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Research Article

Wrist Support Does Not Prevent Wrist Injury or Pain but May be Therapeutic for Existing Wrist Pain in Female Gymnasts

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Abstract

Objective: To determine effects of wrist support use by female gymnasts based on self-reported wrist support use, wrist pain, and wrist injury to provide foundational data for designing subsequent prospective studies aimed at optimizing use of wrist support in gymnastics. **Methods:** A survey was distributed to current and former female gymnasts. Data collection was carried out using a commercially available electronic platform with de-identified data collected from participants. Descriptive statistics were calculated and comparisons for statistically significant ($p<0.05$) differences among variables of interest were determined. **Results:** In total, 343 female gymnasts (149 current and 194 former athletes) completed the questionnaire. Overall, 81.9% reported wrist injury/pain (mean number of 2.6 wrist injuries per injured athlete). Also, 61% of athletes reported using wrist support and 78.7% reported less pain with wrist support use; 39.3% reported needing to adjust the pre-designed wrist brace with additional tape/inserts to provide adequate support. In addition, 93% of former athletes experienced wrist pain/injury (mean number of 1.9 wrist injuries per injured athlete). A significantly higher proportion of former athletes used wrist support compared to current athletes ($p=0.0017$). Further, 91% of former gymnasts noted wrist injury and/or pain despite wrist support use, and 39.4% of athletes modified their supports in attempt to improve their symptoms. **Conclusion:** Results of the study support previous data denoting high incidence of wrist injuries and wrist pain in female gymnasts and suggest that wrist braces and/or taping was not associated with prevention of wrist injuries or pain but did mitigate existing wrist pain.

Keywords: Wrist guards; Gymnastics; Wrist pain; Injury.

Introduction

Gymnastics is one of the highest-risk National Collegiate Athletic Association (NCAA) sports with respect to musculoskeletal injuries [1]. Among NCAA women's sports, gymnastics is reported to be associated with the highest overall injury rate and practice injury rate (10.4 and 10.0 per 1,000 athletic exposures, respectively) [2]. Wrist and hand are the sixth-most injured body parts for female collegiate gymnasts, and the second-most frequently injured in the pediatric gymnastic population [3]. The most common wrist injuries reported for gymnasts include distal radial physeal stress injuries, scaphoid impaction syndrome, dorsal impingement syndrome, triangular fibrocartilage complex (TFCC) tears, ulnar impaction syndrome, and lunotriquetral impingement [4,5]. Importantly, wrist pain with or without a diagnosed injury has been reported to affect up to 88% of gymnasts at some time during their careers [6].

Based on the prevalence and impact of wrist pain and injury on gymnasts' performance, well-being, and long-term joint health, preventative strategies have been developed and applied [6-9].Wrist support using wrist guards, braces, or taping has been recommended based on reported biomechanical capabilities for restricting wrist hyperextension in order to prevent carpal

abutment, dorsal impingement, and soft-tissue overloading [7-10]. The commercially available wrist support (Tiger Paw) most commonly used by female gymnasts is a brace designed to prevent hyperextension using dorsal foam or plastic blocking inserts that can be adjusted to modify stiffness. A recent systematic review suggested that wrist braces with palmar pads were associated with protective biomechanical effects that may mitigate wrist pain and injury, particularly in male gymnasts. However, potentially negative effects of wrist support were also reported, and critical gaps in knowledge regarding brace design, most effective indications, and application to female gymnasts remain [11].

Therefore, the purpose of this study was to take the next step in developing evidence-based recommendations regarding wrist support use for female gymnasts by completing a cross-sectional assessment of wrist support use, wrist pain, and wrist injury in a cohort of current and former female gymnasts across levels. The study was structured to provide foundational data for designing subsequent prospective studies aimed at optimizing use of wrist support in gymnastics in order to enhance safety and performance for athletes.

Materials and Methods

Institutional Review Board (IRB) approval was obtained for electronic distribution of an anonymous survey to current and former female gymnasts using gymnastics-related social media outlets and emails to NCAA and club-based women's gymnastics coaching staffs. Distribution included a request for voluntary participation with informed consent or assent. The survey (Appendix A) allowed for collection of de-identified data from female gymnasts of all ages and levels with respect to gymnastics participation, wrist pain, wrist injuries, and wrist support use. Respondents that were male, had never participated in artistic gymnastics, and did not complete the survey were excluded.

