Video Analysis of Ben Johns' Shots in Men's Doubles Pickleball Matches

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Abstract

Ben Johns is widely recognized as the dominant force in professional pickleball, particularly in men's double matches. This study employs video analysis to dissect Ben's shot selection and execution within the context of men's doubles strategy. Footage from high-level tournaments was analyzed to track shot types, strokes, and outcomes. Results reveal pickleball demands substantial physical and mental ability. And Ben possesses an uncanny ability to minimize errors, repeatedly place shots with precision. Our data facilitates a deeper understanding of pickleball, counteracting biases and fostering broader acceptance of the sport. Our findings also provide valuable insights into the shot patterns that contribute to Ben's success at the elite level of men's doubles pickleball. Players seeking to improve their doubles game can use this analysis as a benchmark for strategic shot selection and execution.

Introduction

Nearly 50 million American adults have played pickleball in 2023, according to new research from the Association of Pickleball Professionals (APP). While pickleball initially offers an accessible entry point for various players, mastering the sport demands the development of specialized tactical and technical skills, including dinking and strategic use of the non-volley zone. To facilitate player development and enhance strategic decision-making, we turn to video analysis techniques. Video provides a powerful tool to break down ball patterns, offering insights that might be difficult to perceive in real-time. Existing research on video analysis in sports has primarily focused on mainstream disciplines such as tennis, soccer, and basketball. However, there is a paucity of studies dedicated to the application of video analysis specifically within pickleball. This could be due to the sport's relative youth and the recent rise of accessible video recording technology. This study aims to address this gap by exploring the potential of video analysis in the context of pickleball performance improvement. It will specifically investigate Men's double pickleball matches for Ben Johns. Ben Johns is widely considered the greatest pickleball player of all time, boasting an exceptional win record and numerous championship titles. Analyzing him could reveal the strategies, techniques, and mindset that lead to such consistent dominance. Through a systematic analysis of video recordings, this paper seeks to identify the reasons behind Ben Johns dominance. The findings of this study have the potential to inform all levels of players, coaching practices and athlete development strategies within pickleball.

Methods

Due to the limited camera angles, our study concentrated on shot types, hand selections and error rates. We used recorded matches on YouTube to manually count Ben's performances in the matches. The critical facts in the methods are listed below.

- Data collection.
  - Video Footage:
    - Source: Records from YouTube uploaded by [PPA Tour].
    - Quantity: 10 videos (5 best-of-three, 5 best-of-five).
    - Win/lost: Ben won 9 out of the 10 games, while lost the 10th game in the list.
    - Selection criteria:
      - All games were played by Ben Johns and Collin Johns with their opponents.
  - Video Analysis Tools:
    - Software: Google Sheets.
    - Specific techniques: The shot types and counts were manually inputted while watching the videos.
- Coding scheme
  - Shot types. There's no single standardized classification for shots, we defined the following categories.
    - Dink: Shots when Ben was very close to the kitchen line trying to make the ball go back to opponents' kitchen, including volley dink and regular dink.
    - Drop: Similar to dink but when Ben was behind the kitchen line. This includes third-shot drops and reset when Ben was in the middle and back of the court.
    - Drive: Shots when Ben hit the ball after bounce, were targeting behind the opponents' kitchen line, and the ball's speed is fast (as compared to normal dinking speed). This also includes the serve.
    - Volley: Any shots Ben hits when the ball hasn't bounced and the ball's speed is fast (as compared to normal dinking speed). This includes kitchen firefights and smash.
    - Lob: Any shots that were higher than all other types listed above and targeting the back of the court.
  - Difficulty: We introduced a measurement of difficulty of a match. It's defined as the net win/lost points over the total points to win with a precision of 2 decimals. For example, in a match when Johns Brothers played 3 games by 11:3, 11:8, and 11:9, the difficulty is ((11-3) + (11 - 8) + (11 - 9)) / 11 * 3 = 3.55. We believe this measurement could help normalize the data and minimize the effect of difficulty bias.
- Statistical data

- Total Shots Count: Number of shots by Ben in a game.
- Match Length: Total match length in the video as in seconds.
- Success Shots: Shots that were not out of the court were considered success, including those that lead to adverse situations. For example, a pop-up within the court is still considered success even though better shots exist.
- Success rate: Success shots / all shots * 100%.
- Dink Count: Number of dink shots.
- Drop Count: Number of drop shots.
- Drive Count: Number of drive shots.
- Volley Count: Number of volley shots.
- Lob Count: Number of lob shots.
- Dink Rate: Dink count / Total Shots Count * 100%.
- Drop Rate: Drop count / Total Shots Count * 100%.
- Drive Rate: Drive count / Total Shots Count * 100%.
- Volley Rate: Volley count / Total Shots Count * 100%.
- Lob Rate: Lob count / Total Shots Count * 100%.
- Success Dink Count: Dink shots that were in.
- Success Drop Count: Drop shots that were in.
- Success Drive Count: Drive shots that were in.
- Success Volley Count: Volley shots that were in.
- Success Lob Count: Lob shots that were in.
- Failed Dink Rate: 1 - Success Dink Count / Total Shots Count * 100%.
- Failed Drop Rate: 1 - Success Drop Count / Total Shots Count * 100%.
- Failed Drive Rate: 1 - Success Drive Count / Total Shots Count * 100%.
- Failed Volley Rate: 1 - Success Volley Count / Total Shots Count * 100%.
- Failed Lob Rate: 1 - Success Lob Count / Total Shots Count * 100%.
- Forehand Count: Shots finished when paddle is generally facing the right side as Ben is right-handed.
- Forehand rate: Forehand shots / all shots * 100%.
- Forehand Dink Count: Number of forehand dink shots with dink and forehand.
- Forehand Drop Count: Number of forehand drop shots with drop and forehand.
- Forehand Drive Count: Number of forehand drive shots with drive and forehand.
- Forehand Volley Count: Number of forehand volley shots with volley and forehand.
- Forehand Lob Count: Number of forehand lob shots with lob and forehand.
- Forehand Dink Rate: Forehand Dink Count/Total Shots Count * 100%.
- Forehand Drop Rate: Forehand Drop Count/Total Shots Count * 100%.
- Forehand Drive Rate: Forehand Drive Count/Total Shots Count * 100%.
- Forehand Volley Rate: Forehand Volley Count/Total Shots Count * 100%.
- Forehand Lob Rate: Forehand Dink Count/Total Shots Count * 100%.
- Failed Forehand Dink Rate: Success Forehand Dink Count/Forehand Dink Count * 100%.
- Failed Forehand Drop Rate: Success Forehand Drop Count/Forehand Drop Count * 100%.

  - Failed Forehand Drive Rate: Success Forehand Drive Count/Forehand Drive Count * 100%.
  - Failed Forehand Volley Rate: Success Forehand Volley Count/Forehand Volley Count * 100%.
  - Failed Backhand Dink Rate: Success Backhand Dink Count/Backhand Dink Count * 100%.
  - Failed Backhand Drop Rate: Success Backhand Drop Count/Backhand Drop Count * 100%.
  - Failed Backhand Drive Rate: Success Backhand Drive Count/Backhand Drive Count * 100%.
  - Failed Backhand Volley Rate: Success Forehand Volley Count/Forehand Volley Count * 100%.
- Analysis
  - Summary statistics were calculated for each metric, including mean, max, min, and standard deviation.
  - Scatter charts were made for each meaningful dimension metrics combination. A total of 40 charts were built.
  - Linear regression was used to analyze the dimensions/metrics that seem to have relationships.

Results

- All data is in a spreadsheet available in the same folde.
- The 10 men's double matches have on average ~400 shots (best-of-three has 284 shots and best-of-five has 519 shots). The match is on average ~45 minutes long (best-of-three is 37 minutes and best-of-five is 58 minutes). Each single game is roughly 12 minutes long. Table 1 shows statistical summaries of the matches.

Table 1. Descriptive statistics for the matches.

	Mean ± sd	Min	Max
Number of Shots	401.8 ± 181.3	183	759
Match Length(seconds)	2865.2 ± 935.6	1377	4532

- On average, Ben played 9 shorts per minute.
- Ben's success rate exceeds 90% as shown below in Table 2.

Table 2. Success statistics.

	Mean ± sd	Min	Max
Success Shots	378.4 ± 181.3	183	759
Success Rate(%)	93.86 ± 2.03	90.04	96.38

- Table 3 displays match difficulties.

	Mean ± sd	Min	Max

Difficulty	0.297 ± 0.272	-0.13	0.72

- Out of all shots, roughly dink shots take ⅓. Volley shots take ¼. Drive shots take ¼. Drop shots take 1/10.
  Table 4. Counts of shots types.

	Dink	Volley	Drive	Drop	Lob
Percentage of shot types(Mean ± sd)	37.81± 11.94	26.74 ± 4.69	23.74 ± 6.92	11.68 ± 5.56	0.04 ± 0.09

- Ben almost never lobs the opponents. In all the 10 matches with a total of ~ 3000 shots, only 2 shots are lob. One of them is under pressure to deal with an overhead smash.
- Ben has maintained a high level of consistency. In table 5, dink has the lowest failure percentage while volley has the highest.
  Table 5. Failure percentage.

	Dink	Volley	Drive	Drop	Lob
Percentage of failed shots(Mean ± sd)	2.45 ± 1.89	19.35 ± 2.91	10.14 ± 2.90	10.52 ± 3.50	N/A

- Table 6 shows the forehand shot counts and forthand shot rate.

	Mean ± sd	Min	Max
Forehand shot count	233 ± 103	430	95
Forehand shot rate(%)	57.94 ± 5.32	48.28	63.58

- The table below shows the forehand shot rate for all shot types. Slightly more drinks are backhand. Predominantly drives are forehand. Volley and drop are about the same.
  Table 7. Forehand shot type percentage.

	Dink	Volley	Drive	Drop	Lob
Percentage of forehand shots(Mean ± sd)	41.52 ± 8.56	52.63 ± 6.65	94.04 ± 3.81	49.37 ± 12.35	N/A

- The table below shows the failed forehand shot rate for all shot types. Dink and drive shots have a low failure rate.
  Table 8. Failed forehand shot rate.

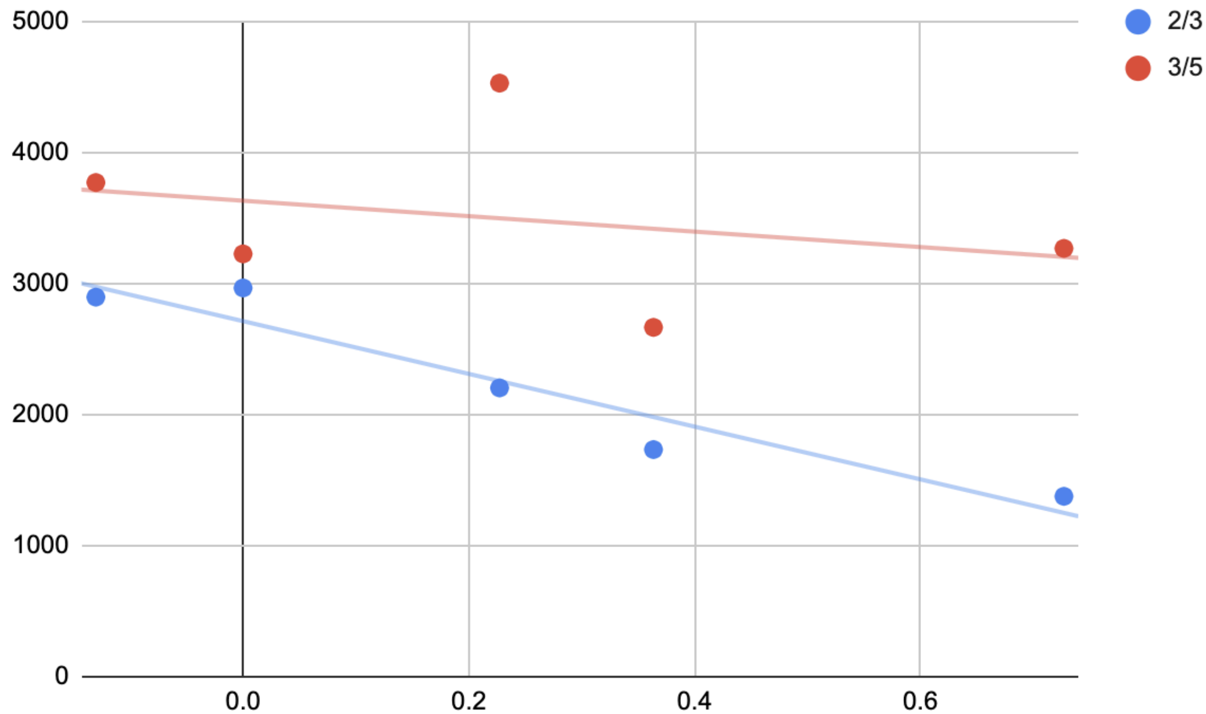
	Dink	Volley	Drive	Drop	Lob
Percentage of failed forehand shots(Mean ± sd)	4.00 ± 4.73	10.28 ± 5.01	3.00 ± 2.75	9.75 ± 7.91	N/A

- The table below shows the failed backhand shot rate for all shot types. Similar to forehand, dink and drive shots have a low failure rate.
  Table 8. Failed backhand shot rate.

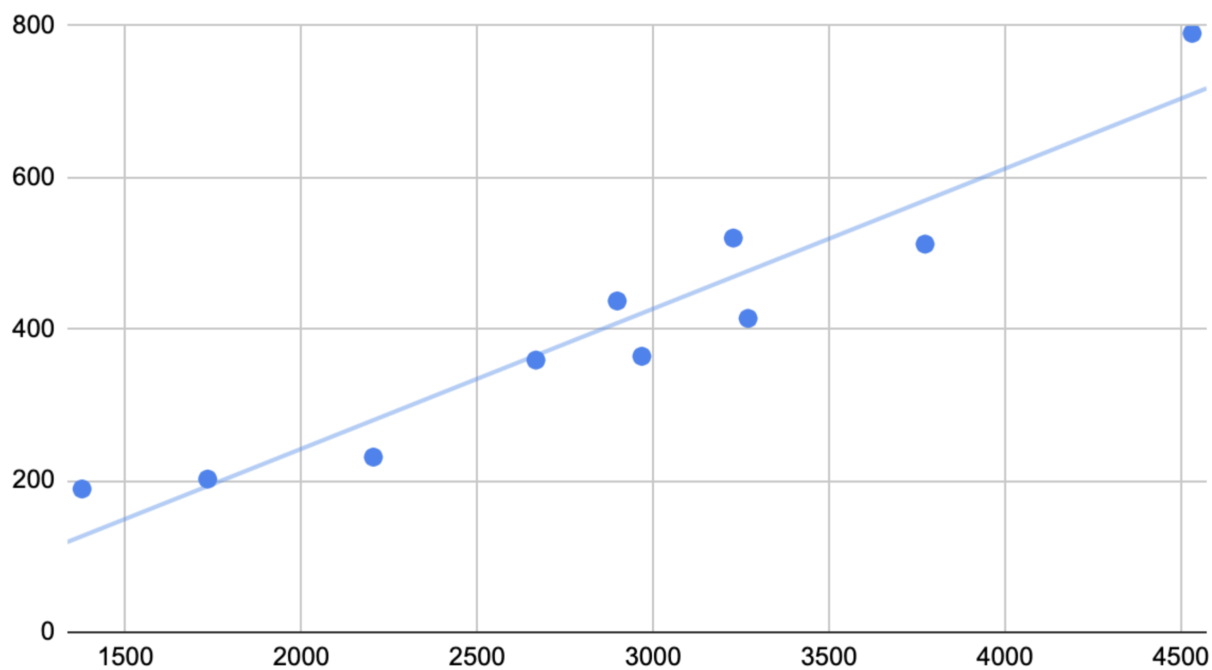
	Dink	Volley	Drive	Drop	Lob
Percentage of failed forehand shots(Mean ± sd)	2.00 ± 1.18	12.81 ± 5.05	5.00 ± 15.81	10.43 ± 7.69	N/A

Match Length vs Everything else:

- The following figure displays that more difficult games would require more time to finish. This is true for both best of three or best of five matches. For the same difficulty, best of five games are all longer than best of three games. We would assume the linear relationship between game length and difficulty and would not show both figures for time and difficulty.
  Figure 1. Difficulty vs match length in seconds.(note that the more difficulty, the more negative value). Best of three matches are blue dots(⅔). Best of five matches are red dots(⅔). Red dots are all above blue dots for the same difficulty.

