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RESEARCH ARTICLE

Investigation of The Effects of Elizabethan Collar and Wound-Protective Corset on Intraocular Pressure in Cats

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Abstract

This study aimed to compare the effects of the commonly used Elizabethan collar and an alternative protective body garment on intraocular pressure (IOP) in cats during the postoperative period. The research was designed as a prospective, randomized, and controlled clinical trial, and included 20 healthy cats scheduled for orchiectomy. IOP measurements were performed using rebound tonometry at baseline (T_0), during the surgical procedure, and at various postoperative time points (T_5–T_{60}, T_{24h}). The results demonstrated that cats fitted with an Elizabethan collar exhibited more pronounced fluctuations in IOP over time, with significantly higher values recorded at certain time points. In contrast, cats wearing the protective body garment maintained more stable IOP levels throughout the observation period. Statistical analyses revealed a significant interaction between time and group (P=0.034), whereas the group factor alone did not have a statistically significant effect on IOP (P=0.690). These findings suggest that the protective body garment may represent a more physiological, safe, and effective option for maintaining ocular health in the postoperative period. Moreover, the data obtained from this study provide valuable guidance for veterinarians in clinical practice and can assist pet owners in making more informed decisions regarding postoperative care. In conclusion, the protective body garment can be considered a promising alternative to the Elizabethan collar in feline postoperative management.

Key Words: Corset, collar, elizabethan, eye, intraocular

Kedilerde Elizabeth Yakalık ve Yara Koruyucu Korsenin Göz İçi Basıncı Üzerindeki Etkilerinin Araştırılması

Öz

Bu çalışma, postoperatif dönemde kedilerde yaygın olarak kullanılan Elizabeth yakalığı ile alternatif bir yara koruyucu korsenin göz içi basıncı (GİB) üzerindeki etkilerini karşılaştırmak amacıyla yürütülmüştür. Araştırma, prospektif, randomize ve kontrollü bir klinik çalışma olarak tasarlanmış olup, orşiektomi operasyonu planlanan 20 sağlıklı kedi çalışmaya dâhil edilmiştir. GİB ölçümleri rebound tonometri yöntemi ile başlangıçta (T_0), operasyon süresince ve postoperatif dönemde farklı zaman noktalarında (T_5–T_{60}, T_{24h}) gerçekleştirilmiştir. Bulgular, Elizabeth yakalığı kullanılan kedilerde GİB değerlerinde zaman içerisinde daha belirgin dalgalanmalar meydana geldiğini ve bazı zaman dilimlerinde anlamlı derecede yüksek seviyeler kaydedildiğini göstermiştir. Buna karşılık, yara koruyucu korse uygulanan kedilerde GİB değerlerinin daha stabil seyrettiği gözlenmiştir. İstatistiksel değerlendirmeler sonucunda, zaman ve grup etkileşiminin anlamlı olduğu (P=0.034) belirlenmiş, ancak grup faktörünün tek başına GİB üzerine anlamlı bir etkisinin bulunmadığı (P=0.690) ortaya konmuştur. Elde edilen sonuçlar, postoperatif dönemde yara koruyucu korsenin göz sağlığının korunması açısından daha fizyolojik ve güvenli bir alternatif olabileceğini ortaya koymaktadır. Ayrıca, bu çalışmadan elde edilen veriler, veteriner hekimlere klinik uygulamalarda pratik yol gösterici bilgiler sunmakta ve evcil hayvan sahiplerine de daha bilinçli tercihler yapabilme konusunda katkı sağlamaktadır. Sonuç olarak, yara koruyucu korsenin Elizabeth yakalığına kıyasla postoperatif bakımda önemli bir alternatif olarak değerlendirilebileceği düşünülmektedir.

Anahtar Kelimeler: Elizabeth, göz, göz içi, korse, yakalık

INTRODUCTION

Intraocular pressure (IOP) refers to the pressure within the eye and is regulated by the central nervous system, which maintains a balance between aqueous humor production and its outflow (1,2). In most cases, increases in IOP are associated with impaired outflow rather than excessive production. Measuring IOP is a routine ophthalmic procedure for the diagnosis and monitoring of glaucoma (3). Various factors can influence IOP measurement, including extraocular muscle tone, eyelid manipulation, contraction of the retractor bulbi muscle, head/body position, external pressure, corneal curvature and thickness, scleral rigidity, intraocular changes, medications, time of day, and tear film viscosity (2).

