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Original Article

The evaluation of the effect of vaginal delivery and aging on anal sphincter anatomy and function

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ABSTRACT

Objective. – This study was conducted to evaluate the effect of vaginal delivery and aging on anal sphincter anatomy and function.
Method. – Asymptomatic thirty women were included in this prospective study. Group 1 included 10 women (age range: 18–50) who had never been pregnant. Group 2 included 10 women (age range: 18–50) who had vaginal delivery. Group 3 included 10 women over 50 who had vaginal delivery.
Results. – There was no statistically significant difference between the three groups in terms of resting and squeeze pressures. It was found that sphincter thickness showed statistically significant difference between the group 1 and group 3, and also group 2 and group 3. There was not statistically significant difference between the group 1 and group 2 in terms of sphincter thickness. There was a positive correlation between the age and sphincter thickness in all groups. In terms of sphincter thickness and pressure findings there was a positive correlation between the squeeze pressure and external anal sphincter thickness only in group 3.
Conclusion. – The vaginal delivery did not have a negative influence on the structure and function of the anal sphincter in asymptomatic women. However, it was found that anal sphincter thickness changed strongly in a positive manner with aging.

1. Introduction

Canalis analis (anal canal) forms the last part of digestive system. This part, which is approximately 4 cm long and 3 cm in diameter, starts from linea anorectalis below ampulla recti. It extends posteriorly and inferiorly and ends at the line called anus or anal verge [1,2]. In the anatomy of the canal, which is very important in terms of continence, two important muscles are known to enable this function. These muscles are m. sphincter ani internus (internal anal sphincter – IAS) and m. sphincter ani externus (external anal sphincter – EAS) [1]. Anal continence is maintaining stool until social conditions are suitable and being able to realize what the content of rectum is even during sleep. Defecation is a special function. Its forming at an unsuitable moment and the person's not being able to control it creates a big problem. Besides causing a person to get away from social life and the society, it can also cause sexual problems and sexual dysfunction [3]. When anal continence is disrupted, the clinical condition also defined as anal incontinence or fecal incontinence develops [3,4]. Anal continence occurs based on a great number of factors [4–8]. These factors can be summarized as the relationship of sphincter muscles with each other and having rectal and anal sensation and normal pelvis anatomy. When gas and stool reach the rectum, the rectum stretches and thus rectoanal inhibitor reflex awakens and causes IAS to relax. Thus, the content of rectum starts to enter the anal canal. Sensitive receptors at anoderm differentiate between whether the content is gas or stool. If the person wants to prevent the disposal of content, anal sphincters stretch through pudendal nerve and defecation is blocked. This physiological situation is defined as continence. If this mechanism is not working, the patient is accepted to develop incontinence [4,6]. A great number of factors can be said to cause disruption of anal sphincter. Especially in women, the most important reason for

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anal sphincter disruption is delivery and complications due to delivery. Some researchers report that disruptions occur in the anatomic structure of anal sphincter after vaginal birth and functional effects decrease or disappear completely [9]. At the same time, there are also studies reporting changes in the function and structure of anal sphincters due to aging [6–8]. For definitive diagnosis, the responses of muscles to stimulants are checked with anal manometry/anorectal manometry (ARM) test, while the integrity of anal muscles and defects in muscles are assessed with endoanal ultrasonography (EAUSG) [10]. The purpose of our study was to examine the anal sphincters of women who gave birth and women who never gave birth with ARM test and three dimensional endoanal ultrasonography (3D-EAUSG) in order to understand the effects of vaginal birth and age on the anatomic structure and functions of anal sphincters.

2. Material and method

This study is a prospective clinical study approved with the 2016/01 numbered decision of Malatya Clinical Researches Ethical Board. First of all, the participants of the study were informed in detail about ARM and 3D-EAUSG processes to be applied and the participants read and singed the "volunteer informed consent form" that the results would be used in our study. Before starting ARM and 3D-EAUSG applications, the patients were asked questions about their ages, obstetric and medical history, general health problems, anorectal disease histories and whether they had any surgical procedures performed on this area. In normal spontaneous vaginal births, the shape of episiotomy, perineal lacerations to be formed and their degrees were recorded. In addition, the patients were asked about their smoking habits, height-weight values, their existing fecal and urinary incontinence complaints and the results were recorded in the patient information form.