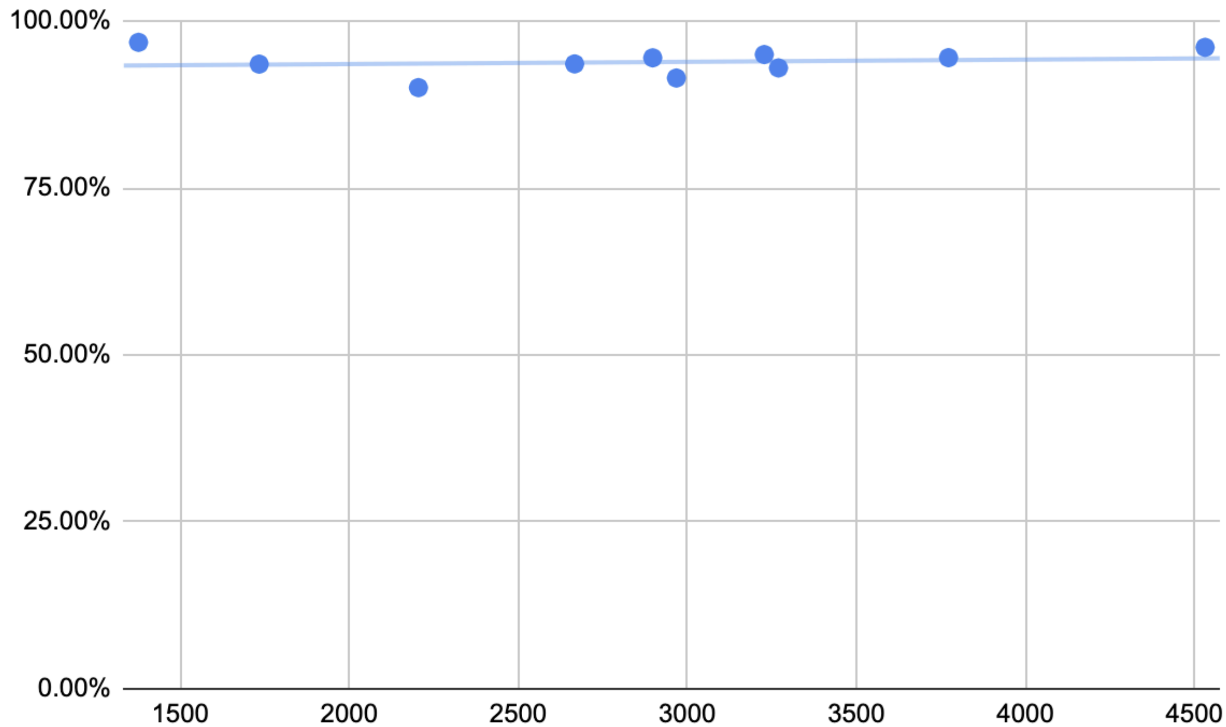


- The next figure shows longer matches require more shots. Linear regression shows for every minute increased in the game, 11 more shots are expected. More difficult games would require more shots as assumed from figure 1.
  Figure 2. Time in seconds vs number of shots.



- The figure below explains longer matches don't affect the success rate. Ben kept almost the same success shot rate in matches with various lengths and difficulty.

Figure 3. Match length vs success rate.



- This figure shows longer matches will require more dinks. Linear regression shows each more minute would require 7.72 more dinks.

  Figure 4. Match length vs dink rate with the least difficult match included.

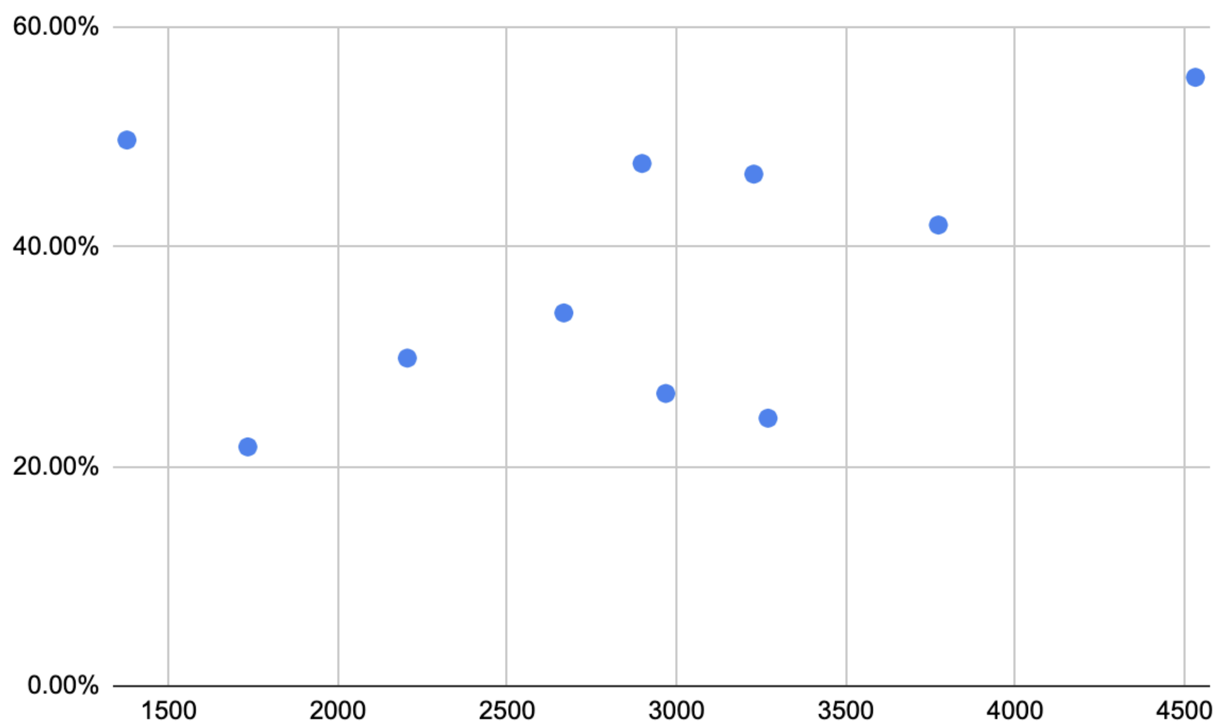
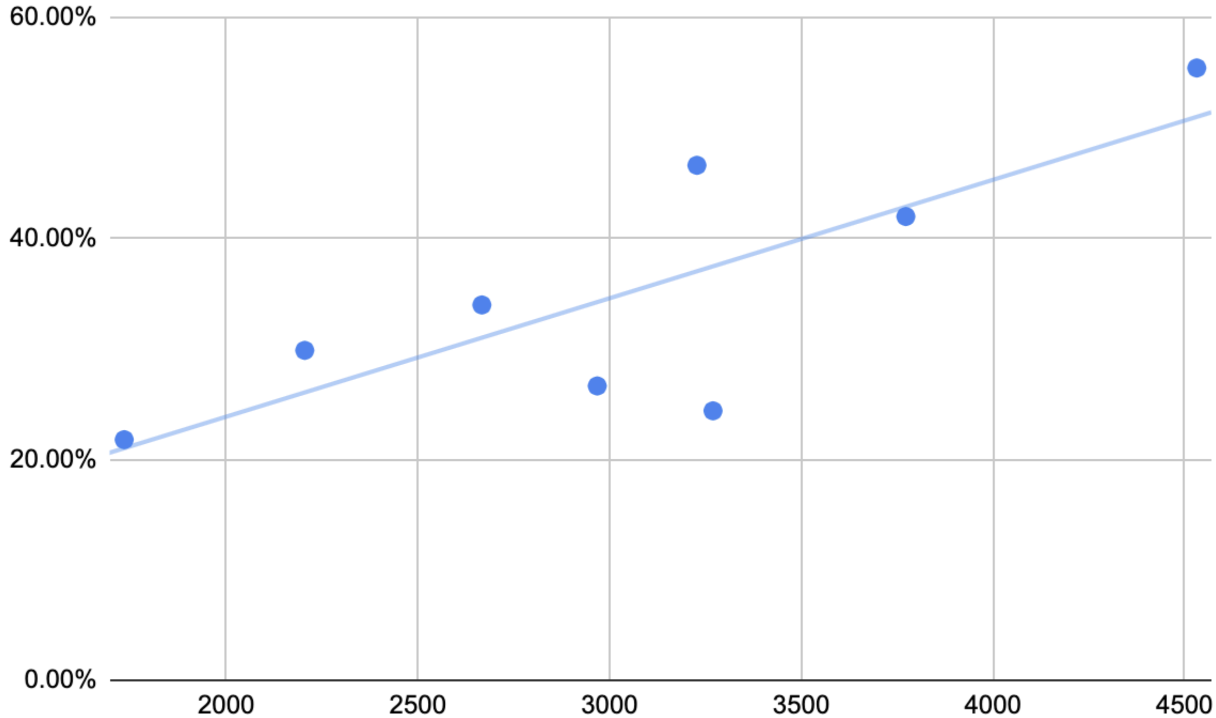
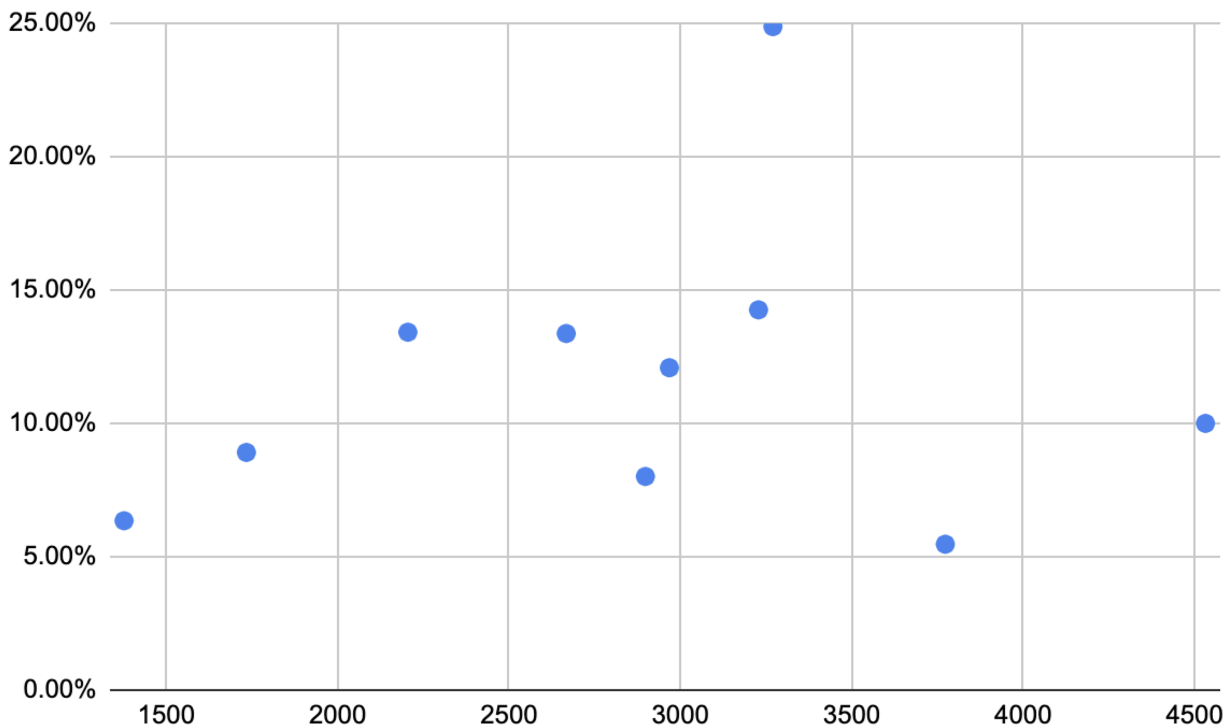


Figure 5. Same as Figure 4 excluding the least difficult match.



- The next figure shows no relationship between drop shot rate and match length.
  Figure 6. Match length vs drop shot rate.



- The following figure shows decreasing drive shots with longer matches. Linear regression shows roughly 1 less drive for every increased minute.
Figure 7. Match length vs drive rate.