Surveys were distributed using a commercially-available platform (Qualtrics) and data were collected and compiled into a spreadsheet (Excel) in a de-identified manner. Descriptive statistics were calculated and comparisons for statistically significant ($p<0.05$) differences among variables of interest were determined using commercially-available software (SigmaStat). Statistical comparisons were performed using unpaired t-Tests or one-way ANOVA for continuous data and one-way ANOVA on ranks for categorical data. Differences in proportions were analyzed using chi-square or Fisher's exact tests.

Results

Of the 400 subjects that voluntarily participated by initiating the survey, 343 subjects (85.8%) completed the survey. For female gymnasts who completed the survey and were included for analyses, 149 (43.4%) self-identified as current gymnasts and 194 (56.6%) self-identified as former gymnasts. For both categories, the majority were level 10 gymnasts. The majority of respondents also reported that they trained in all four events (vault, uneven bars, balance beam, floor exercise). The average amount of hours trained on each event for the subjects was 4.9 + 2.3 hours on uneven bars, 4.7 + 2.1 hours on balance beam, 4.4 + 1.8 hours on floor exercise, and 4.2 + 1.9 hours on vault. Respondents trained for significantly more hours on bars and beam compared to floor and vault ($p<0.01$). When asked to rank which events caused the most wrist pain, events were ranked from most- to least-associated with wrist pain in the following order: uneven bars, balance beam, vault, floor exercise. Differences in ranks were not statistically significant ($p=0.86$). Wrist supports reported to be used included wrist braces (Tiger Paw) and/or tape.

A total of 149 of the 343 subjects were currently participating in gymnastics at the time of the survey. The mean age for current gymnasts that completed the survey was 14.7 years (range, 7-52 years). Highest level of competition was distributed as follows: developmental level (n=1), level 4 (n=7), level 5 (n=7), level 6 (n=14), level 7 (n=21), level 8 (n=30), level 9 (n=22), level 10 (n=40), and elite (n=7). The average duration of participation for these gymnasts was 9.3 years (range, 3-34 years).

A total of 122 of 149 current athletes (81.9%) reported experiencing wrist injury and/or pain associated with their sport. Thirty-one of these athletes reported a total of 81 wrist injuries, with the remaining 91 athletes noting wrist pain without a diagnosed injury. Diagnosis of wrist injuries experienced by current gymnasts included ligamentous injuries (n=13), tendon injuries (n=19), muscular injuries (n=6), bone injuries (n=39) nerve injuries (n=1), TFCC tears (n=1), and ganglion cysts (n=2).

Of the 149 current athletes, 61% (91/149) reported using wrist support. Of the athletes that used wrist support, 90% (82/91) still experienced a wrist injury and/or pain, whereas 69% (40/58) of the athletes that did not use wrist support reported a wrist injury and/or pain. Interestingly, there was a significantly higher ($p=0.0019$) proportion of athletes noting they had wrist injury and/or pain while using wrist support than those that did not use wrist support. For the 91 gymnasts using wrist support, 61 respondents provided data regarding wrist pain before and after wrist support use; 78.7% (48/61) of these athletes reported that their pain was reduced, 18% (11/61) reported pain to remain the same, and 3.3% (2/61) reported worsening of wrist pain with use of wrist support. For the 39.3% (24/61) of athletes who attempted to improve the wrist support by the addition of tape or plastic inserts, 79.2% (19/24) noted that this reduced the pain experienced when performing their sport and the remaining 20.8% (5/24) did not find this helpful.

A total of 194 of the 343 subjects reported being former gymnasts at the time of the survey. The mean age for former gymnasts was 28.9 years (range, 13-72 years). Highest level of competition was distributed as follows: level 4 (n=2), level 5 (n=3),

level 6 (n=6), level 7 (n=12), level 8 (n=15), level 9 (n=38), level 10 (n=97), and elite (n=21). The average duration of participation for these gymnasts was 14.8 years (range, 4-22 years) and average age at retirement was 19.6 years (range, 9-26 years).

A total of 181 of 194 former gymnasts (93%) reported experiencing wrist injury and/or pain associated with their sport. Out of that number, 78 of these athletes reported a total of 143 wrist injuries, with the remaining 103 athletes noting wrist pain without a diagnosed injury. The former gymnasts had a significantly higher proportion of diagnosed injuries versus pain without a diagnosed injury (p=0.0022) when compared to current gymnasts. Diagnosis of wrist injuries for former gymnasts included ligamentous injuries (n=28), tendon injuries (n=36), muscular injuries (n=6), bone injuries (n=52), nerve injuries (n=1), TFCC tears (n=10), and ganglion cysts (n=10).