2.1. Study groups

Our study was planned in three groups; the patients in group 1 consisted of 10 women between the ages of 18 and 50 who had never been pregnant. The patients in Group 2 consisted of 10 women between the ages of 18 and 50 who had only vaginal birth. The patients in Group 2 consisted of 10 women at and over the age of 50 who had only vaginal birth (Table 1).

Since the intergroup highest anal sphincter thickness difference was 0.2, standard deviation was 0.12, Type-1 (α) error was 0.05 and Type-2 error (β) was 0.20, it was confirmed with statistical power analysis that each group needed at least 10 individuals.

2.2. Inclusion criteria

Being between the ages of 18 and 50 and not having any births or pregnancies, being between the ages of 18 and 50 and having given vaginal birth, being at and over the age of 50 and having given vaginal birth

2.3. Exclusion criteria

The patients who had received pelvic radiotherapy, who had fecal incontinence, sphincter defect, neurological disorder, those who had undergone anorectal surgery and those who had diabetes were not included in the study. To all the patients in all three groups, both ARM test and 3D-EAUSG were given on the day they came to the polyclinic.

Table 1
Age intervals and birth histories of study groups.

Groups	Patients	Age	Birth history
Group 1	10	18–50	Never been pregnant
Group 2	10	18–50	Only vaginal birth
Group 3	10	50 and over	Only vaginal birth

2.4. ARM test examination

ARM mechanism we used in the study (MMS, Solar GI, software version 9.1, Holland) has ballooned barometer, pressure calibration device, monitor, computer and scanner (Fig. 1).

There are 4 pressure canals on the ARM catheter put on the barometer with 7 mm between each canal and it can measure 360° pressure. The catheter which has four measuring points starting from the distal, has a diameter of Fr (French) and it has the technology of measuring pressure with air (air-charged, clinical innovation).

ARM test was applied on the patients in line with the literature [11,12]. Before starting the application, fleet enema was applied on all the patients to empty the rectum. After the rectum was emptied, the patients wore a special leg covering. Due to the anatomic location of sigmoid colon, the process was conducted on all patients while on a position lying on the left lateral. After the procedure was explained to the patient who was brought to a position ready for the test, rectal palpation examination was made first and sensitivity was assessed. Later, ARM catheter which had balloons on the tip was calibrated and placed in the anal canal with the help of lubricant gel. After the catheter was placed, a resting period was given to ensure sphincter tone and relaxation. Meanwhile, pressure canals were followed from the monitor to confirm that the basal level occurred. Firstly, resting pressure was measured for 20 s. Later, squeezing pressure, tolerated squeezing pressure, coughing reflex, defecation intervention (pushing), RAIR, first sensation, squeezing sensation and maximum tolerance volume values were examined respectively (Fig. 2).

ARM test lasted for 15 min approximately and after the procedure was finished, the balloon in the anal canal was removed

Fig. 1. ARM facility. Balloon capillary system pressure gauge, pressure calibrator, monitor, computer and printer.

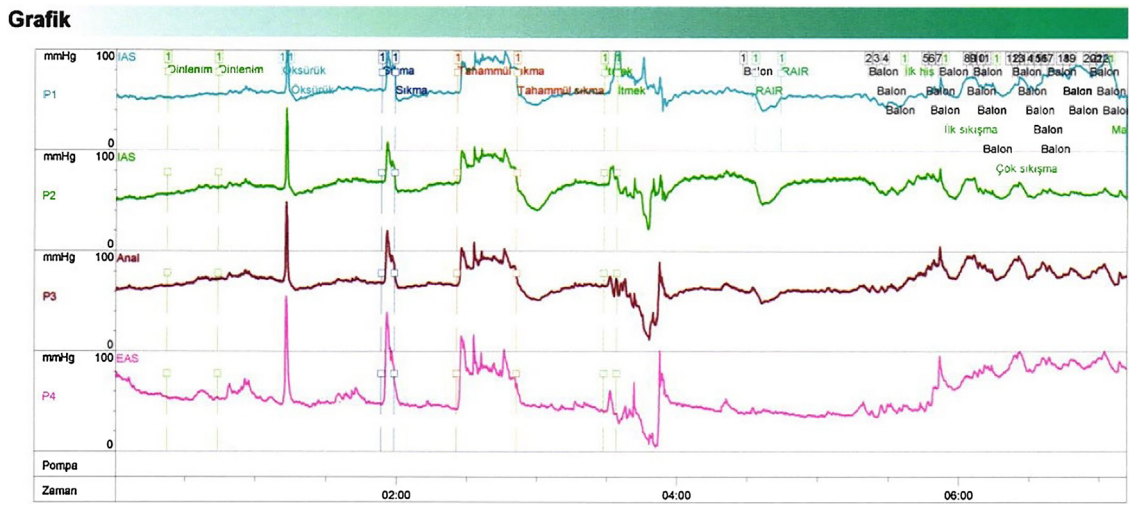

Fig. 2. ARM graph of one of the patients participating in the study.