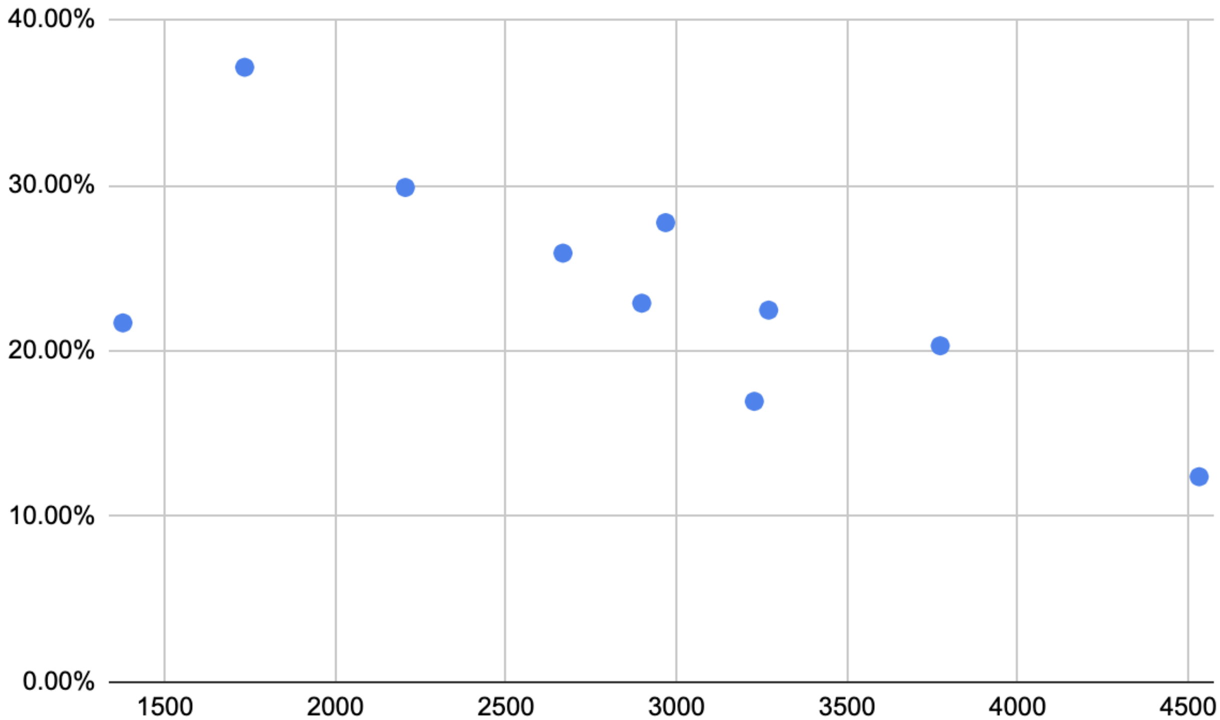
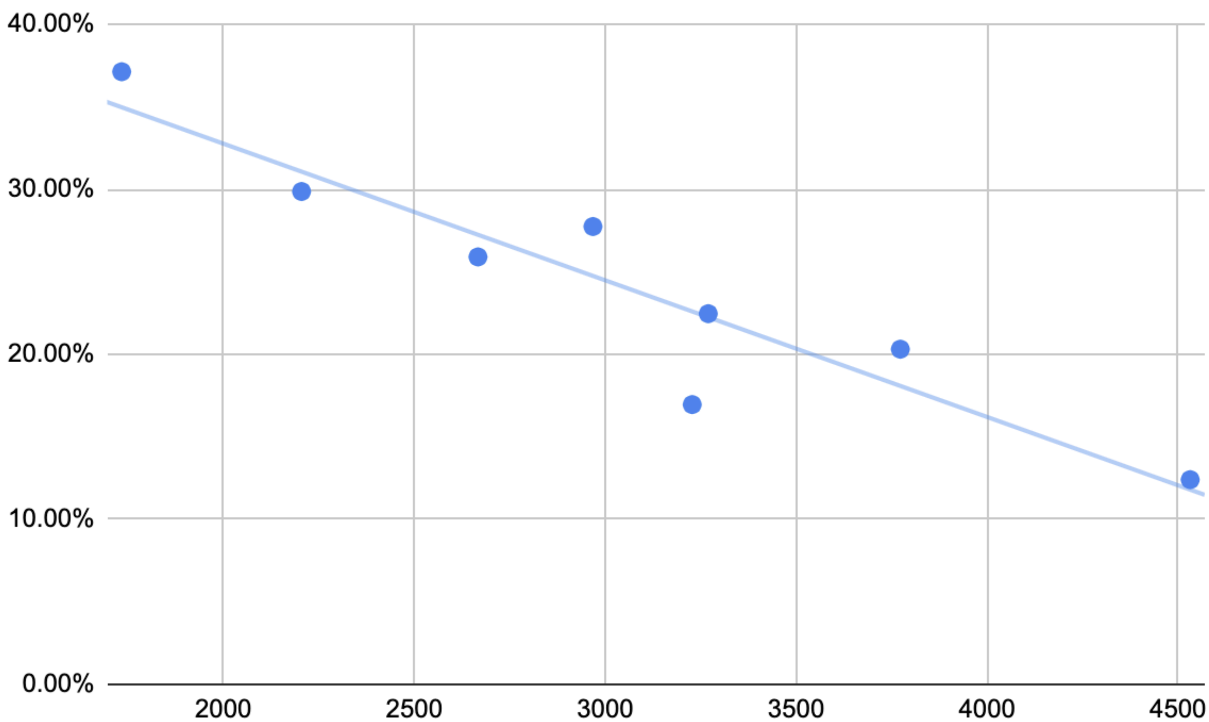
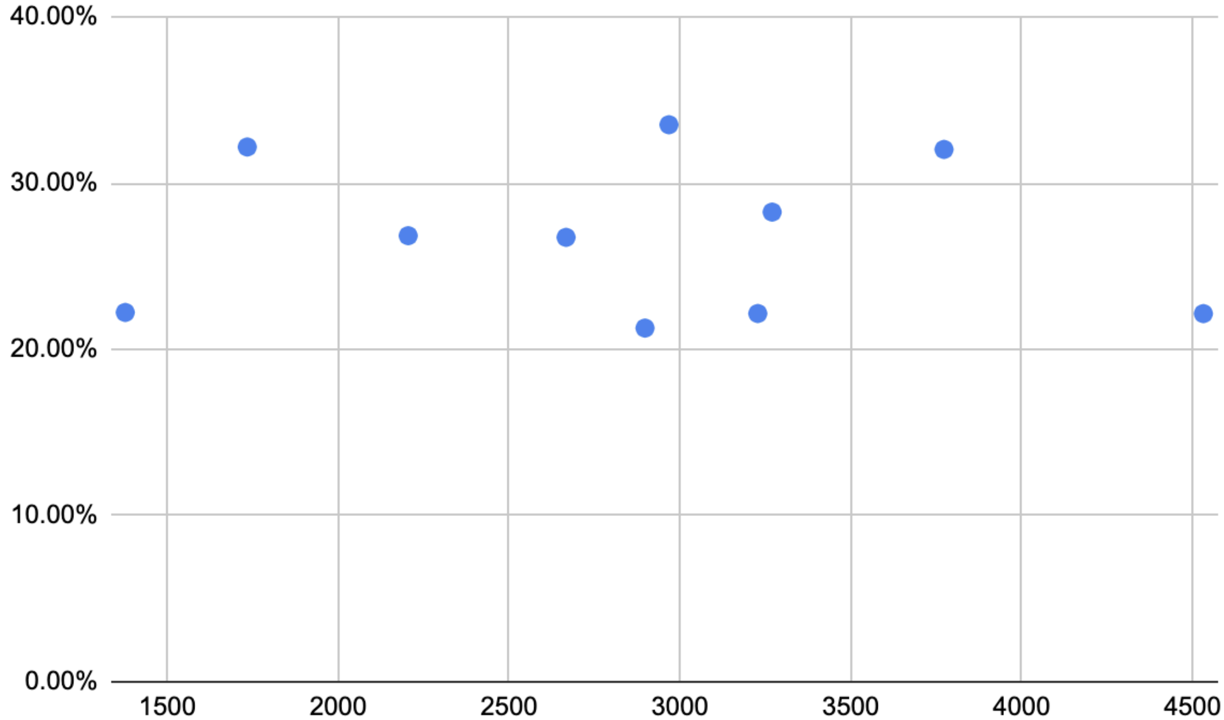


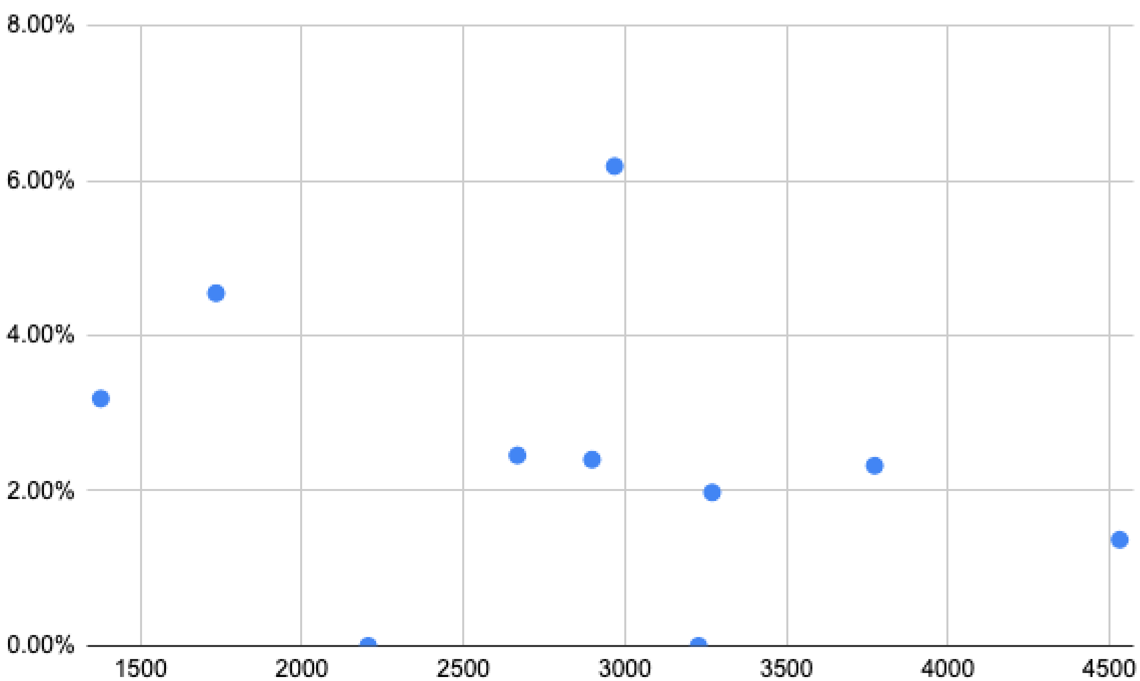
Figure 8.Match length vs drive rate excluding the easiest match.



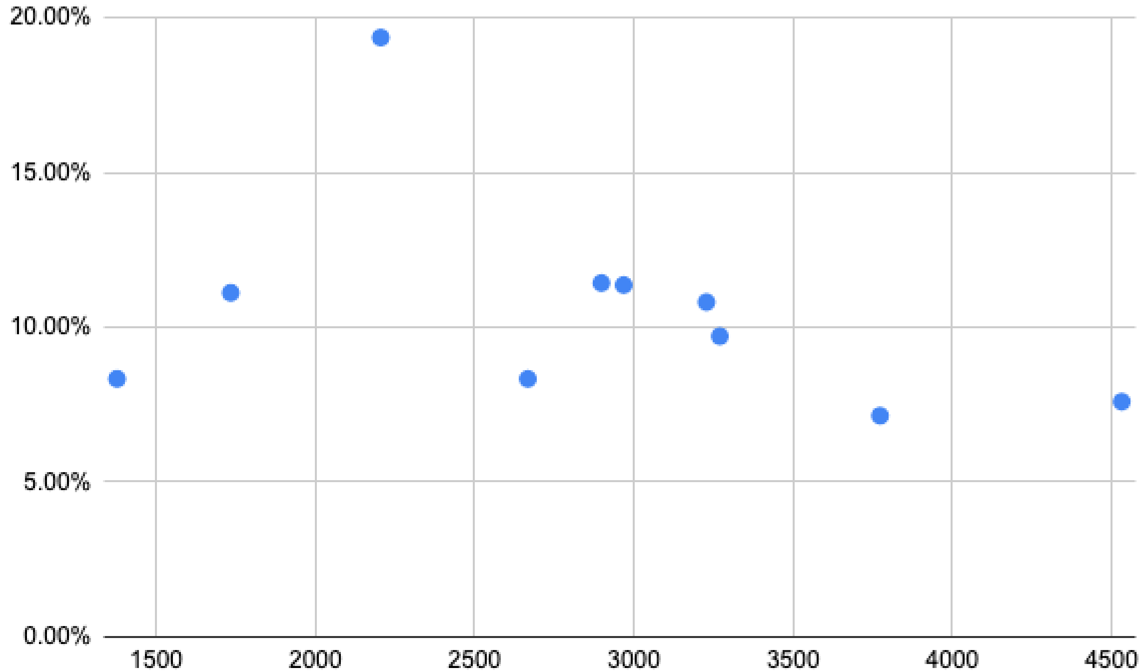
- The figure below shows no relationship between volley shot rate and match length.
  Figure 9. Match length vs volley rate.



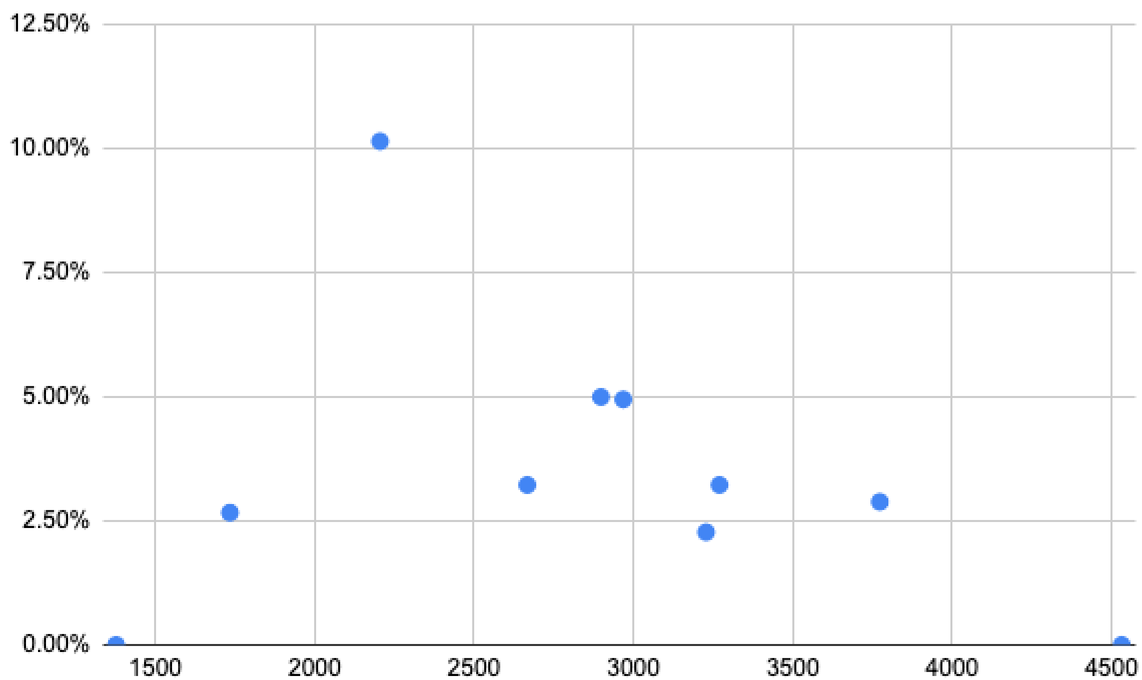
- The figure shows no relationship between match length and failed dink rate.
  Figure 10. Match length vs failed dink rate.