Of the 194 retired respondents, 79.9% (155/194) reported using wrist support. Of note, this is a significantly higher proportion (p=0.00017) of wrist support compared to the current gymnasts. Of the athletes that used wrist protection, 91% (141/155) still experienced a wrist injury and/or pain, whereas 62.5% (40/64) of the athletes that did not use wrist support reported a wrist injury and/or pain. There was a significantly higher (p<0.0001) proportion of former gymnasts noting they had wrist injury or pain while using wrist support than those that did not. For the 155 respondents who used wrist support during their careers, 94 provided data regarding wrist pain before and after use; 85.1% (80/94) of these athletes reported that their pain was reduced, 12.8% (12/94) reported their pain to remain the same, and 2.1% (2/94) reported worsening of wrist pain with use of wrist support. For the 39.4% (37/94) of athletes who attempted to improve the wrist support by the addition of tape or plastic inserts, 78.4% (29/37) noted that this reduced the pain experienced when performing their sport and the remaining 21.6% (8/37) noted no improvement after these modifications. (Tables 1-3) provide tabulated summary data for comparisons between current and former gymnasts.

Female Gymnasts (N=343)	**Years of Participation** Mean+SD (range)	**Wrist Pain/ Injury** N (%)	**Wrist Pain Alone** N (%)	**Wrist Injury** N (%)	**Mean # of wrist injuries/ injured athlete**	**Wrist Support Use** N (%)
Current (N=149)	9.3+4.6 (3-34)	122 (81.9)	91 (61)	31 (20)	2.6	91 (61)
Former (N=194)	14.8+3.7 (4-22)	181 (93)	103 (53)	78 (40)	1.9	155 (79.9)
p-value	***<0.0001***	***0.0012***	*0.15*	***0.00017***	*0.18*	***0.00017***

Table 1 : Self-reported Wrist Injury, Pain, and Support Use for Current and Former Female Gymnasts; N = number; SD = standard deviation; % = percentage; ***Bold italics*** denotes statistically significant differences between current and former female gymnasts.

Female Gymnasts	**Wrist Pain-Injury/ Gymnasts Not Using Wrist Support** (%)	**Wrist Pain-Injury/ Gymnasts Using Wrist Support** (%)	**Wrist Pain Improved/Gymnasts Using Wrist Support** (%)	**No Change in Pain/ Gymnasts Using Wrist Support** (%)	**Pain Worsened/ Gymnasts Using Wrist Support** (%)
Current	40/58 (69)	82/91 (90)	48/61 (78.6)	11/61 (18)	2/61 (3.3)
Former	40/64 (62.5)	141/155 (91)	80/94 (85.1)	12/94 (12.8)	2/94 (2.1)
p-value	0.57	0.99	0.39	0.49	0.99

Table 2 : Self-reported Efficacy Associated with Wrist Support Use for Current and Former Female Gymnasts; % = percentage.

Female Gymnasts	Wrist Support Modified/ Gymnasts Reporting □ Wrist Pain (%)	Wrist Pain Improved/Gymnasts Modifying Wrist Support (%)	Wrist Pain Not Improved/ Gymnasts Modifying Wrist Support (%)
Current	24/61 (39.9)	19/24 (79.2)	5/24 (20.8)
Former	37/94 (39.4)	29/37 (78.4)	8/37 (21.6)
p-value	0.99	0.92	0.92

Table 3 : Self-reported Wrist Support Modifications and Associated Efficacy for Current and Former Female Gymnasts; □ = change in; % = percentage.

Discussion

The results of the present study provide foundational data for developing evidence-based recommendations regarding wrist support use for female gymnasts. This cross-sectional assessment of wrist support use, wrist pain, and wrist injury in a cohort of current and former female gymnasts across levels suggests that wrist pain and injury are extremely common in these athletes, with undiagnosed wrist pain being the predominant complaint. The majority of female gymnasts used wrist support, although a lower proportion of current gymnasts reported wrist support use when compared to former gymnasts. Interestingly, the self-reported data suggest that wrist supports did not prevent the occurrence of wrist injuries or pain, but did mitigate wrist pain with continued use. In addition, for athletes that modified their wrist support in an attempt to improve efficacy, the majority reported an associated reduction in wrist pain.