and the patients were asked to rest for some time. The patients' 3D-EAUSG images were examined after ARM test.

2.5. Three dimensional endoanal ultrasonography (3D-EAUSG) examination

In the device that we used according to ultrasonography working principles, there is an ultrasonography probe (Anorectal 3D 2052 probe, 16 – 6 MHz, 360°) which can take 360° images, 3D image computer software and a scanner to scan the images (Flex Focus 400, 19″ monitor, ultrasound scanner 1202; BK Medical, Herlev, Denmark) (Fig. 3).

After the ARM test, the patients' anal sphincter and anal canal images were examined with 3D-EAUSG in the same position. After a condom was placed on the USG probe, the probe was placed in the patients' anal canal with the help of lubricant gel. 3D image of the anal canal was taken and thickness measurements of EAS and IAS were conducted. The measurements taken were recorded and the procedure was completed (Fig. 4).

2.6. Statistical analysis

Shapiro–Wilk test was used for normality assumption of the data. Mann–Whitney *U* test and Spearman Correlation Analysis were conducted for data analysis. The data were expressed in arithmetic mean (*X*), standard deviation. IBM SPSS Statistics 22.0 for Windows was used for statistical analysis.

3. Results

The ages of 30 women who participated in our study were between 18 and 77 and the average age was found as 42.9 ± 16.79. The average age of 10 patients in Group 1, who were between 18 and 42 and who had never been pregnant, was 26.5 ± 8.48. The average age of 10 patients in Group 2, who were between 28 and 47 and who had only vaginal birth, was 39.5 ± 7.87. The average age of 10 patients in Group 3, who were between 51 and 77 and who had only vaginal birth, was 58.4 ± 7.72. While the number of births of the women in Group 2, who had vaginal birth, was between 1 and 3, the average birth rate was 2.5 ± 1, the number of births of the women in Group 3 was between 2 and 7 and the average birth rate was 4.2 ± 1.44. When the body mass index (BMI) of the participants were examined, it was found to differ between 15.4 and 41 and the average body mass index of 30 patients was found as 27.42. The body mass index of the patients in Group 1 differed between 15.4 and 35.1 and their average body mass index (BMI) value was 23.87 ± 6.39. The BMI values of the patients in Group 2 differed between 19.3 and 30.5 and their average BMI value was 26.2 ± 4.77. The BMI values of the patients in Group 3 differed between 23.4 and 41 and their average BMI value was 30.76 ± 5.24 (Table 2).

Before the participants were assessed, the patient identification forms were assessed. As a result of this, it was found that none of them had received pelvic radiotherapy, fecal incontinence, anorectal surgery, diabetes and neurological disorder.

3.1. ARM pressure results

IAS average resting pressure of the patients in Group 1 was 59.1 ± 20.95 mmHg (28–85 mmHg), while their average resting pressure (RP) was 60.63 ± 12.86 mmHg (38–81 mmHg). IAS RP average of the patients in Group 2 was 69.6 ± 22.28 (32–93 mmHg) mmHg, while their average RP was 60.40 ± 17.27 mmHg (37–84 mmHg). IAS RP average of the patients in Group 3 was 72 ± 17.3 mmHg (55–100 mmHg), while their average RP was 60.40 ± 7.83 mmHg (51–77 mmHg) (Table 3). EAS squeezing power (SP) average of the patients in Group 1 was 127.25 ± 33.9 mmHg (74–193 mmHg), while their average SP X ± sd was 105.25 ± 33.68 mmHg (52–144 mmHg). EAS SP average of the patients in Group 2 was 134.8 ± 32.36 mmHg (86–170 mmHg), while their average SP X ± sd was 105.00 ± 24.17 (56–127 mmHg) mmHg. EAS SP average of the patients in Group 3 was 142.4 ± 67.18 mmHg (60–310 mmHg), while their average SP X ± sd sd was 132.80 ± 51.78 mmHg (54–247 mmHg).