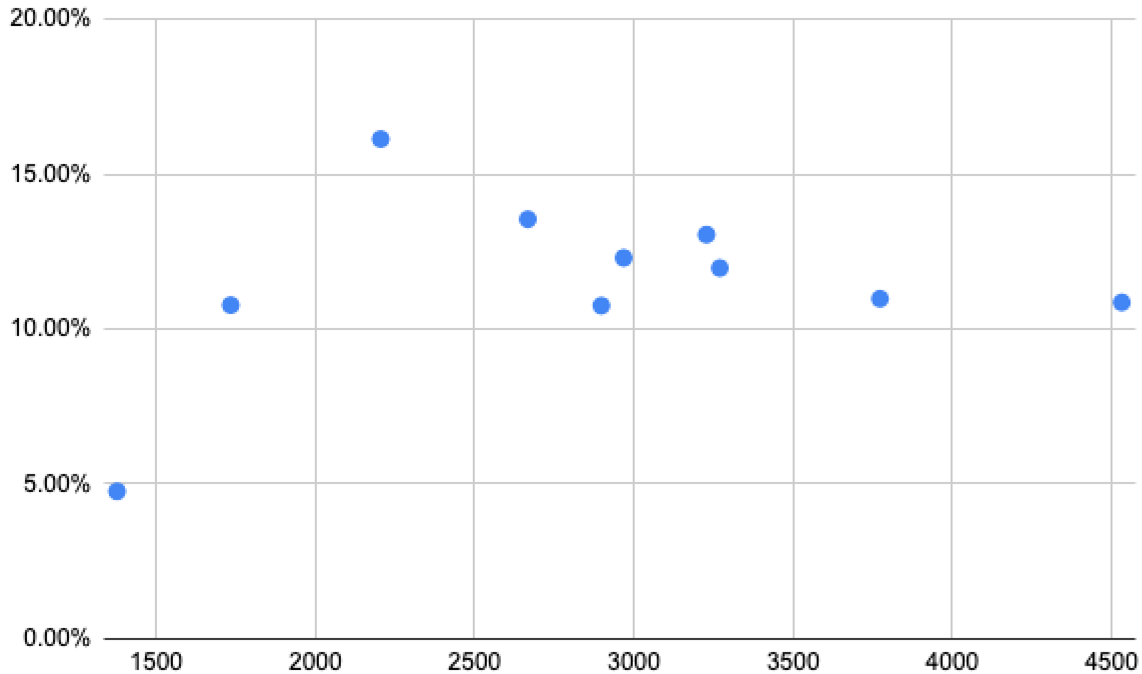
- This figure shows no relationship between match length and failed drop rate.
  Figure 11. Match length vs failed drop rate.



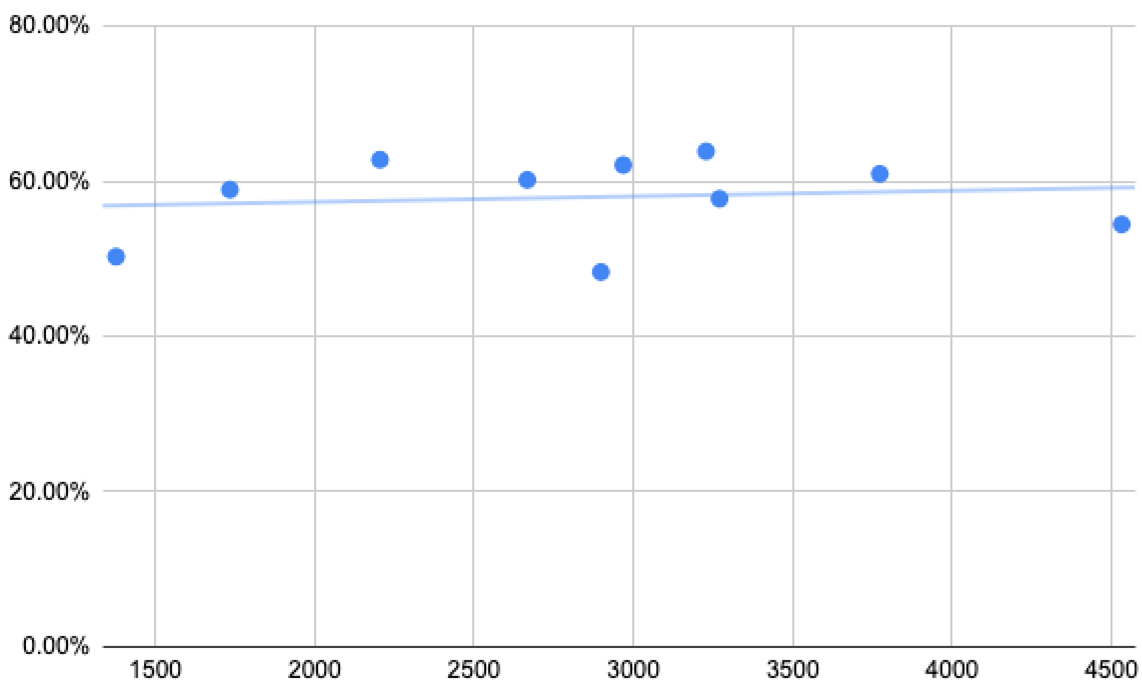
- The next figure shows no relationship between match length and failed drive rate.
  Figure 12. Match length vs failed drive rate.



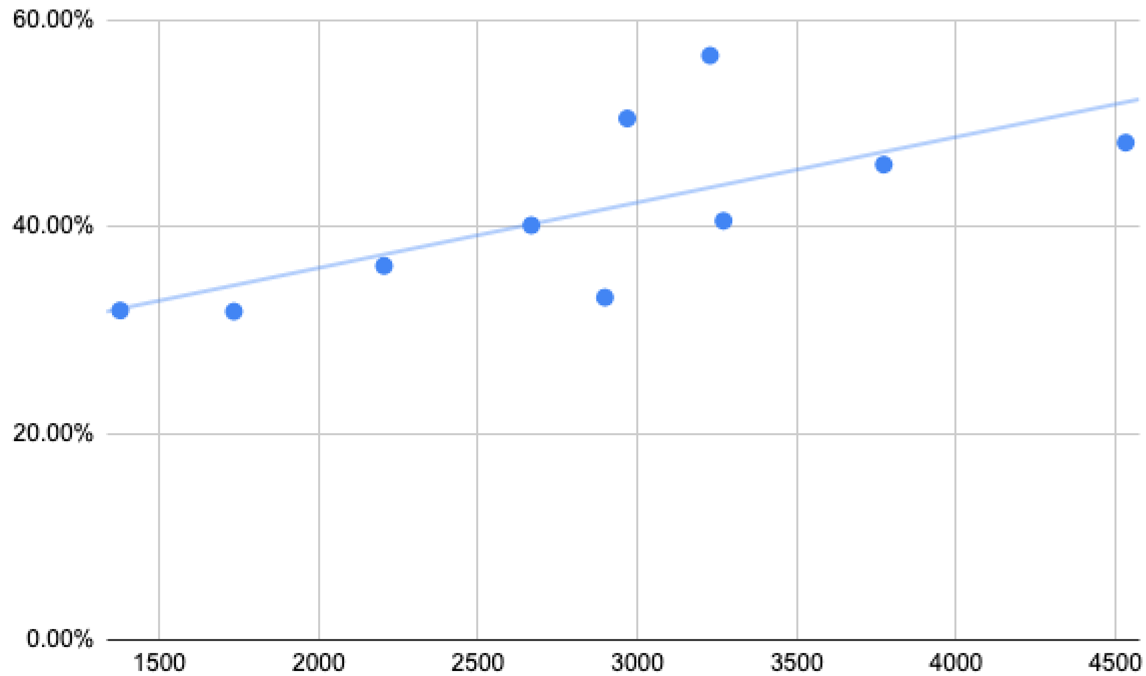
- The following figure shows no relationship between match length and failed volley rate.
  Figure 13. Match length vs failed volley rate.



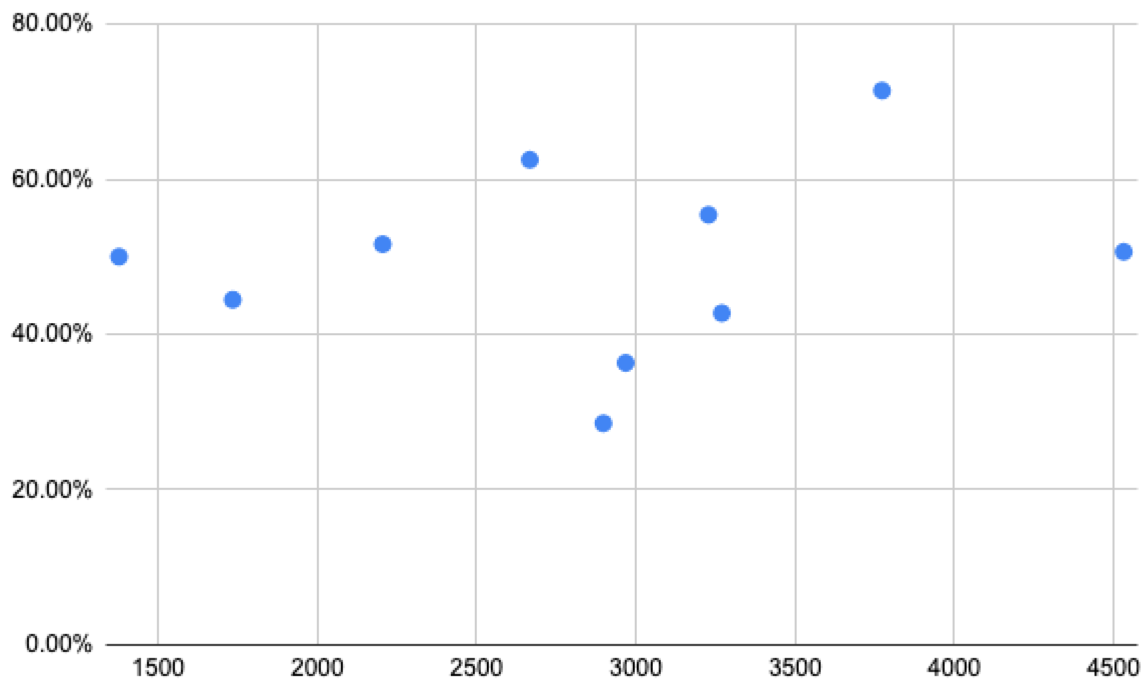
- The following figure below shows no relationship between match length and forehand shot rate. The forehand shots take about 60% of all shots.
  Figure 14. Match length vs forehand shot rate.



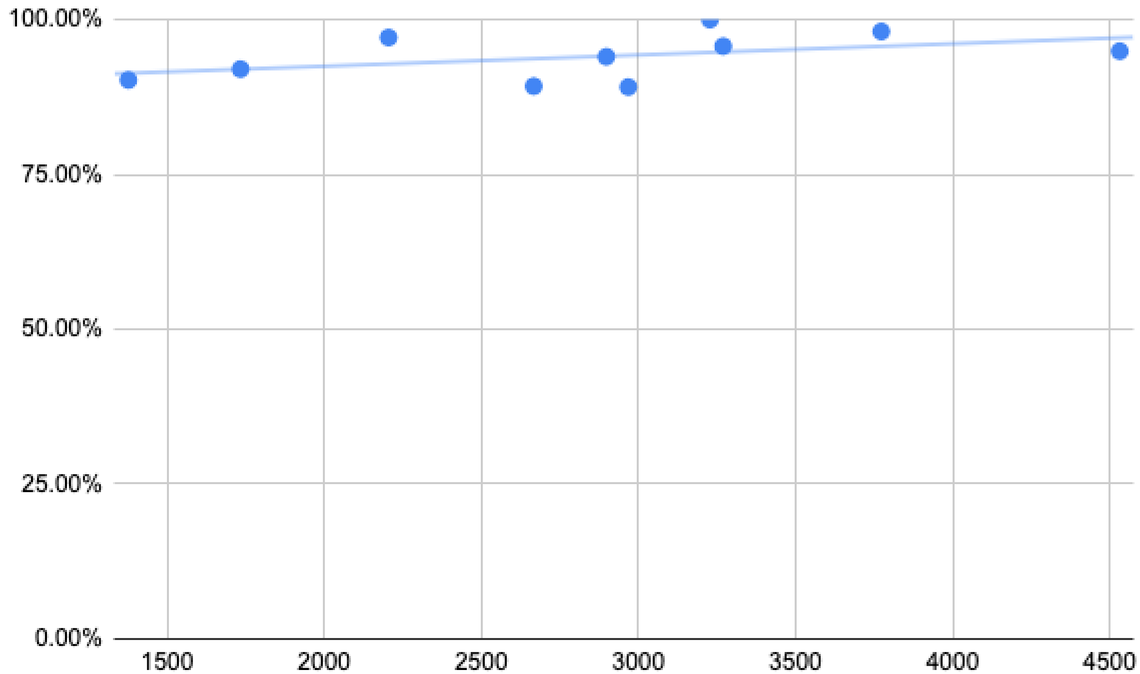
- The next figure shows with longer matches, forehand dink rate increases. Linear regression shows 3 more forehand dinks for each minute played.
  Figure 15. Match length vs forehand dink rate.



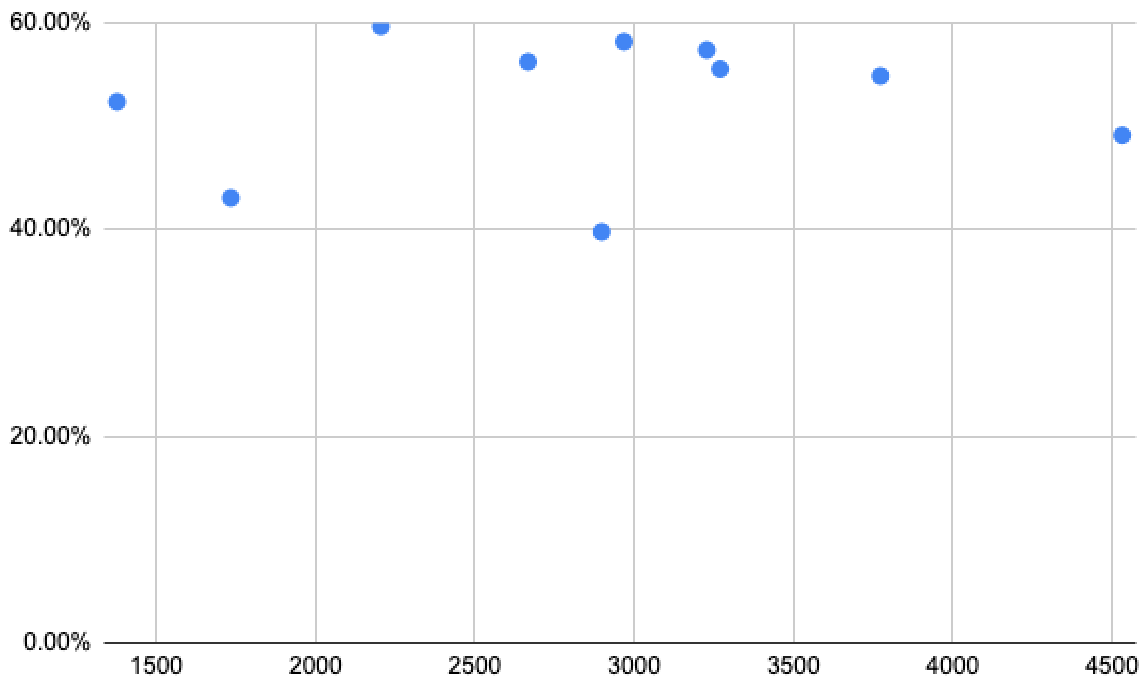
- This figure shows no relationship between match length and forehand drop rate.
  Figure 16. Match length vs forehand drop rate.



- The next figure shows no relationship between match length and forehand drive rate.
  Figure 17. Match length vs forehand drive rate.

