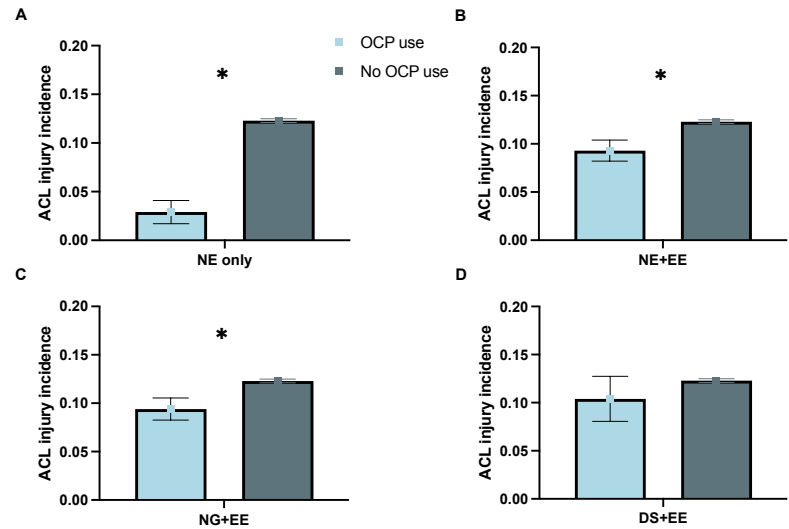


Figure 2. Incidence of ACL injuries in females by OCP formulation (a) ACL injury incidence in NE only OCP users (0.029%; CI: [0.019, 0.043]) was less compared to non-contraceptive users (0.123%; CI: [0.121, 0.125]). (b) ACL injury incidence in NE+EE OCP users (0.093%; CI: [0.082, 0.104]) was less compared to non-contraceptive users. (c) ACL injury incidence in NG+EE OCP users (0.094%; CI: [0.083, 0.106]) was less compared to non-contraceptive users. (d) ACL injury incidence in DS+EE OCP users (0.104%; CI: [0.083, 0.13]) had no difference compared to non-contraceptive users.

CONCLUSION

This initial evaluation of associations between OCP use and ACL injury incidence has shown:

- OCP use may be associated with a lower incidence of ACL injuries compared to no hormonal contraception use in females.
- The 15-19 yo age range saw no difference in ACL injury between OCP use groups, suggesting age could be a factor in the effects of OCP use on ACL injury incidence.
- Different progesterone formulations, specifically first-generation progesterone like NE, could play a role in protection against ACL injuries in females.

Further research is warranted to explore additional variables impacting associations, such as mechanism of injury and subject-specific demographics. Investigating if other hormonal contraceptive methods, such as intrauterine devices, show similar ACL injury proportions will be beneficial in finding potential protective interventions to reduce ACL injury incidence in females.

REFERENCES

1. Wang CX, Kale N, Wu VJ, et al. Age, female sex, and oral contraceptive use are risk factors for ACL reconstruction: A nationwide database study. *The Knee*. 2023.
2. Konopka JA, Hsue LJ, Dragoo JL, et al. Effect of oral contraceptives on soft tissue injury risk, soft tissue laxity, and muscle strength: A systematic review of the literature. *Orthop J Sports Med*. 2019.