The cohort of female gymnasts included in the present study was representative of all levels, developmental to elite, and consistent with the key characteristics of the US female gymnast population. Statistics from USA Gymnastics suggest that approximately 70,000 females participate in gymnastics programs with the majority being level 4 and the lowest number of participants being elite level [12]. As such, the cohort in the present study represents a much greater proportion of athletes in the higher levels. This is reflected in training time data as athletes in the present study trained 4-5 hours per week in each event on average. According to the USA Gymnastics Committee, approximately 1 hour of training should be dedicated to each event on each day of practice with most higher-level gymnasts training at least four days per week [13]. The results of the present study regarding incidence of wrist pain and/or injury in current (82%) and former (93%) gymnasts also correspond well with previous studies reporting wrist pain with or without a diagnosed injury in up to 88% of gymnasts [6]. Further, the types of injuries reported by both groups of gymnasts matched previous studies and included muscle, ligament and tendon injuries, ulnar impaction syndrome, 'gymnast wrist', physeal fractures, TFCC tears, ganglion cysts, ulnar and median nerve disorders, and arthritis [4,5]. The common wrist injuries and pain are likely attributable to repetitive, high-impact, axial compression loading and torsional stresses on the joint and periarticular tissues associated with gymnastic activities [3,14].

Although many of the self-reported data were similar for current and former gymnasts participating in this study, there were a few key differences noted. A significantly higher proportion of former gymnasts reported wrist injuries and/or pain, primarily based on diagnosed injuries, when compared to current athletes. This difference may be due to the significantly longer duration of participation in the sport for former gymnasts at the time of survey completion. There was also a higher proportion of former gymnasts that reported use of wrist protection compared to the current athletes. This may be related to the greater number of former gymnasts competing at the highest levels, which may contribute to more wrist support use based on the higher demands of related training and performance. However, this difference in wrist support use may also signal a trend in decreased utilization based on coaches discouraging athletes from using wrist support due to concerns for weakening the wrists and/or lack of evidence-based efficacy [15].

For both current and former female gymnasts, neither a commercially available wrist brace nor wrist taping was associated with a reduction in self-reported wrist injury or wrist pain. In fact, the use of these types of wrist support was associated with a significantly higher proportion of wrist pain and/or injury in both groups. However, wrist support use was associated with subjective reduction in pain for the majority of athletes and modification of wrist supports further improved these symptoms. Taken together, these findings suggest that wrist support may be beneficial

for female gymnasts, but that current methods have not been optimized for preventative or therapeutic efficacy. While wrist supports have reported biomechanical capabilities for restricting wrist hyperextension in order to prevent carpal abutment, dorsal impingement, and soft-tissue overloading, current designs may not be sufficient for counteracting the loads and motions that lead to injuries and pain, especially in higher-level female gymnasts [6-10,16]. Seeley et al analyzed reaction forces transmitted to the upper extremity of high-level gymnasts during the round-off phase of the Yurchenko vault, demonstrating a vertical reaction force 2.4 times body weight transmitted to the upper extremities [17]. These and ever greater biomechanical demands repetitively placed on the wrists over years of training and competition encourage further research toward optimizing strategies for effectively reducing detrimental loading while not diminishing the athletes' ability to perform their skills.

There are limitations to this study that must be considered when interpreting and applying the results. This study was designed as an anonymous survey-based collection of self-reported data from a targeted population of current and former female gymnasts in the US. While the participants were representative of the general population of female gymnasts, selection bias is likely such that the results cannot be assumed to be generalizable. In addition, the single time point cross-sectional design required respondents to provide data for their entire careers, such that recall bias is likely for both current and former gymnasts. In addition, the study questionnaire did not collect details regarding timing of wrist pain and injuries, timing of wrist support use, taping technique, support modification, level- and event-specific data, or injury treatments and outcomes. As such, the data from this study should be used as initial foundational information for design of subsequent prospective studies to further characterize etiology and timing of wrist injuries and pain, direct effects of wrist support use based on type and timing, and level- and event-specific outcomes in order to optimize safe and effective use of wrist support for female gymnasts.

The results of the present study support previous data denoting a high incidence of wrist injuries and wrist pain in female gymnasts. While use of wrist support as a preventative method has been commonly recommended and implemented, these recommendations have been largely based on anecdotal information and opinion, especially for female gymnasts [6-9]. The data from the present study suggest that wrist braces and/or taping was not associated with prevention of wrist injuries or pain, but did mitigate existing wrist pain. In addition, for female gymnasts who modified their wrist support in an attempt to improve efficacy, the majority reported further relief of wrist pain.