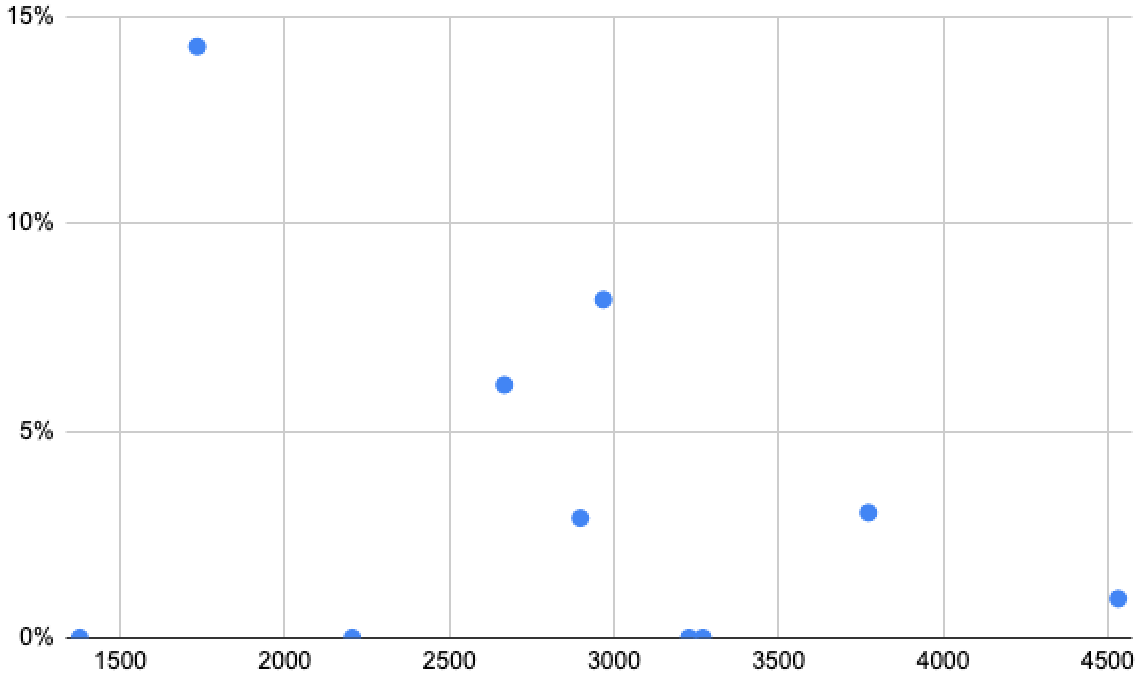


- This figure shows no relationship between match length and forehand volley rate.
  Figure 17. Match length vs forehand volley rate.

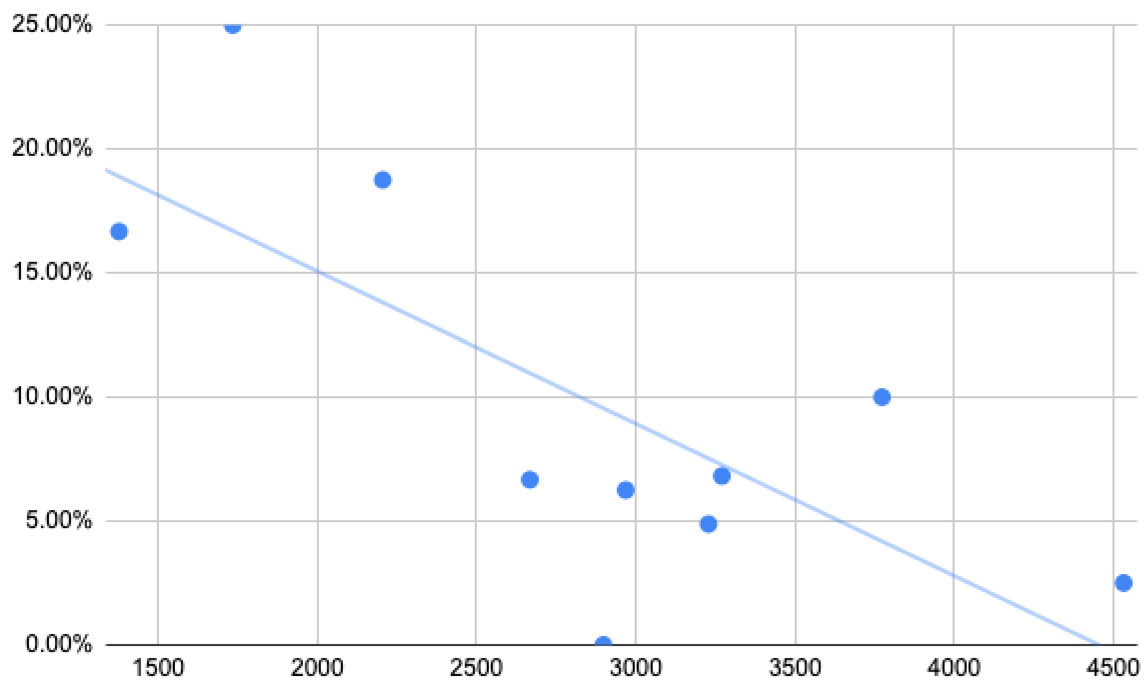


- The next figure shows no relationship between match length and failed forehand dink rate.

Figure 18. Match length vs failed forehand dink rate.

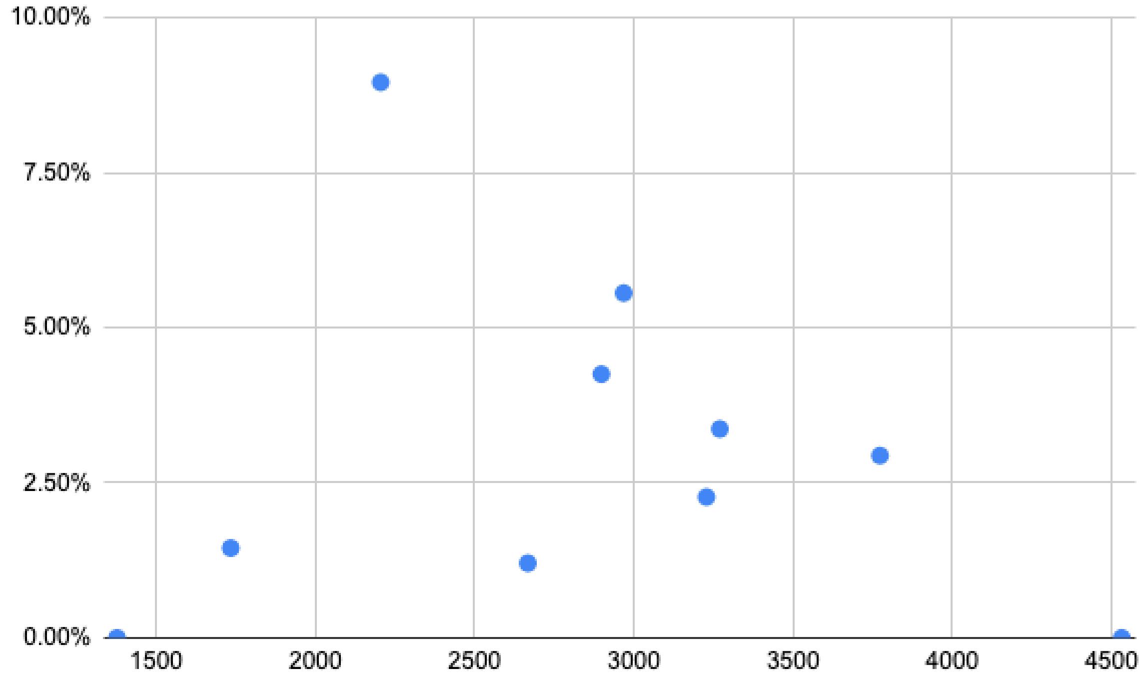


- The next figure shows the relationship between match length and failed forehand drop rate.
  Figure 19. Match length vs failed forehand drop rate.



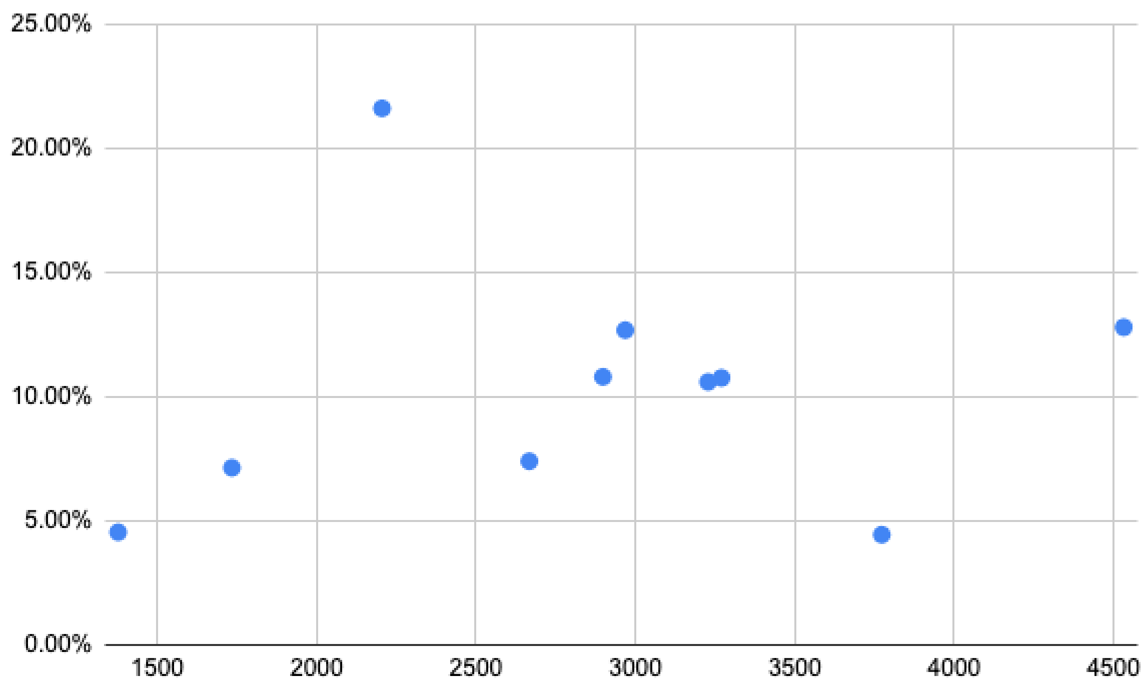
- The next figure shows no relationship between match length and failed forehand drive rate.

Figure 20. Match length vs failed forehand drive rate.



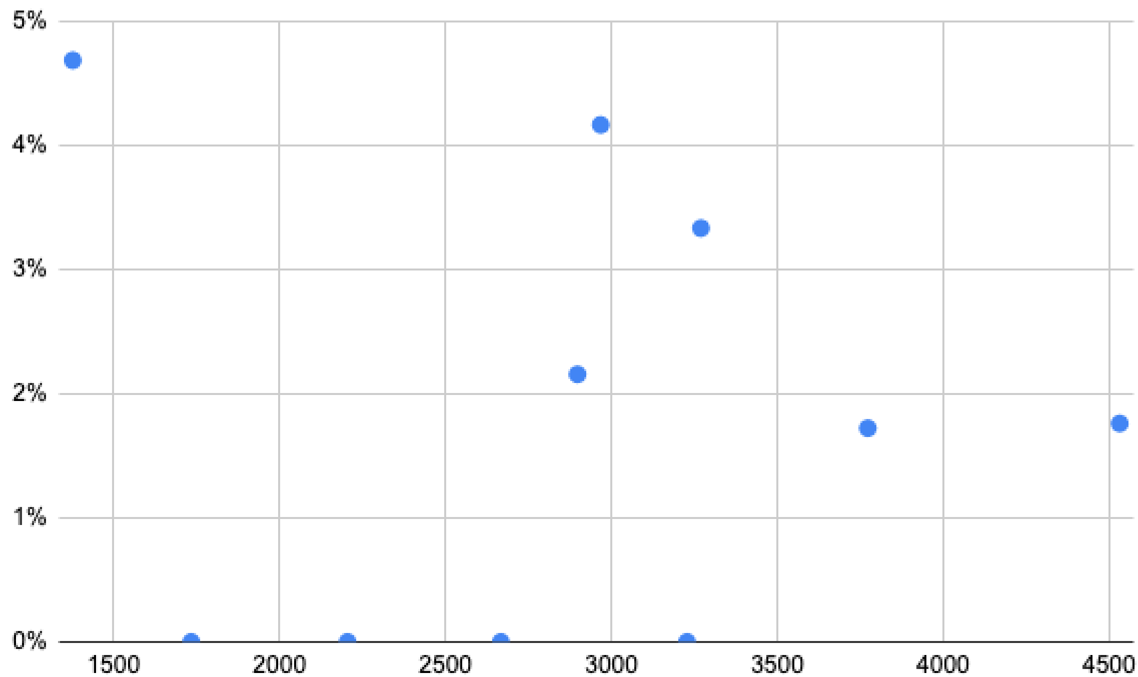
- The next figure shows no relationship between match length and failed forehand volley rate.

Figure 21. Match length vs failed forehand volley rate.

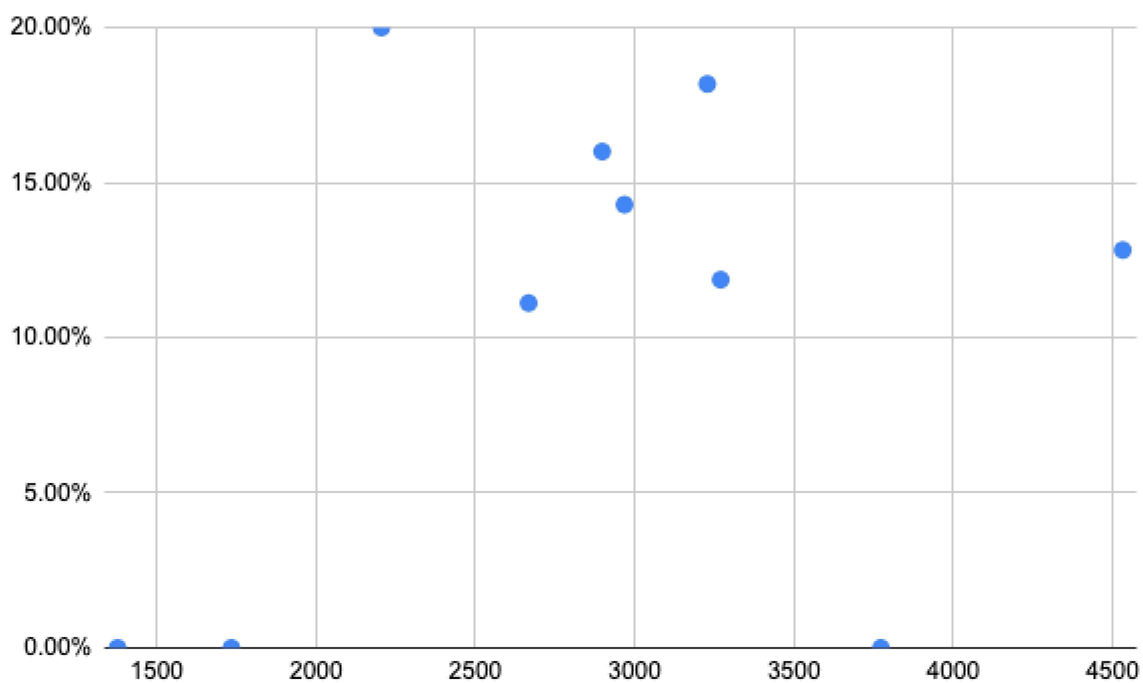


- The next figure shows no relationship between match length and failed backhand dink rate.