Restraining devices are non-invasive tools used by researchers and clinicians to prevent undesirable behaviors such as self-trauma, licking of surgical sites, and removal of dressings or bandages. One of the most commonly used restraining devices is the Elizabethan collar (EC). Choosing the appropriate type, size, and purpose-specific design of such devices is crucial to ensure animal comfort. Improperly fitted collars may result in attempts to remove them (4). ECs may cause stress, neck wounds, aggressive behavior, and difficulties in feeding. They can also limit the animal's field of vision, and their prolonged use in cats has been associated with increased flea burden. However, immediate behavioral improvement has been observed upon collar removal (5). Additionally, some animals may develop allergic reactions to the plastic materials used in ECs (5).

The wound protection corset (WPC) is a breathable, flexible bodysuit made of lycra fabric, offering both comfort and proper ventilation for animals (6). It helps reduce the risk of injury to the surgical site. Moreover, it is made of durable polyester-based materials that help minimize shedding (7). Both ECs and WPCs play a significant role in routine veterinary care (8) and commonly used in dogs and cats especially postoperative care (9,10).

Previously studies demonstrated that the use of collar or tie for used for human can be effected IOP pressure (11). However, to the author knowledge, there was no difference reported between EC and WPC effect on IOP in cat. For this reason, the aim of this study is to compare the effects of two commonly used postoperative restraint methods, EC and WPC, on IOP in cats. Our hypothesis is that the WPC will have a lesser impact on IOP compared to the Elizabethan collar.

MATERIAL AND METHODS

This prospective, randomized, controlled clinical study was conducted at the Atatürk University Animal Hospital between July 2024 and March 2025. Prior to inclusion in the study, written informed consent was obtained from the owners of cats of various breeds, ages, and sexes that were scheduled for elective orchiectomy. The study protocol was approved by the Local Ethics Committee for Animal Experiments of Atatürk University (Decision No: 144; 2025/08).

Animals

All cats were classified as American Society of Anesthesiologists (ASA) physical status I based on a comprehensive physical examination and routine blood tests, including hematocrit, plasma protein concentration, blood urea level, and glucose level. A total of 20 male cats were included in the study. Each candidate cat underwent a detailed ophthalmic examination, which included direct and indirect ophthalmoscopy (Aesculap AC635 C, Braun, Tuttlingen, Germany), rebound tonometry (iCare TA01, Tiolat Oy, Inc. Helsinki, Finland), the Schirmer tear test, and the fluorescein staining test. Only cats with pre-study IOP measurements between 10 mmHg and 25 mmHg were included (12). Exclusion criteria included cats with an ASA score other than I or II, those exhibiting aggressive behavior, those in poor general health, those with ocular disorders, or a history of ocular surgery. All animals were individually housed in adjacent cages in the feline ward of the university animal hospital.

Study Design

The right and left eyes selected for the current study were randomly determined by a randomizer (Excel, Microsoft cooperation, Redmond, WA, USA) and the same eye measured first in all subsequent reading with both tonometers. Throughout the study, all IOP measurements were performed while the cats were maintained in a sternal recumbency position, with their heads and necks gently stabilized in a forward orientation to minimize the risk of inaccurate readings. If an error warning due to excessive deviation was issued by the tonometer during measurement, the procedure was repeated to ensure data reliability. In cases where the third measurement attempt with the tonometer also failed, the respective cat was excluded from the study. Measurements of IOP in cats were performed using the tonometer (TonoVet®[TV], using the "d" setting) (iCare TA01, Tiolat Oy, Helsinki, Finland), which operates based on rebound tonometry. This device provides measurements with an accuracy of ±2 mmHg in the 5–30 mmHg range and 10% accuracy in the 30 - 80 mmHg range. Due to its non-invasive nature, it is widely used in veterinary ophthalmology. The procedure was conducted in accordance with the manufacturer's instructions (iCare Tonovet, 2015) and the current literature standards (13). Measurements were taken at a distance of 4 - 8 mm from the central cornea and at a 90° angle. The tonometer records IOP in mmHg and is programmed to perform six consecutive rebound measurements to calculate and display the mean IOP.

All IOP measurements were taken between 09:00 and 11:00 AM to minimize the effects of circadian variation. To reduce individual variability, all measurements were performed by the same operator. During the procedure, cats were held in sternal recumbency, with the head and neck gently stabilized in a forward-facing position to avoid erroneous readings. The tonometer was calibrated according to the manufacturer's instructions, and a new probe was attached before measuring each animal.

Measurements of IOP were recorded at several time points: before applying the EC or WPC (T_0; baseline) (Figure 1), at 5-minute intervals during surgery, and after the application of the respective restraint device in 5-minute intervals (T_5, T_{10}, T_{15}, T_{20}, T_{25}, T_{30}, T_{45}, and T_{60}), as well as 24 hours postoperatively (Figures 2 and 3).