Conflict of Interest

• James L. Cook receives research support from AO Trauma; receives IP royalties, is a paid consultant and receives research support from Arthrex, Inc; receives research support from Collagen Matrix Inc; receives research support from DePuy, A Johnson & Johnson Company; is on the editorial or governing board for the Journal of Knee Surgery; is a board or committee member for Midwest Transplant Network; is a board or committee member, receives IP royalties and research support from Musculoskeletal Transplant Foundation; receives research support from the National Institutes of Health (NIAMS & NICHD); receives research support from Orthopaedic Trauma Association; receives research support from Purina; receives research support from Regenosine; receives research support from SITES Medical; receives publishing royalties, financial or material support from Thieme; is a paid consultant for Trupanion; and receives research support from the U.S. Department of Defense.

• Stephanie Choo has no conflicts of interest to disclose.

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Appendix A

Figure 1: Questionnaire

Q1.1 – Please select your current involvement with gymnastics?

- Current Athlete
- Retired Athlete

Q1.2 – What is your current age?

Current Athletes:

Q1.4 – What level of gymnastics are you currently training for/ competing in as defined by USA Gymnastics?

- Developmental: levels 1-3 – non-competitive and achievement oriented program for use within a gym's pre-team program
- Compulsory: level 4
- Compulsory: level 5
- Optional: level 6
- Optional: level 7
- Optional: level 8
- Optional: level 9
- Optional: level 10
- Elite

Q1.6- How many years have you been training gymnastics?

Q1.8- Which gymnastics events do you train and/or compete (check all that apply)

- Vault
- Uneven Bars
- Balance Beam
- Floor

Q1.10- How much time (in hours) do you spend each week training for each event?

- Vault
- Uneven Bars
- Balance Beam
- Floor

Wrist injury Questions:

Q2.1 – have you injured your wrist(s) or experienced wrist pain while participating in gymnastics?

- Yes
- No

Q2.4- How many times do you believe you have sustained an injury to your wrist(s)?

- Less than 3 times
- 3-6 times
- 6-10 times
- >10 times (please specify)

Q2.2 – Which wrist have you injured participating in gymnastics?

- Right
- Left
- Both

Q2.5 – Please indicate yes or no to the following statements:

- My wrist injury limited my ability to participate in certain events
- I had to take time off from gymnastics because of my wrist injury
- I had to see a physician for my wrist injury
- My wrist injury required non-operative intervention
- My wrist injury required surgical intervention

Q49 – Have you had a formal diagnosis for your wrist pain or wrist injury?

- Yes

- No

Q2.6- What type(s) of wrist injury have you had?

- Ligament injury
- Tendon injury
- Muscle Injury
- Bone Injury
- Other (please specify)

Q2.7 – Currently, which wrist do you have the most problems with?

- Right
- Left
- Both

Q2.10 – Rank which events cause(d) the most wrist pain from most pain to least pain

- Vault
- Uneven Bars
- Balance Beam
- Floor

Q2.11 – Rate the average amount of pain in your wrist over a week of gymnastic practice by selecting the number that best describes your pain on a scale from 0-10. A zero (0) means that you did not have any pain and a ten (10) means that you had the worst pain ever experienced or that you could not do the activity because of pain

- Right wrist
- Left wrist

Wrist Protection Questions:

Q3.1 – Do you use wrist protection (e.g. athletic tape, Tiger Paw wrist supports)?

- Yes
- No

Q3.3 – At what level did you start using wrist protection?

Q3.4 – At what age did you start using wrist protection?

Q3.5 – Why did you start using wrist protection?

- Injury prevention
- Wrist pain
- Wrist injury
- Required by Team
- Other (please specify)

Q3.6 – For which of the following events do you wear wrist protection (select all that apply)

- Vault
- Uneven Bars
- Balance Beam
- Floor

Q3.8 – What type of wrist protection do you use?

- Athletic tape
- Wrist supports (e.g. Tiger Paws)
- Other (please specify)

Q3.10 – Have you had to alter the wrist protection over time as you moved up in levels/increased training to provide more protection?