Figure 22. Match length vs failed backhand dink rate.

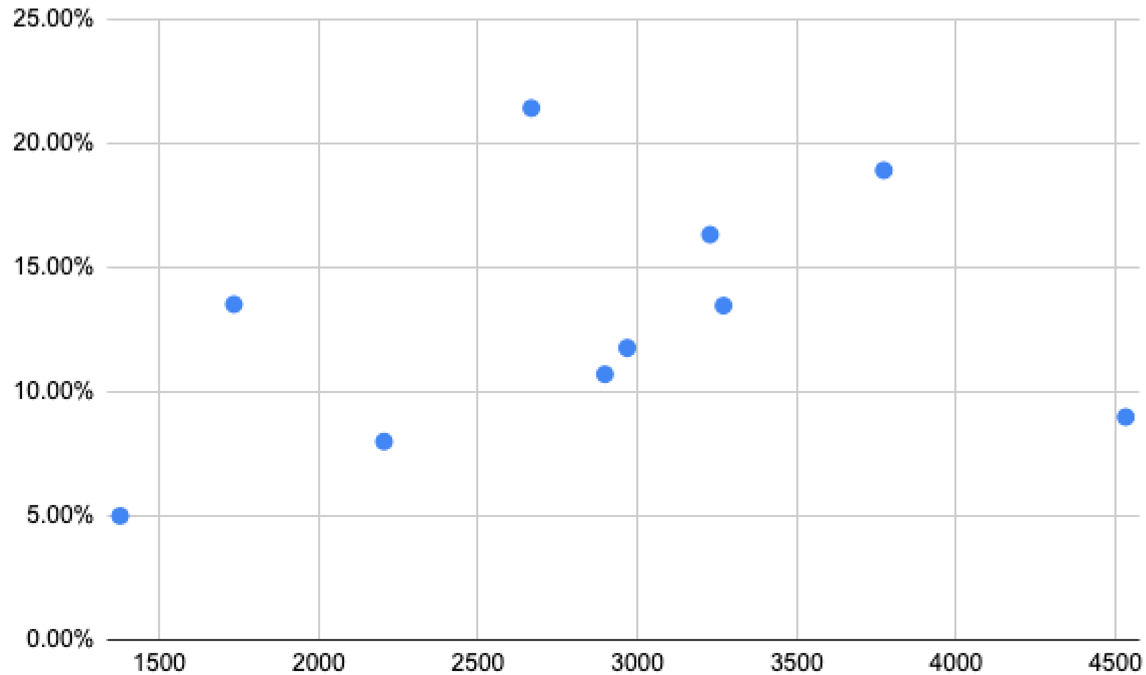


- The next figure shows no relationship between match length and failed backhand drop rate.
Figure 23. Match length vs failed backhand drop rate.

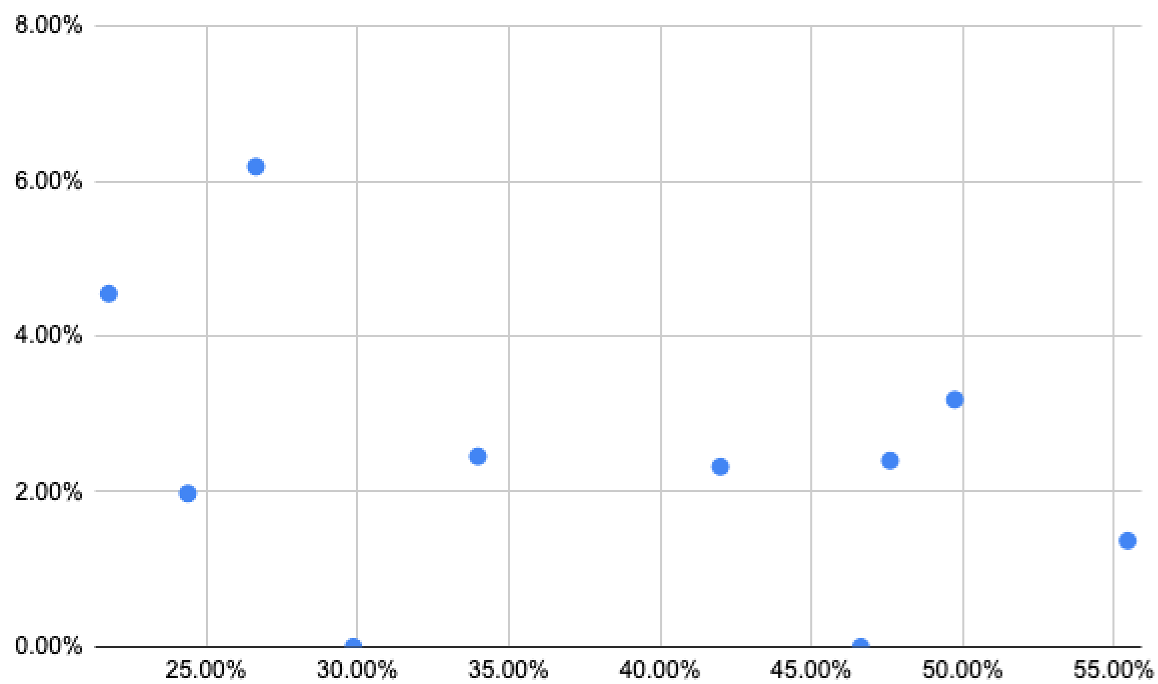


- The next figure shows no relationship between match length and failed backhand volley rate.

Figure 24. Match length vs failed backhand volley rate.

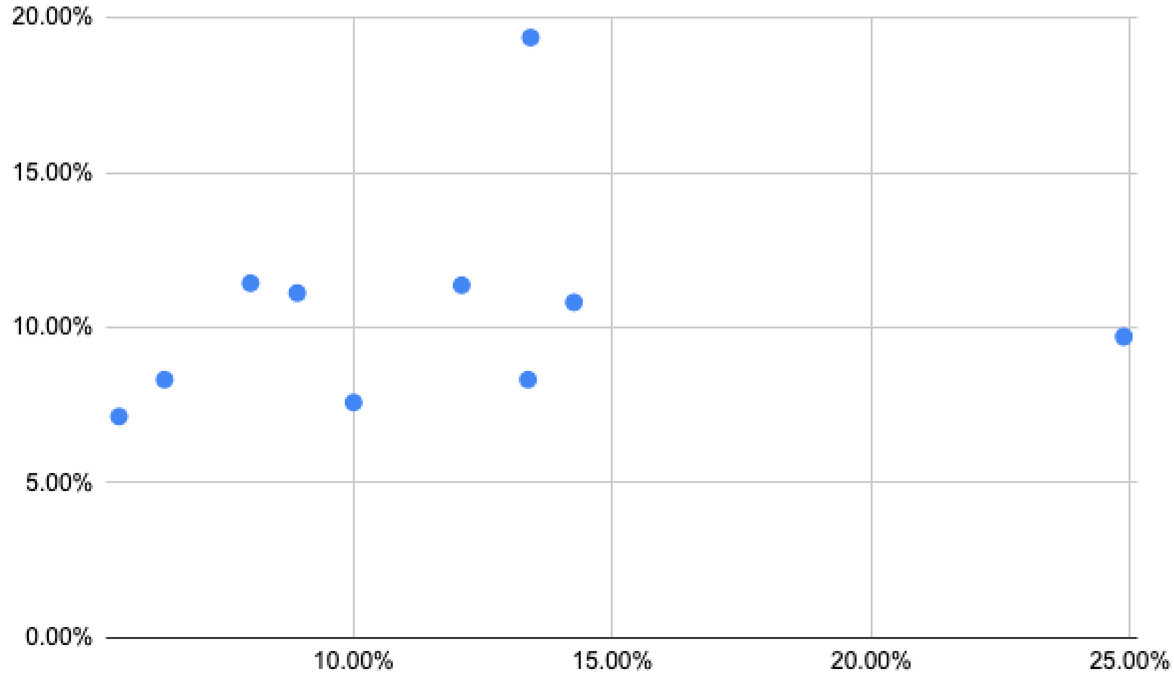


- The next figure shows no relationship between dink rate and failed dink rate.
  Figure 25. Dink rate(x axis) vs failed dink rate.

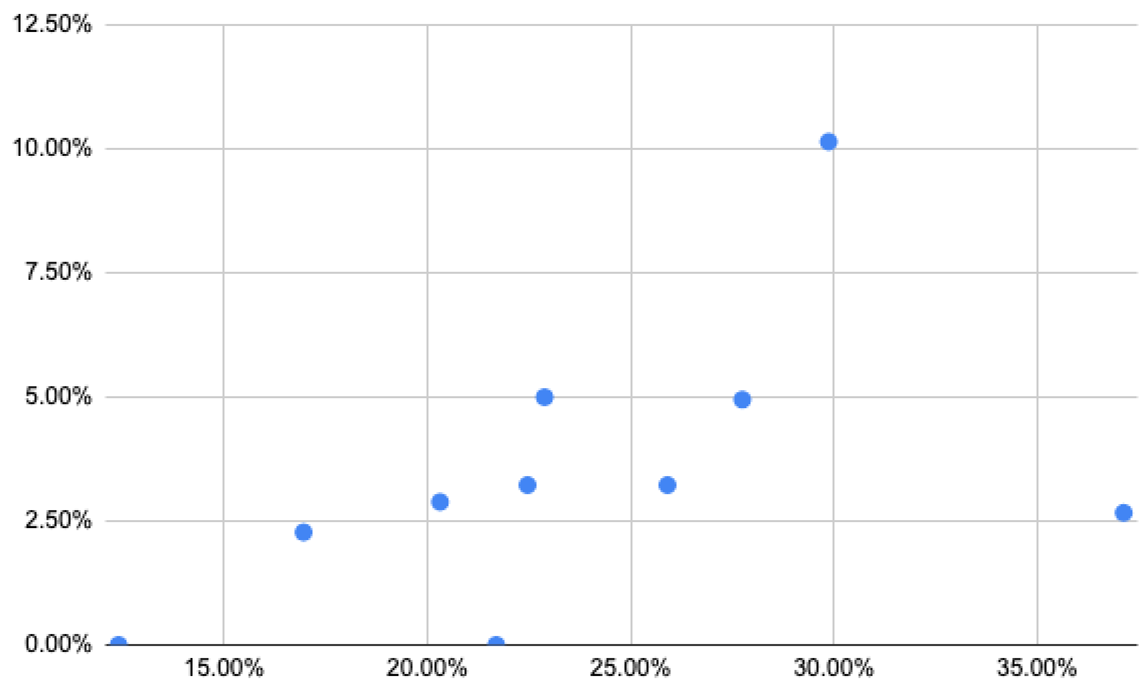


- The next figure shows no relationship between drop rate and failed drop rate.

Figure 26. Drop rate(x axis) vs failed drop rate.

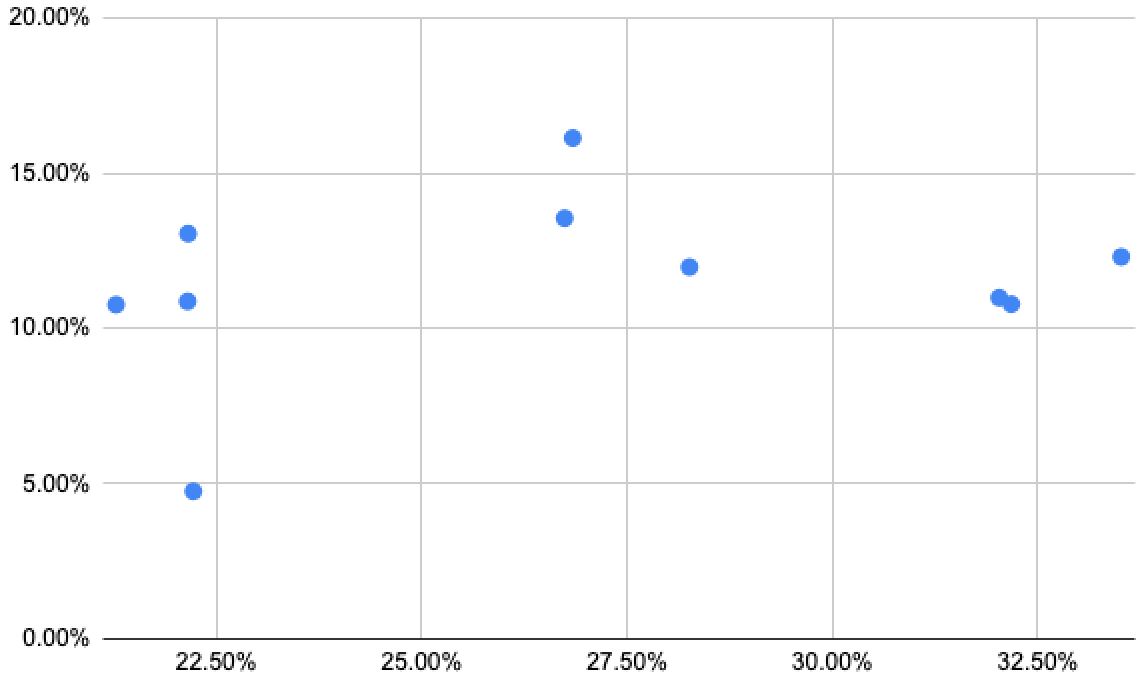


- The next figure shows no relationship between drive rate and failed drive rate.
Figure 27. Drive rate(x axis) vs failed drive rate.