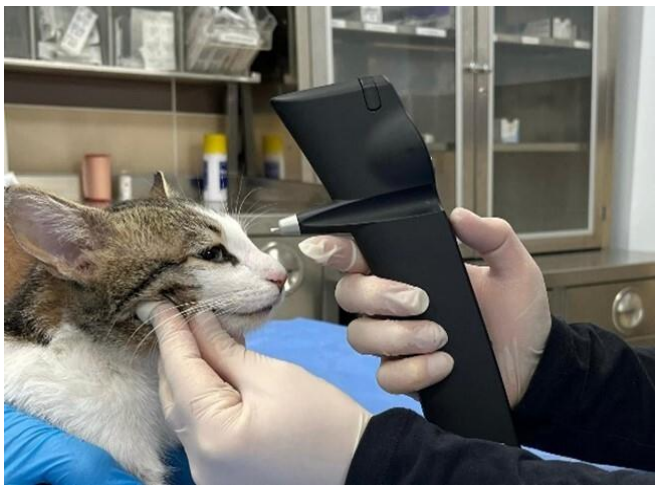

Figure 1. Intraocular pressure measurement in a cat using rebound tonometry

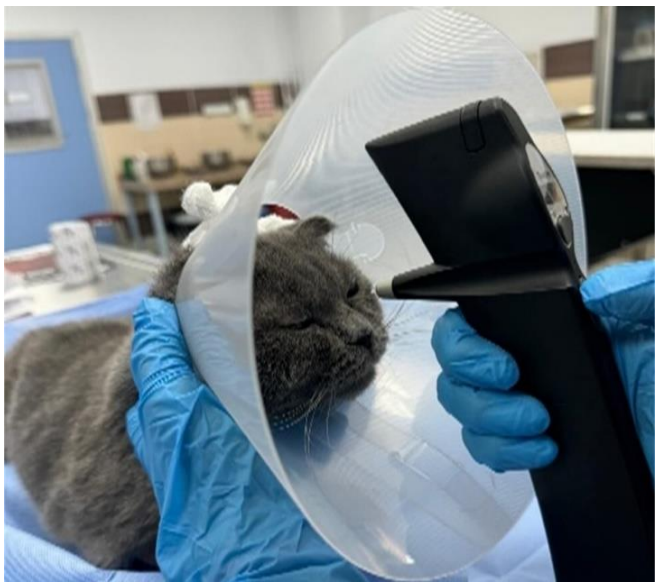

Figure 2. Intraocular pressure measurement by rebound tonometry in a cat wearing an Elizabethan collar

Figure 3. Observation posture of a cat wearing a wound-protective garment postoperatively

Statistical Analysis

All data were analyzed using SPSS version 23.0 (SPSS Inc., Chicago, IL, USA) for statistical analysis. A paired samples t-test was used to evaluate whether there was a statistically significant difference in IOP between the right and left eyes. If no significant difference was detected, the mean of the right and left eye IOP values for each individual was calculated and used as a single representative value. To compare and evaluate changes in IOP over time between the groups, repeated measures analysis of variance (Repeated Measures ANOVA) was employed with *post hoc* Tukey test. In all statistical analyses, a significance level of $P<0.05$ was considered statistically significant and addressed with mean and standard deviation.

RESULTS

IOP measurements were successfully completed in all animals without any complications. In both the study and control groups, no statistically significant difference was observed between the IOP values of the right and left eyes ($P<0.05$).

At the T_{10} time point, the average IOP in the EC group was 21.15±4.68 mmHg, while it was 18.67±4.60 mmHg in the WPC group (P?). Similarly, at T_{15}, the mean IOP in the EC group was recorded as 23.00±6.25 mmHg, compared to 19.37±2.98 mmHg in the WPC group. This difference persisted at the T_{24h} time point, with the EC group showing a mean IOP of 24.29±1.10 mmHg and the WPC group 20.79±0.53 mmHg. Statistical analysis revealed a significant interaction between time and group (P=0.034). However, the group factor alone did not have a statistically significant effect on IOP (P=0.690).

Time series analyses showed that IOP values were notably higher in the EC group at T_{10}, T_{15}, and T_{24h}. In contrast, the WPC group demonstrated lower and more stable IOP values over the same period (Table 1). The findings of this study revealed that IOP values in cats wearing an EC exhibited greater fluctuations over time, whereas IOP values in cats using a WPC remained more stable. In contrast, WPC, used as an alternative restraint method, was found to maintain more balanced IOP levels during the postoperative period, suggesting that it may be a safer and more physiological option. Based on these results, it is recommended that wound-protective garments be considered in place of traditional Elizabethan collars during postoperative care in cats, particularly to better preserve ocular health. This study may serve as a valuable guide for veterinarians in clinical decision-making and assist pet owners in making more informed choices regarding postoperative restraint devices.