- Yes
- No

Q3.11 – In what ways have you altered the wrist protections (select all that apply)

- Increased Tape
- Addition of support inserts into wrist supports
- Other (please specify)

Q3.12 – What is/was your level of wrist pain after you use(d) wrist protection? Rate the average amount of pain in your wrist over a week of gymnastic practice by selecting the number that best describes your pain on a scale from 0-10. A zero (0) means that you did not have any pain and a ten (10) means that you had the worst pain ever experienced or that you could not do the activity because of pain

- Right Wrist
- Left Wrist

Q3.13 – Dioyou notice pain starting/worsening in other locations when using wrist protection? If so, where? (check all that apply)

- Elbow
- Shoulder
- Other (please specify)
- I did not experience pain in other locations

Retired Athletes:

Q1.3 – At what age did you retire from gymnastics?

Q1.5 – What was the highest level of gymnastics you trained/ competed in as defined by USA Gymnastics?

- Developmental: levels 1-3 – non-competitive and achievement oriented program for use within a gym's pre-team program
- Compulsory: level 4
- Compulsory: level 5
- Optional: level 6
- Optional: level 7
- Optional: level 8
- Optional: level 9
- Optional: level 10
- Elite

Q1.7- How many years did you train gymnastics?

Q1.12 – How many years has it been since you have been training gymnastics at your highest level?

Q1.9- Which gymnastics events did you train and/or compete (check all that apply)

- Vault
- Uneven Bars
- Balance Beam
- Floor

Q1.11- How much time (in hours) did you spend each week training for each event?

- Vault
- Uneven Bars
- Balance Beam
- Floor

Wrist injury Questions:

Q2.1 – have you injured your wrist(s) or experienced wrist pain while participating in gymnastics?

- Yes
- No

Q2.4- How many times do you believe you have sustained an injury to your wrist(s)?

- Less than 3 times
- 3-6 times
- 6-10 times
- >10 times (please specify)

Q2.3 – Which wrist did you injure participating in gymnastics?

- Right
- Left
- Both

Q2.5 – Please indicate yes or no to the following statements:

- My wrist injury limited my ability to participate in certain events
- I had to take time off from gymnastics because of my wrist injury
- I had to see a physician for my wrist injury
- My wrist injury required non-operative intervention
- My wrist injury required surgical intervention

Q49 – Have you had a formal diagnosis for your wrist pain or wrist injury?

- Yes
- No

Q2.6- What type(s) of wrist injury have you had?

- Ligament injury
- Tendon injury
- Muscle Injury
- Bone Injury
- Other (please specify)

Q2.9 – Which wrist while participating in gymnastics caused you the most problems?

- Right wrist
- Left wrist
- Both

Q2.8 – Do you still continue to have wrist pain following retiring from gymnastics?

- Yes
- No

Q2.10 – Rank which events cause(d) the most wrist pain from

most pain to least pain

- Vault
- Uneven Bars
- Balance Beam
- Floor

Q2.11 – Rate the average amount of pain in your wrist over a week of gymnastic practice by selecting the number that best describes your pain on a scale from 0-10. A zero (0) means that you did not have any pain and a ten (10) means that you had the worst pain ever experienced or that you could not do the activity because of pain

- Right wrist
- Left wrist

Wrist Protection Questions –

Q3.2 – Did you use wrist protection (e.g. athletic tape, Tiger paws wrist supports)?

- Yes
- No

Q3.3 – At what level did you start using wrist protection

Q3.4 – At what age did you start using wrist protection?

Q3.5 – Why did you start using wrist protection?

- Injury prevention
- Wrist pain
- Wrist injury
- Required by Team
- Other (please specify)

Q3.7 – For which of the following events did you wear wrist protection (select all that apply)

- Vault
- Uneven Bars
- Balance Beam
- Floor

Q3.9 – What type of wrist protection did you use?

- Athletic tape
- Wrist supports (e.g. Tiger Paws)
- Other (please specify)

Q3.10 – Have you had to alter the wrist protection over time as you moved up in levels/increased training to provide more protection?

- Yes
- No

Q3.11 – In what ways have you altered the wrist protections (select all that apply)

- Increased Tape
- Addition of support inserts into wrist supports
- Other (please specify)

Q3.12 – What is/was your level of wrist pain after you use(d) wrist protection? Rate the average amount of pain in your wrist over a week of gymnastic practice by selecting the number that best describes your pain on a scale from 0-10. A zero (0) means that you did not have any pain and a ten (10) means that you had the worst pain ever experienced or that you could not do the activity because of pain

- Right Wrist
- Left Wrist

Q3.14 – Did you notice pain starting/worsening in other locations when using wrist protection? If so, where? (check all that apply)

- Elbow
- Shoulder
- Other (please specify)
- I did not experience pain in other locations