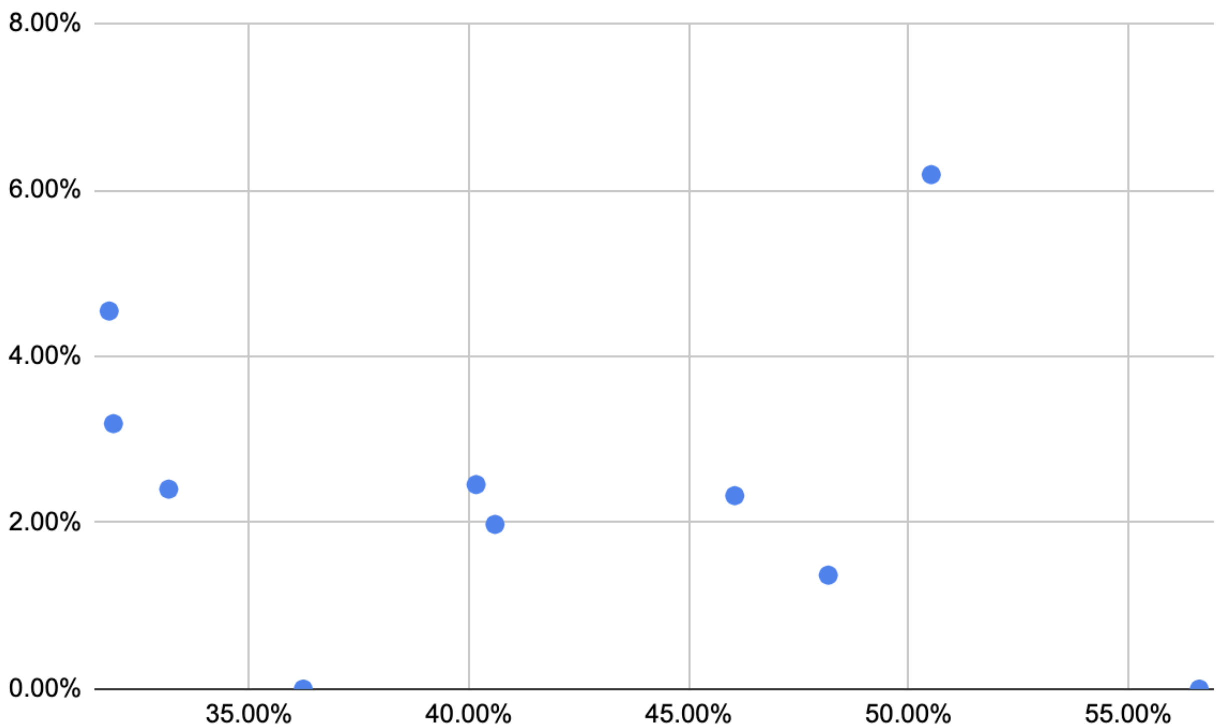


- The next figure shows no relationship between volley rate and failed volley rate.

Figure 28. Volley rate(x axis) vs failed volley rate.

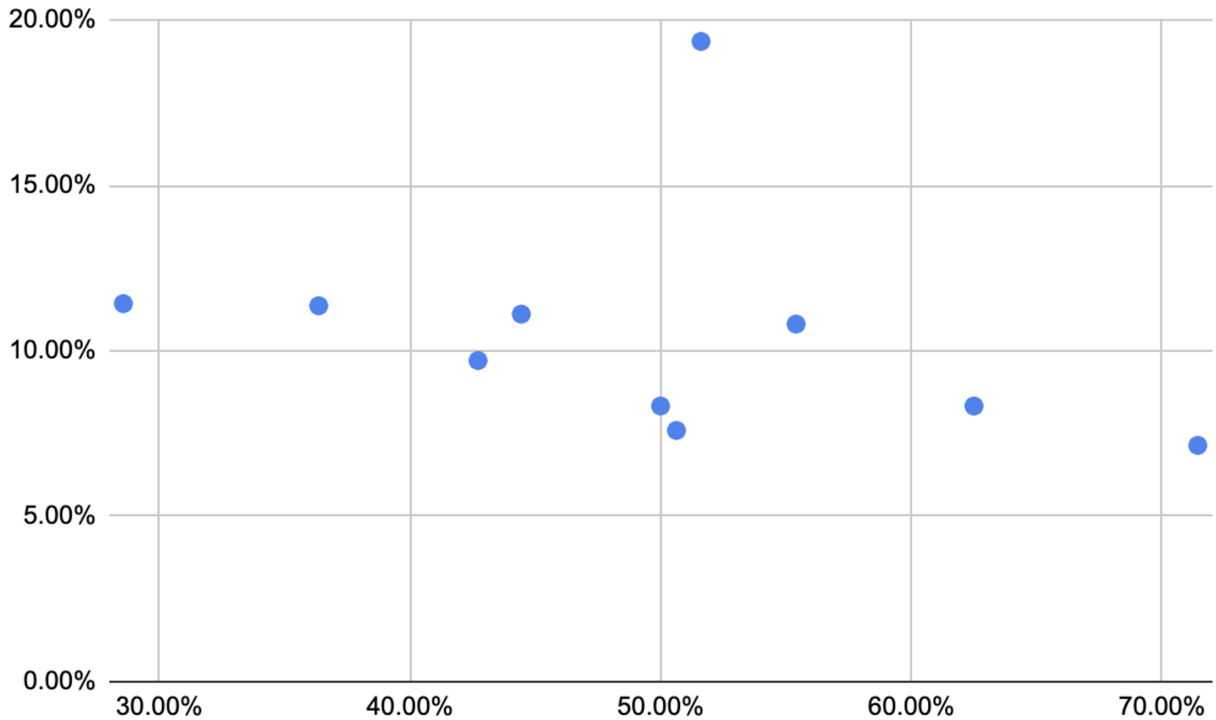


- The next figure shows no relationship between forehand dink rate and failed dink rate.
  Figure 29. Forehand dink rate(x axis) vs failed dink rate.

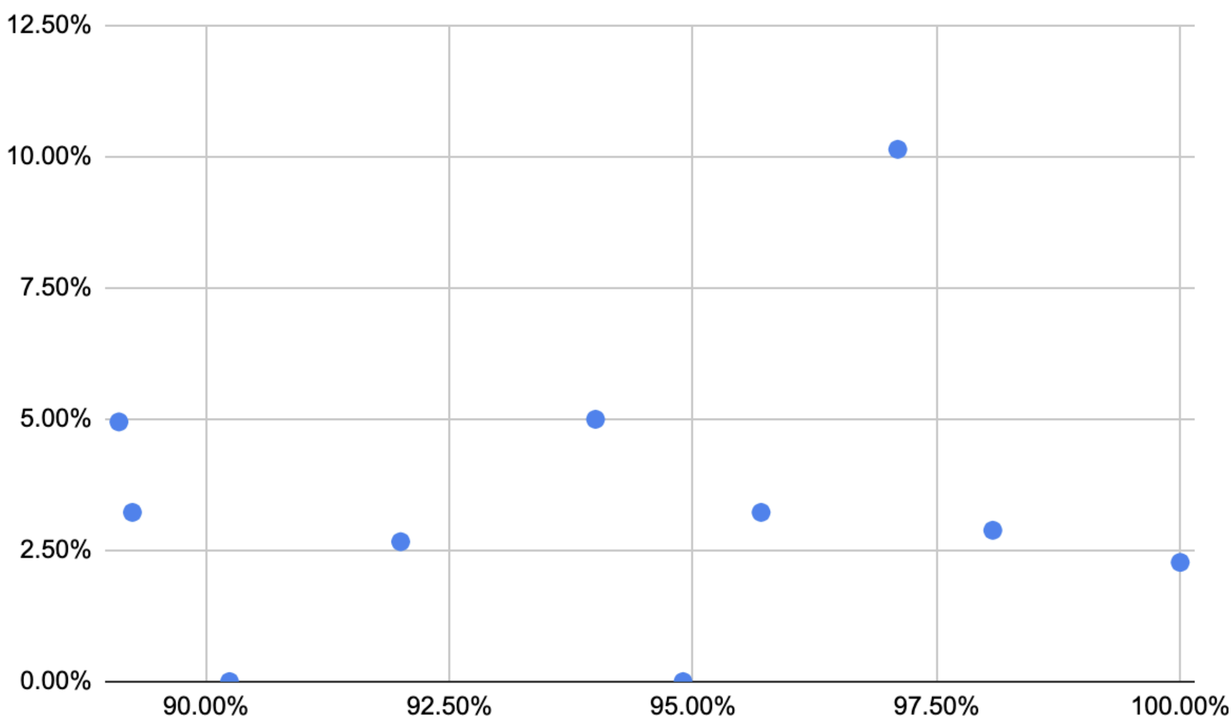


- The next figure shows no relationship between forehand drop rate and failed drop rate.

Figure 30. Forehand drop rate(x axis) vs failed drop rate.

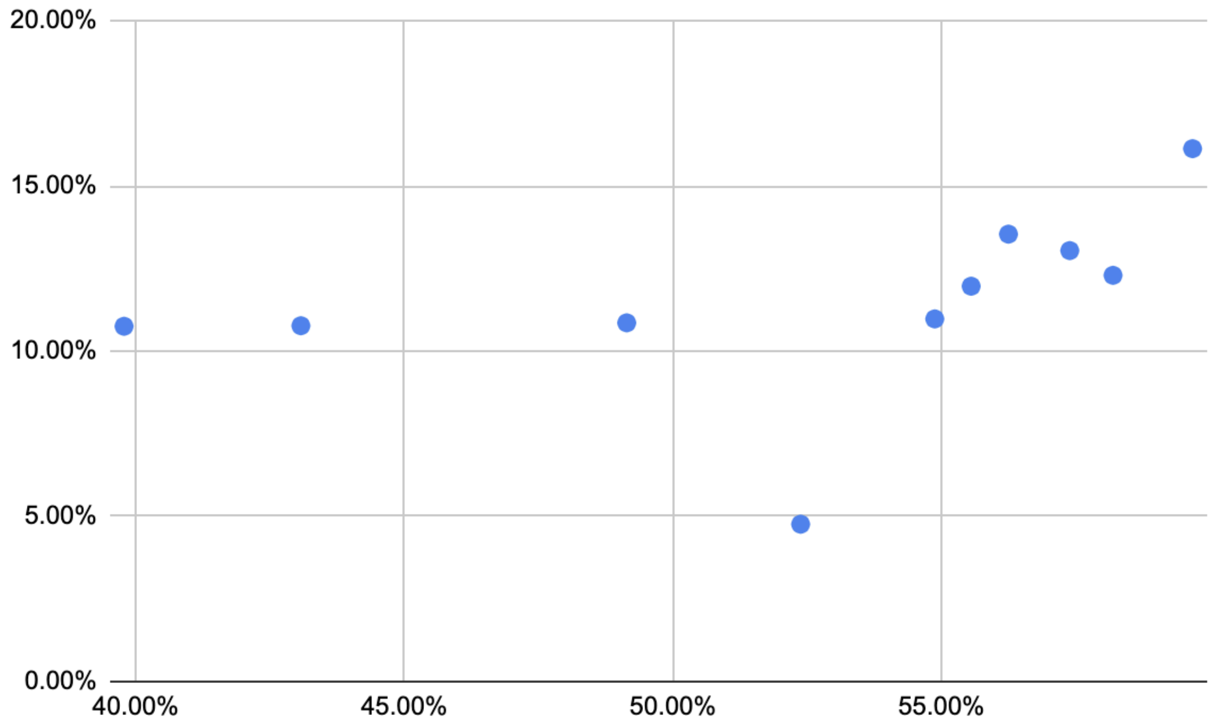


- The next figure shows no relationship between forehand drive rate and failed drive rate.
  Figure 31. Forehand drive rate(x axis) vs failed drive rate.

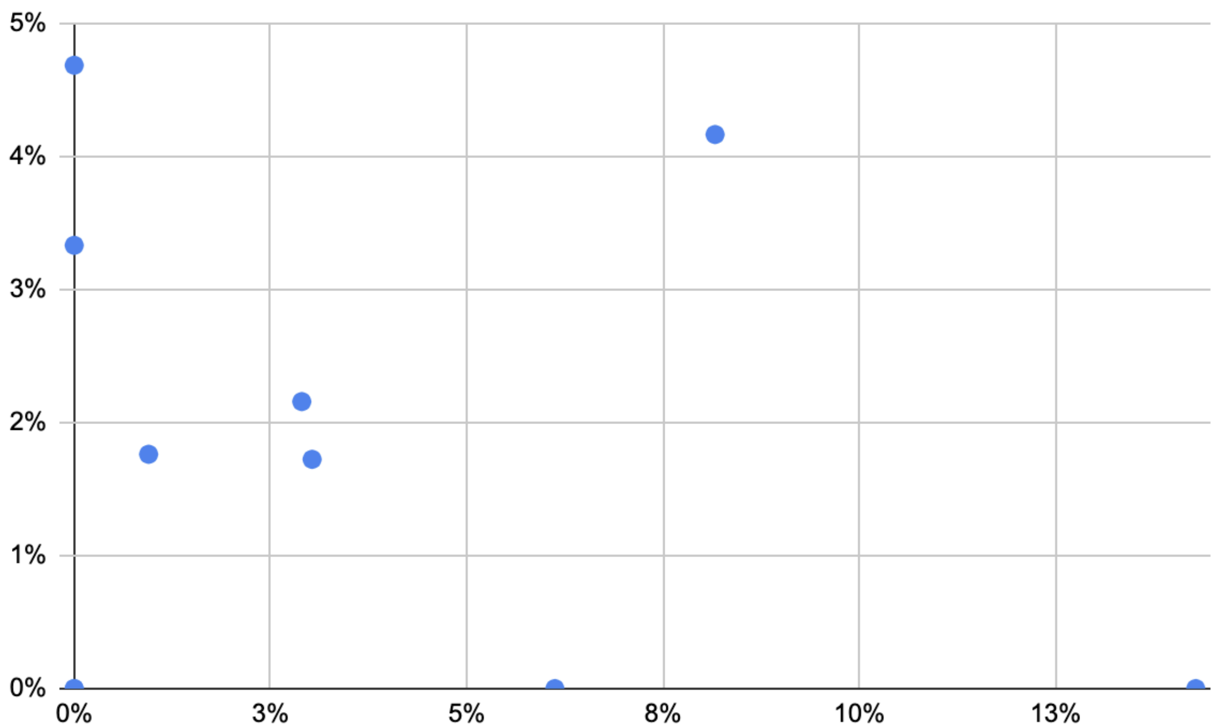


- The next figure shows no relationship between forehand volley rate and failed volley rate.

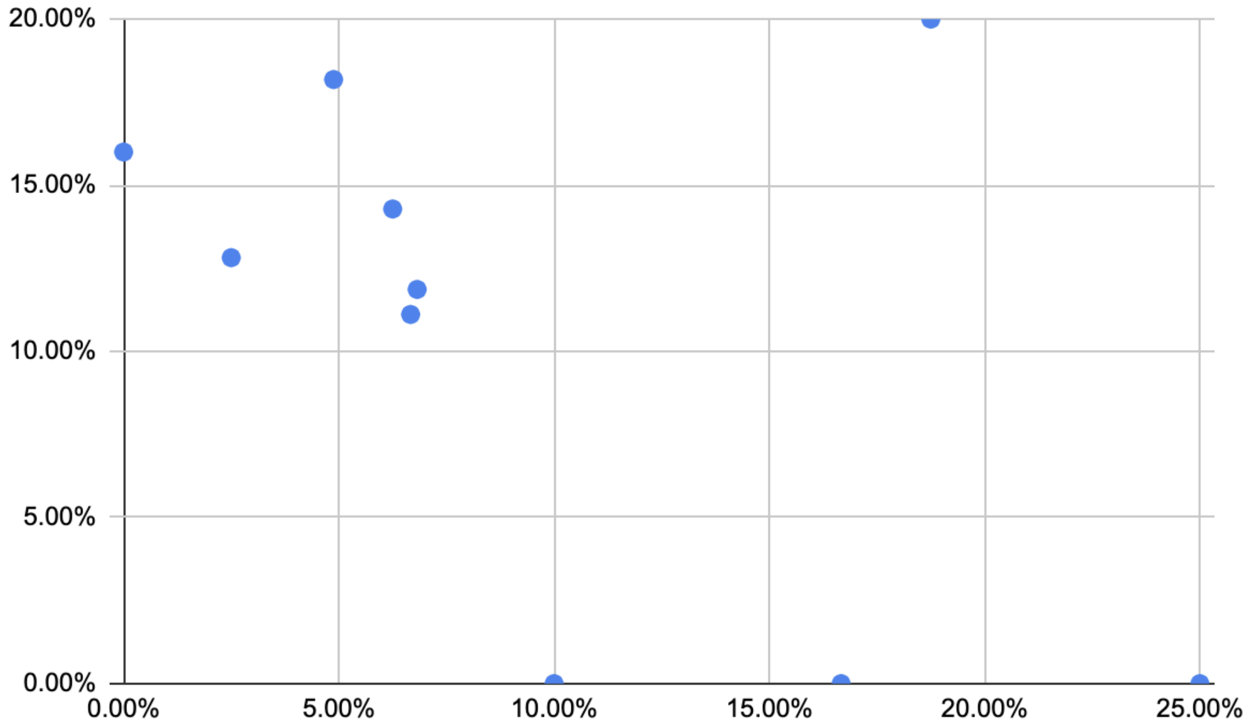
Figure 32. Forehand volley rate(x axis) vs failed volley rate.