Mann–Whitney *U* test was used for the paired comparison of groups. According to Mann–Whitney *U* test results, RP and SP were not statistically significant between Group 1 and Group 2 ($P > 0.05$). Similarly, no statistically significant association was found between Group 2 and Group 3 in terms of RP and SP ($P > 0.05$). Mann–Whitney *U* test results showed that no statistically significant association was found between Group 1 and Group 3 in terms of RP and SP ($P > 0.05$) (Table 3).

3.2. 3D-EAUSG measurement results

Anal sphincter thicknesses of all patients were measured with 3D-EAUSG. None of the patients were found to have sphincter defect. IAS and EAS thickness measurements were taken separately. The lowest IAS thickness of the patients was measured as 1.54 mm,

Fig. 3. 3D-EAUSG device and 3D-EAUSG probe capable of 360° view.

while the highest IAS thickness was measured as 4.60 mm. Average IAS thickness was found as 2.86 ± 0.88 mm. IAS thicknesses of the patients in Group 1 were between 1.54 and 3.05 mm. Average IAS thickness of Group 1 was found as 2.32 ± 0.55 mm. IAS thicknesses of the patients in Group 2 were between 2.01 and 3.42 mm. Average IAS thickness of Group 2 was found as 2.53 ± 0.63 mm. IAS thicknesses of the patients in Group 3 were between 1.95 and 4.60 mm. Average IAS thickness of Group 3 was found as 3.43 ± 0.87 mm (Table 5). The lowest EAS thickness of the patients was measured as 2.89 mm, while the highest IAS thickness was measured as 8.04 mm. Average EAS thickness of all the patients was measured as 4.48 ± 1.21 mm. EAS thicknesses of the patients in Group 1 were between 3.25 and 4.75 mm. Average EAS thickness of Group 1 was found as 3.71 ± 0.51 mm. EAS thicknesses of the patients in Group 2 were between 3.09 and 4.96 mm. Average EAS thickness of Group 2 was found as 3.97 ± 0.77 mm. EAS thicknesses of the patients in Group 3 were between 2.89 and 8.04 mm. Average EAS thickness of Group 3 was found as 5.29 ± 1.27 mm.

Paired comparisons of IAS and EAS thicknesses of the groups were made and Mann–Whitney *U* test was conducted to find out whether there were statistical differences between them. No statistically significant difference was found between Group 1 and Group 2 in terms of IAS and EAS thicknesses ($P > 0.05$). However, statistically significant difference was found between Group 2 and Group 3 in terms of IAS and EAS thicknesses ($P < 0.05$). Similarly, statistically significant difference was found between Group 1 and Group 3 in terms of IAS and EAS thicknesses ($P < 0.05$) (Table 4).

According to the Spearman correlation analysis between age and anal sphincter for all groups, a strong correlation was found between age and IAS thickness (Correlation coefficient (r): 0.513, P: 0.015). Similarly, a strong correlation was found between age and EAS thickness according to Spearman correlation analysis results (r: 0.557, P: 0.007) (Table 5).

Spearman correlation analysis was conducted to find out whether there were correlations between IAS and EAS thicknesses and pressure findings within groups. No significant correlation was found between resting pressure and IAS thickness for all groups ($P > 0.05$). When squeezing power and EAS thickness were compared, a strong positive correlation was found only in Group 3 (r: 0.669, P: 0.035) (Table 6).

