Physical demands of tennis across the different court surfaces, performance levels, and sexes: a systematic review with meta-analysis Sports Medicine

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Supplementary File 6. Stroke Counts 6.1 Strokes per Match - Total (#)

6.1 Strokes per Match - Total (#)		Study re	esults		Study cond	litions			Meta-analysis	
Group Men International Hard (best-of-5-sets)	Author (Year) Whiteside and Reid (2017)	Mean	SD 507.1	N (Matches) 49	Surface	Sex Men	Playing Level International	Comment Australian Open 2012-2016 Cumulative 4 rounds		Reason for exclusion from MA Cumulative 4 rounds, only one study
Men International Hard (best-of-3-sets)	Filipcic et al. (2021) Stare et al. (2015)		199.7 NR	4 5	Hard Hard	Men Men	International	ITF Men's World Tennis Tournament ATP (18.3)	No	Only two studies for analysis SD missing, only two studies for analysis
Junior Men National Hard (best-of-3-sets)	Filipcic et al. (2021) Stare et al. (2015)	1327.3 768.7	425.5 NR	6	Hard Hard	Men Men	National National	National Championships (13.9 y) Juniors (15.6 y)	No	Only two studies for analysis SD missing, only two studies for analysis
Women International Hard Junior Women National Hard	Whiteside and Reid (2017) Stare et al. (2015)		205.5	61 5	Hard	Women Women	International National	Australian Open 2012-2016 Cumulative 4 rounds Juniors (14.1)	No	Only one study for analysis SD missing, only one study for analysis
Notes: NR = Not Reported										
6.2 Serves per Match (#) Group	Author (Year)	Study re			Study cond	litions			Meta-analysis	
	Kovalchik and Reid (2017)	Mean 134^	SD NR	N (Matches) 21	Hard	Sex Men	Playing Level International	Comment Australian Open 2012-2017	Included in MA No	Reason for exclusion from MA SD missing
Men International Hard (best-of-5-sets)	Myers et al. (2016) Whiteside and Reid (2017)	157 433	NR 78	NR 49	Hard Hard	Men Men	International International	US Open 2013 - 2014 Australian Open 2012-2016 Cumulative 4 rounds - 1st serves	No No	SD and nr of matches missing Cumulative 4 rounds
Junior Men International Hard (best-of-3-sets)	Whiteside and Reid (2017) Kovalchik and Reid (2017)	154 72^	33 NR	49 12	Hard Hard	Men Men	International	Australian Open 2012-2016 Cumulative 4 rounds - 2nd serves Australian Open 2012-2017 - juniors	No No	Cumulative 4 rounds SD missing
Junior Men International Clay (best-of-3-sets)	Myers et al. (2016) Kovalchik and Reid (2017)	94 75^	NR NR	NR 21	Clay Hard	Men Women	International	Orange Bowl 2014 Australian Open 2012-2017	No No	SD and nr of matches missing SD missing
Women International Hard	Myers et al. (2016) Whiteside and Reid (2017)	96 278	NR 48	NR 64	Hard	Women Women	International	US Open 2013 - 2014 Australian Open 2012-2016 Cumulative 4 rounds - 1st serves	No	SD and nr of matches missing Cumulative 4 rounds
Junior Women International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Kovalchik and Reid (2017)	99 64^	19 NR	64 6	Hard	Women	International	Australian Open 2012-2016 Cumulative 4 rounds - 2nd serves Australian Open 2012-2016 Cumulative 4 rounds - 2nd serves Australian Open 2012-2017 - juniors	No	Cumulative 4 rounds SD missing
Junior Women International Clay Notes: ^Median, NR = Not Reported	Myers et al. (2016)	86	NR	NR	Clay	Women	International	Orange Bowl 2014	No	SD and nr of matches missing
6.3 Forehands per Match (#) Group	Author (Year)	Study re		N (Matches)	Study cond	litions Sex	Playing Level		Meta-analysis	
Men International Hard (best-of-5-sets)	Kovalchik and Reid (2017)	Mean 237^	SD NR	21	Hard	Men	International	Comment Australian Open 2012-2017	No	Reason for exclusion from MA Only one study for analysis
	Whiteside and Reid (2017) Whiteside and Reid (2017)	203 631	44 196	49 49	Hard Hard	Men Men	International	Australian Open 2012-2016 Cumulative 4 rounds - forehand returns Australian Open 2012-2016 Cumulative 4 rounds - forehand groundstrokes	No No	Cumulative 4 rounds Cumulative 4 rounds