Table 1. Intraocular measurement of both groups (Elizabeth collar [EC] and Wound protect collar [WPC]) within various time points.

Groups	Time-points											
	T_b	T_5	T_{10}	T_{15}	$T_r^{\dagger}$	T_{r5}	T_{r10}	T_{r15}	T_{r30}	T_{r45}	T_{r60}	T_{r24h}
EC	22±3.2	21±2.1	21±4.7	23±6.2	20±2.2*	22±3.2	22±4.1	22±5.1	21±4.2	18±2.3	19±2.2	24±1.1*
WPC	21±2.3	19±3.1	19±4.6	19±2.8	24±2.5*	23±3.1	23±2.4	20±2.2	21±3.6	20±2.6	21±3.5	21±0.5*

Tb - T15 preoperative periods, Tr - Tr24h postoperative periods. † time of application EC or WPC. * indicates significant difference between groups at the same time point (P<0.05). Data expressed mean ± standard deviation

DISCUSSION AND CONCLUSION

In this study, the effects of the commonly used EC and the WPC, developed as an alternative, on IOP in cats during the postoperative period were compared. The findings indicate that the use of EC led to more pronounced increases in IOP over time, whereas the WPC maintained more stable IOP levels. These results suggest that the type of restraint method may influence an animal's physiological parameters. In our study, significantly higher IOP values were observed at T_{10}, T_{15}, and T_{24h} in cats using the EC. This may be attributed to the mechanical pressure exerted around the neck by the collar and the stress it induces in the animal. In a study conducted by Shenoda et al. (5), ECs were reported to cause stress, feeding difficulties, restricted movement, and behavioral changes in animals. Additionally, the reduced visual field and discomfort caused by plastic materials may also lead to alterations in physiological responses. On the other hand, the more stable IOP observed in the WPC group could be related to the flexible material, better anatomical fit, and reduced stress levels in the animals. Supporting this, Isil et al. (8) reported that WPCs reduced pain and discomfort and improved overall comfort in cats. In a separate study involving humans, it was shown that tightly buttoned shirt collars exert pressure on the neck region and consequently increase IOP. Similarly, in our study, the mechanical pressure exerted by the EC around the neck resulted in an increase in IOP, consistent with the findings of Bremner (14), which highlighted the impact of external cervical pressure on IOP. Likewise, Pauli et al. (15) reported that collar use in dogs in a static position caused a significant increase in IOP. This parallels our observation of increased IOP in the EC group. Both studies suggest that external pressure applied to the neck may restrict venous return, leading to elevated orbital venous pressure and, consequently, increased IOP. These similarities underscore the importance of evaluating the physiological effects of different head and neck restraint devices, especially concerning ocular health.

Another notable study by Evangelista et al. (16) compared various restraint methods to improve postoperative comfort in cats. Their results demonstrated that the use of flexible and anatomically designed garments significantly reduced both pain scores and stress indicators compared to traditional ECs. These findings support the notion that WPCs offer advantages in terms of both IOP regulation and animal comfort. Additionally, Azargoun et al. (17) reported that restraining equipment in cats can act not only as physical but also as psychological stressors, potentially contributing to increased IOP. They recommended that materials such as ECs and WPCs be evaluated in conjunction with stress hormone levels and behavioral stress markers. This aligns with our findings and highlights the need for a multifaceted assessment of the physiological and psychological impacts of restraint methods.

In this context, devices used during postoperative care serve not only a protective function but may also influence the animal's physiological balance. This is particularly important in conditions like glaucoma, where maintaining optimal IOP is critical. The use of collars that increase external pressure should be carefully considered in such cases. In contrast, WPCs may represent a more comfortable and safer alternative. Limitations of our study include the relatively small sample size and the lack of subgroup analysis based on breed or age differences. Furthermore, the absence of physiological markers such as stress hormone levels limits the interpretation of the results. Future studies involving larger sample sizes and simultaneous assessment of stress levels and IOP may provide deeper insights into the effects of breed, age, and sex on these parameters.

In conclusion, the use of Elizabethan collars in cats appears to increase IOP and may pose a risk, particularly in predisposed conditions, while the wound-protective garment seems to be a more stable and physiological option. In clinical practice, restraint methods that do not contribute to elevated IOP should be preferred, taking into account the individual condition of the patient, in order to promote animal welfare.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

SO, ŞE and TA took part in the study planning, sample collection, the writing of the study and final check.

ETHICAL STATEMENT

The study protocol was approved by the Local Ethics Committee for Animal Experiments of Atatürk University (Decision No: 144; 2025/08).

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