4. Discussion

Anal continence is the function of voluntary obstruction of gas and stool outlet. For anal continence, various anatomic and physiologic structures should work in coordination [13–16]. In anal canal anatomy, which is the last part of digestive system and which is extremely important for anal continence, there are two important sphincters as IAS and EAS [1,2]. In order to maintain continence, it is extremely important to have an anal sphincter complex which is not anatomically disrupted and which has a strong innervation [17]. While EAS controls voluntary continence function, IAS controls involuntary (autonomous system) continence function [18,19]. When anal continence is disrupted, the clinical situation defined as fecal incontinence develops [3,4]. In various studies, it is thought that the anal sphincters of women change anatomically and functionally due to vaginal birth or aging [6–8]. In order to be able to make a definitive diagnosis of anal sphincter dysfunction, anorectal physiology tests are required [20]. In clinic, ARM test and EAUSG are applied together to be able to fully understand the etiology [20–22]. Latent sphincter injury after vaginal birth has been well defined in literature. Symptoms may not develop even long years after birth [23,24]. A great number of studies have used conventional 2D-EAUSG [25,26] and 3D-EAUSG [27,28] for the assessment of anal sphincter injury. This study measured the changes in anal sphincter anatomy in asymptomatic women (women who have not received pelvic radiotherapy, who do not have fecal incontinence, anal sphincter defect, neurological disorder and who have not undergone anorectal surgery) caused by vaginal birth and aging by using 3D-EAUSG and ARM. According to the literature review we conducted, we believe that this is the first study to examine the effects of both vaginal birth and aging on anal sphincter in asymptomatic women by using ARM and 3D-EAUSG together. Although Wickramasinghe et al. [29] applied ARM and 3D-EAUSG together on primigravida women similar to our study; they did not examine the effects of aging in their study. In our literature review, we found that the studies which examined the effects of vaginal birth and aging on anal canal morphology gave different results. In their study, Murad-Regadas et al. [6] found that vaginal birth increased anal canal symmetry in women and caused some degree of decrease in EAS thickness but stated that this decrease was insignificant. However, in women older than 50 who gave vaginal

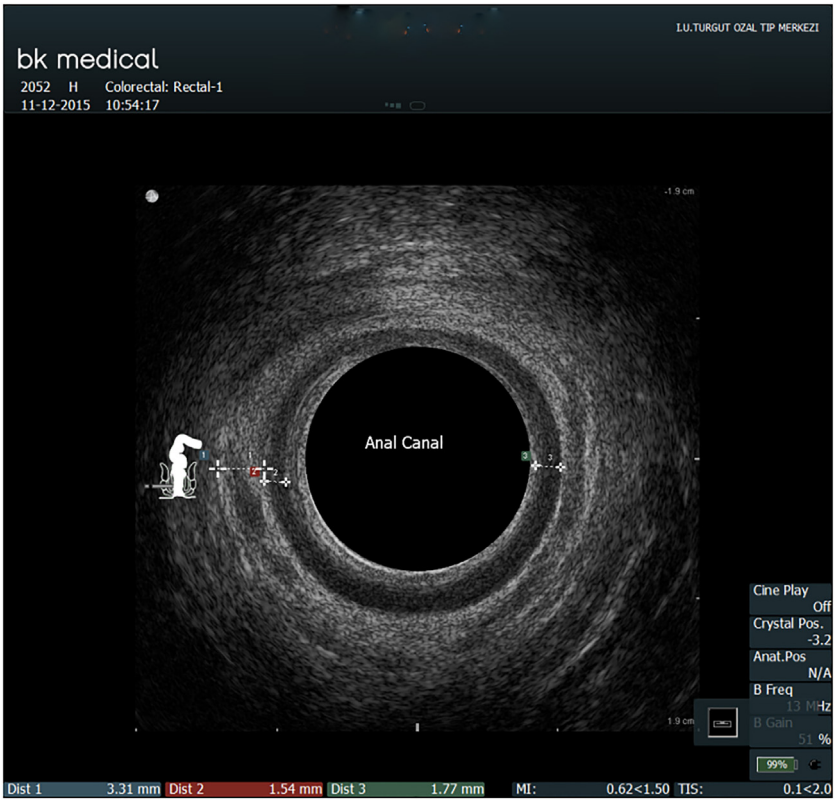

Fig. 4. 3D-EAUSG image of one of the participants.

Table 2
X ± sd, min and max values of the groups' age, number of births and BMI results.

Groups	Age		Number of Births		BMI	
	X ± sd	Min–Max	X ± sd	Min–Max	X ± sd	Min–Max
Group 1	26.5 ± 8.48	18–42	0	0	23.87 ± 6.39	15.4–35.1
Group 2	39.5 ± 7.87	28–47	2.5 ± 1	1–3	26.2 ± 4.77	19.3–30.5
Group 3	58.4 ± 7.72	51–77	4.2 ± 1.44	2–7	30.76 ± 5.24	23.4–41

birth, even if there is an obvious decrease, it has been stated that this can be possible with postmenopausal situation and urogenital atrophy [6,30]. On the other hand, Sultan et al. [31] found in their study that vaginal birth did not have a significant effect on anal

Table 3
Paired comparison results of RP and SP values of groups with Mann–Whitney *U* Test.