- The next figure shows no relationship between failed forehand dink rate and failed backhand dink rate.
  Figure 33. Failed forehand dink rate(x axis) vs failed backhand dink rate.

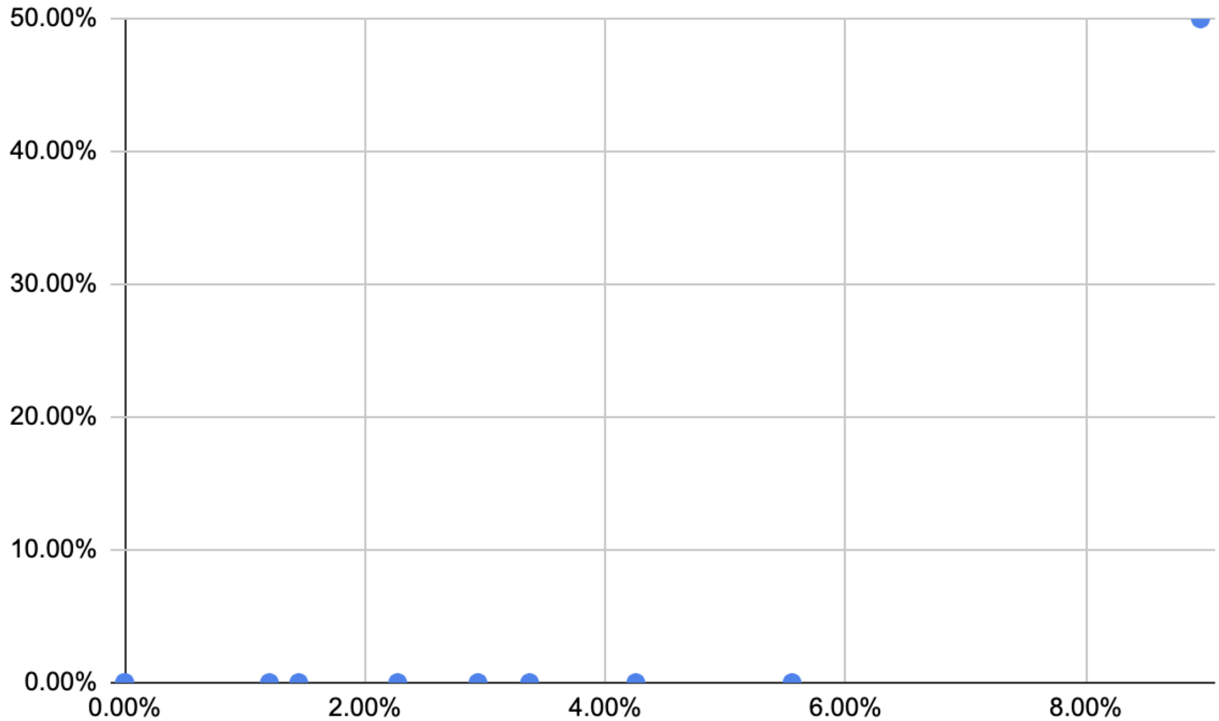


- The next figure shows no relationship between failed forehand drop rate and failed backhand drop rate.
  Figure 34. Failed forehand drop rate(x axis) vs failed backhand drop rate.

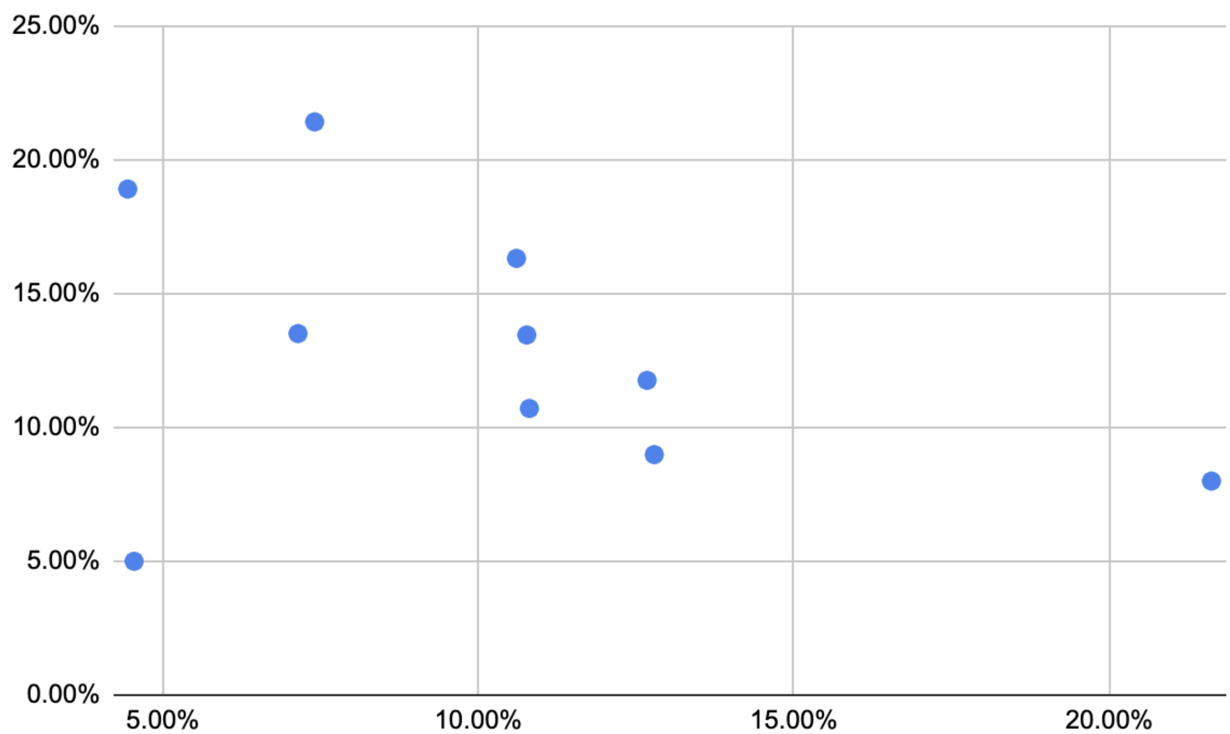


- The next figure shows no relationship between failed forehand drive rate and failed backhand drive rate.

Figure 35. Failed forehand drive rate(x axis) vs failed backhand drive rate.



- The next figure shows no relationship between failed forehand volley rate and failed backhand volley rate.
  Figure 36. Failed forehand volley rate(x axis) vs failed backhand volley rate.



Discussion

First of all, our data analysis aims to enhance understanding of pickleball, challenge biases, and bolster its mainstream recognition. Pickleball faces certain biases and perceptions that can influence its wider acceptance. Pickleball's initial popularity with older adults occasionally leads to unfair stereotypes about it being a slow or easy sport. Moreover there's a degree of snobbery from certain athletes who dismiss sports they don't consider sufficiently challenging. Our data highlighted the complexity of pickleball games. Our descriptive statistics such as match lengths, number of shots, and accuracy requirements indicated that pickleball is physically and mentally challenging. Our tables and figures show pickleball requires technical skills and mental agility. Shot execution isn't just about hitting the ball hard. It's about accuracy, spin, angles, and touch. Developing a variety of shots and knowing when to use them properly adds another layer of complexity. Pickleball shot type diversity requires fast decision-making and the ability to adapt your strategy based on a constantly changing environment. Players need the mental stamina to process all of these factors in real-time.

Our study is the pioneer to systematically summarize pickleball games. We chose to analyze Ben Johns' data because his dominance as a player offers a premier reference point for understanding the strategies and techniques essential for success at the top levels of pickleball. Our study covered an adequate amount of varying difficulty levels, adequate amount of shots, and sufficient match lengths. We provided in-demand content for followers of Ben Johns and players to know more about his techniques and strategies.

Our study provides an overall perspective as a solid foundation for the future to compare with other racket games. There exists no significant data for similar paddle games such as tennis, table tennis and badminton. Our data provides a strong baseline to help potential new players to determine which racket sport could align with their requirements.

We introduced a new measurement of difficulty. Our formula ensures that difficulty is measured consistently across all matches, making comparisons more reliable. This is crucial for maintaining fairness in competitive settings. More complex formulas might be more accurate but also harder to understand and adjust.

Our data measured physical activities for a single player in double games. This offers significant professional advantages. Firstly, it helps players and coaches to understand fitness demands. The match time provides a clear picture of how long the professional players should maintain high levels of endurance, agility, and speed. Players could set tangible fitness goals for their training. While professional matches are more intense than regular leisure play, recreational players could still use this data to gauge their exercise. For example, a game roughly takes 10 minutes. A regular person aiming to exercise 30 minutes a week could play 3 games, since game numbers are easier to quantify, especially for older adults. Secondarily, it helps injury prevention by identifying potential overuse patterns. In our opinion, training schedules could use the number of shots per minute as a baseline to prevent overplaying, burnout, and fatigue. Thirdly, for researchers, our data could help understand pickleball's impact on health as medical researchers could use our data as a reference. Lastly, quantifying the physical activity could attract new players and highlight the sport as an approach to stay active while being entertained.

Our shot type percentage data is incredibly useful for several reasons. Firstly, it helps players to realize potential areas of improvement. For example, high level plays rely on dinks instead of volleys. Dinks may be underutilized among many recreational players. Secondly, coaches could analyze player's shot type percentages and compare with our data to address weakness. Thirdly, understanding the shot distribution of an entire team can expose overall strategic imbalances or tendencies opponents might exploit. Lastly, using our data against specific opponents, knowing their shot tendencies could help tailor defensive strategies to neutralize their strengths.

Our accuracy data also provides accuracy guidelines for players playing professionally to align the shot success rate. Ben's success rate for each type of shot could be a goal for players/coaches daily training. His accuracy data would define the high-water mark for the sport, providing realistic, top-level targets for aspiring players. While impossible to replicate his entire training regimen, the results of his accuracy work might hint at specific, highly effective drills or training methods. For example, as the player on the left should maintain a high backhand dink success rate. The accuracy should not fluctuate in different match lengths. We also have a potential take home message for new players, that is try to keep the error rate low.

Dinking is a fundamental and incredibly important part of pickleball strategy. Dink exchanges represent a significant majority of shots. Our data analysis indicates that dink shots comprise, on average, one-third of all shots in pickleball matches. This percentage can increase to as high as 50% in certain competitive scenarios.

For Ben, our data pinpointed one of his strongest shots, dink shots. Its failure rate is significantly lower than comparable alternatives. This data again revealed the importance of successful dink shots in pickleball. The dink shot may seem elementary, but it's a deceptively powerful weapon in pickleball. Mastering the dink is crucial for controlling the pace of the game, forcing opponents into vulnerable positions, and setting up winning points. A well-placed dink can neutralize an opponent's power, create openings for attacks, and keep them guessing. Ben's dink consistency gives him a substantial edge, wearing down opponents and making him incredibly difficult to beat.

A key strategic takeaway is that difficult matches may necessitate a higher frequency of dink shots and a reduction in drives to facilitate greater control and error reduction. This dink more and drive less trend was shown in our figures. Our assumption is that Ben uses dinking to gain control and setting up offensive opportunities. This high percentage could also indicate that Ben was strong at the net and was forcing opponents onto the defensive with well-placed dinks. We propose that this technique holds significant strategic potential in matches against high-level players.

While some players might have a slightly stronger forehand or backhand naturally, the best pickleball athletes in the world strive for consistent mastery of both shots to reach their fullest potential. Our data show Ben is skilled with both forehands and backhands for most shot types. Interestingly, Ben exhibits a unique tactical preference for forehand drives. If we agree on a dominant forehand drive leaves players vulnerable. This intentionally avoided bachand drive could be an opportunity for top opponents to exploit, forcing errors and making Ben predictable. When a ball is at Ben's backhand side and relatively high position, opponents could assume the ball is a drop if Ben is at the back of the court.

In figure 33 - 36, the data points shift more to the top left region. It means Ben has less failure rate with forehand. They may hint opponents should try forcing Ben to use the backhand to win. For most players, the backhand is a less powerful stroke than the forehand. This holds true even at professional levels.

Ben’s potentially less reliable shots are volleys. We could in this article assume volleying is the key to win/lose points in the matches. Therefore volley becomes a tremendously rewarding skill to master.

Note that Ben doesn’t drive with backhand. Where it’s due to power, reach, or control, more data is required to reveal the reasons behind.

Ben almost never utilizes lob shots. Our assumption is that 1) Ben might prioritize alternative shots. 2) Ben might have an aggressive playing style, favoring drives and volleys to keep the pressure on the opponents. 3) Lobs can be riskier shots if not executed properly. Ben might prefer a lower-risk strategy with a focus on controlled shots. Knowing Ben is infrequent to lob, this is an opportunity for opponents to exploit. On the other hand, we watched how Ben dealt with lobs from the opponents. Roughly 50% lob gives Ben the opportunity to return with a high speed overhead smash. The other 50% lob were returned as drop shots. We assume that the efficacy of lob shots in professional matches is highly situational, and their strategic value depends on various contextual factors. In professional pickleball, the risk-reward ratio of lob shots necessitates careful consideration and strategic execution.

Our analysis of professional pickleball matches reveals a clear hierarchy of point-winning shots: volleys are most successful, followed by drops, drives, and dinks. We believe volleys get most of the points in pickleball for several key reasons. Firstly, it takes away reaction time from opponents, leaving them less time to prepare for the shots. Secondly, volleys are more powerful and aggressive, which are difficult to return. Lastly, It requires a psychological edge, which puts mental pressure on opponents and can lead to errors.

Our study has limitations. First, the success shot was not judged by quality but “in-or-out” of the court. This limits us to conduct further investigations on which shots are effective in winning/losing. The pickleball matches are filmed with a single, wide-angle camera. This limits the ability to analyze from different perspectives or zoom in on minute details. Our study may not capture the whole potential complexity of Ben's subtle strategies. And a few shots may be categorized into wrong categories. Analyzing Ben Johns' preferred shots is a valuable tool, but it should be one piece of a larger puzzle. All aspects of the game, from shot variety, footwork, strategy, and mental toughness are crucial to analyze pickleball. The results of this study, while valuable, would be significantly strengthened by incorporating data from other players. This would allow for broader comparisons and more reliable conclusions.