Groups	IAS RP	Average RP	EAS SP	Average SP
1–2	0.195	0.542	0.253	0.879
2–3	0.493	0.469	0.304	0.170
1–3	0.212	0.426	0.705	0.151

Table 4
Mann–Whitney *U* Test paired comparison results of IAS and EAS thicknesses of the groups.

Groups	IAS thicknesses	EAS thicknesses
1–2	0.283	0.078
2–3	**0.007**	**0.004**
1–3	**0.004**	**0.002**

However, statistically significant difference was found between Group 2 and Group 3 in terms of IAS and EAS thicknesses ($P < 0.05$). Similarly, statistically significant difference was found between Group 1 and Group 3 in terms of IAS and EAS thicknesses ($P < 0.05$).

Table 5
Spearman correlation analysis results of IAS and EAS thicknesses for all groups.

Parameter	Test	IAS thicknesses	EAS thicknesses
Age	*r*	0.513	0.557
	P	**0.015**	**0.007**

According to the Spearman correlation analysis between age and anal sphincter for all groups, a strong correlation was found between age and IAS thickness (Correlation coefficient (r): 0.513, *P*: 0.015). Similarly, a strong correlation was found between age and EAS thickness according to Spearman correlation analysis results (*r*: 0.557, *P*: 0.007).

Table 6
Spearman correlation analysis results of anal sphincter thickness measurements and pressure findings.

Groups	Parameter	Average RP		Parameter	Average SP	
Group 1	IAS thicknesses	*r*	0.405	EAS thicknesses	*r*	0.571
		p	0.320		*p*	0.139
Group 2		*r*	0.365		*r*	0.594
		p	0.343		*p*	0.118
Group 3		*r*	0.316		*r*	**0.669**
		p	0.374		*p*	**0.035**

When squeezing power and EAS thickness were compared, a strong positive correlation was found only in Group 3 (*r*: 0.669, *P*: 0.035).

sphincter morphology. In addition, Starc at al. [26] reported that anal sphincters did not change significantly with aging. In our study, when EAS and IAS thicknesses of women younger than 50 who gave vaginal birth and those who never gave birth were compared, although some degree of thickness was found in both sphincters in women who gave birth, this thickness was not found to be statistically significant. The results in literature support our findings. In addition, EAS and IAS thicknesses of women older than 50 who gave vaginal birth were found to be significantly thicker when compared with both women who never gave birth and younger women who gave birth in our study. According to correlation analysis between age and anal sphincter thickness for all ages, a positive strong correlation was found between IAS and EAS thicknesses. In their study, Knowles et al. [28] found that EAS thickness increased with aging. These results support our results. It is thought that contradictory results in literature are due to different measurement techniques, population, race or imaging equipment in previous studies [6,26,29]. We agree with this opinion. Squeezing pressure of anal canal reflects the function of EAS objectively, while resting pressure reflects the function of IAS [32]. Manometric results are influenced by the equipment used and in asymptomatic women squeezing pressures vary too much [33–39]. In their study conducted on asymptomatic women, Jie Li et al. [37] found the average resting pressure of women who never gave birth (18–34 years of age) as 62.7 ± 2.5 mmHg, while they found their squeezing pressure as 187.4 ± 6.5 mmHg. They found average resting pressure of women who gave vaginal birth (24–59 years of age) as 60.8 ± 2.9 mmHg and squeezing pressure as 164.8 ± 8.3 mmHg. The results of Jie Li et al.'s [37] study showed that the decrease in anal canal resting pressure was not statistically significant, while the decrease in anal canal squeezing pressure was statistically significant. Carrington et al. [38] found average resting pressure of asymptomatic women who never gave birth (18–68 years of age) as 66 mmHg, while they found their squeezing pressure as 191 mmHg. In the same study, Carrington et al. [38] found average resting pressure of asymptomatic women who gave vaginal birth (24–68 years of age) as 62 mmHg, while they found their squeezing pressure as 149 mmHg. As a result of their study, while they found that the decrease in resting pressure was not statistically significant, they found that the decrease in squeezing pressure was statistically significant. While Carrington et al. [38] reported that vaginal birth and aging did not have an influence on resting pressure, they found that there were changes in squeezing pressure. In their study, Coss-Adame et al. [39] found that average resting pressure was 92 mmHg in 19 asymptomatic women who never gave birth, and of the 23 asymptomatic women who gave vaginal birth, they found that average resting pressure was 82.3 mmHg in women who gave birth once and 77.8 mmHg in women who gave birth twice and more. Coss-Adame et al. [39] reported that their results about resting pressure were not statistically significant. In the same study, squeezing pressures were also measured and the results were found to be statistically insignificant. In our study, no statistically significant change was found in the resting and squeezing pressures of asymptomatic women of the same age group who did not give birth and who gave vaginal birth. Our results are statistically similar to the results of Coss-Adame et al. [39]. In the same study, Coss-Adame et al. [39] examined the effects of aging on anal sphincter and found that sphincter resting pressure and sphincter squeezing pressure were stronger in young women. In their study conducted with asymptomatic women who never gave birth and women who gave vaginal birth, Starc et al. [26] reported that no change was observed in anal sphincter pressures with aging. In our study, we found that there were no statistically significant changes in resting and squeezing pressures with aging and these results were in line with literature. We believe that the reasons why our results were different when compared with some studies in literature were caused by equipment differences or the differences that may occur in the squeezing pressures of asymptomatic women [33–36]. The association between imaging techniques and manometric methods has not been defined clearly [26]. Pedersen and Christiansen [40] found that there was no correlation between the endosonographic and manometric findings of anal sphincters. Starc et al. [26] reported that EAS and IAS thicknesses they measured by using anal endosonography were not associated with anal sphincter resting pressure and squeezing pressure. However, in the same study, they found a reverse correlation between IAS thickness and squeezing pressure. In their study they conducted with primigravida women, Wickramasinghe et al. [29] reported that there were no correlations between resting and squeezing pressure they found with 3D-ARM and IAS and EAS thicknesses they measured with 3D-EAUSG. In our study, we did not find any correlation between EAS and IAS thicknesses and anal sphincter pressures of women in the same age group who never gave birth and those who gave vaginal birth. However, we found a positive correlation between EAS thickness and average squeezing pressure in women older than 50 who gave vaginal birth. When considered in terms of functionality, although a positive correlation is expected between EAS thickness and squeezing pressure, the fact that this result was not found in other groups and no correlation examples were found in literature makes it difficult for us to comment on this. However, with more studies that we will conduct with new patient groups, we believe that we can get results on which we can comment more. Frudinger et al. [41] researched the effects of aging on anal sphincter thickness in asymptomatic women between the ages of 19 and 80 and found that IAS thickness and aging correlated positively. However, in the same study, they found a negative correlation between EAS thickness and aging. In their study, Wickramasinghe et al. [29] found a statistically positive correlation between IAS thickness and age. However, they did not find a statistical association between age and EAS thickness. Nielsen et al. [42] found a positive significant correlation between IAS thickness and age in their study they conducted on 20 asymptomatic women between the ages 24 and 62; however, they reported that there was no statistical correlation between EAS thickness and age. In our study, we found a statistically positive correlation between IAS and EAS thicknesses and aging. We found that both IAS and EAS thickness increased significantly with aging. We found that the positive correlation between IAS thickness and age in our study was parallel to literature. The fact that the positive correlation between EAS thickness and age was not in parallel with the literature can be explained with various factors. Different measurement techniques and equipment, different attitudes and experiences of researchers, limitations in the number of patients and differences in patient population can cause differences in EAS thickness measurements [42].

5. Conclusion

As a conclusion, we found that in asymptomatic women who gave vaginal birth, vaginal birth did not have a significant effect on the anatomic and functional structure of anal sphincters. However, we found that IAS and EAS thicknesses of women changed positively in women with aging. Using our results as literature in general surgery proctology polyclinic can be useful especially before biofeedback practice. At the same time, our results can be positively supportive about informing the patients who refer to our gynecology and obstetrics polyclinic about vaginal birth. Since this study we conducted on asymptomatic women includes anal region assessment, it was conducted with a minimum number of participants, and we believe that more reliable results can be obtained when the number of participants is increased. In addition, we believe that our results will form a serious information background to treatment protocols planned to be conducted when anal region morphometry and dynamics are disrupted.

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Disclosure of interest

The authors declare that they have no competing interest.

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