Junior Men International Hard (best-of-3-sets)	Kovalchik and Reid (2017) Kovalchik and Reid (2017)	140^ 120^	NR	12 21	Hard	Men Women	International	Australian Open 2012-2017 - juniors Australian Open 2012-2017	No	Juniors, only one study for analysis Only one study for analysis
Women International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017)	145 412	27 99	64 64	Hard Hard	Men Men	International International	Australian Open 2012-2016 Cumulative 4 rounds - forehand returns Australian Open 2012-2016 Cumulative 4 rounds - forehand groundstrokes	No No	Cumulative 4 rounds Cumulative 4 rounds
Junior Women International Hard Notes: ^Median, NR = Not Reported	Kovalchik and Reid (2017)	118^	NR	6	Hard	Women	International	Australian Open 2012-2017 - juniors	No	Only one study for analysis
6.4 Backhands per Match (#)										
Group	Author (Year)	Study re Mean	SD	N (Matches)		Sex	Playing Level	Comment		Reason for exclusion from MA
Men International Hard (best-of-5-sets)	Kovalchik and Reid (2017) Whiteside and Reid (2017)	219^ 271	NR 28	21 49	Hard Hard	Men Men	International International	Australian Open 2012-2017 Australian Open 2012-2016 Cumulative 4 rounds - backhand returns	No No	Only one study for analysis Cumulative 4 rounds
Junior Men International Hard (best-of-3-sets)	Whiteside and Reid (2017) Kovalchik and Reid (2017)	516 119^	196 NR	49 12	Hard Hard	Men Men	International	Australian Open 2012-2016 Cumulative 4 rounds - backhand groundstrokes Australian Open 2012-2017 - juniors	No No	Cumulative 4 rounds Juniors, only one study for analysis
Women International Hard	Kovalchik and Reid (2017) Whiteside and Reid (2017)	110^ 164	NR 38	21 64	Hard Hard	Women Men	International International	Australian Open 2012-2017 Australian Open 2012-2017 Australian Open 2012-2016 Cumulative 4 rounds - backhand returns	No	Only one study for analysis Cumulative 4 rounds
Junior Women International Hard	Whiteside and Reid (2017) Kovalchik and Reid (2017)	359	67 NR	64	Hard	Men Women	International	Australian Open 2012-2016 Cumulative 4 rounds - backhand groundstrokes Australian Open 2012-2017 - juniors	No	Cumulative 4 rounds Only one study for analysis
Notes: ^Median, NR = Not Reported	Advantance and Rela (2017)									,
6.5 Foreband Volleys per Match /#\										
6.5 Forehand Volleys per Match (#) Group	Author (Year)	Study re	esults SD	N (Matalar	Study cond	litions Sex	Playing I and	Comment	Meta-analysis	Dancan far avelusion from MA
Men International Hard (best-of-5-sets) Women International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017)	Mean 29.83 16.48	10.05 5.36	N (Matches) 49 64	Hard	Men Men	Playing Level International	Comment Australian Open 2012-2016 Cumulative 4 rounds - forehand volleys	No	Reason for exclusion from MA Cumulative 4 rounds
Women International Hard	Whiteside and Reid (2017)	10.48	5.30	64	Hard	Men	International	Australian Open 2012-2016 Cumulative 4 rounds - forehand volleys	No	Cumulative 4 rounds
6.6 Backhand Volleys per Match (#)										
Group	Author (Year)	Study re Mean	SD	N (Matches)		Sex	Playing Level	Comment	Meta-analysis Included in MA	Reason for exclusion from MA
Men International Hard (best-of-5-sets) Women International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017)	28.39 14.05	11.38 6.62	49 64	Hard	Men Men	International International	Australian Open 2012-2016 Cumulative 4 rounds - backhand volleys Australian Open 2012-2016 Cumulative 4 rounds - backhand volleys	No	Cumulative 4 rounds Cumulative 4 rounds
	Author (Vess)	Study re	esults		Study cond	litions			Meta-analysis	
6.7 Overheads per Match (#) Group Men International Hard (best-of-5-sets)	Author (Year) Whiteside and Reid (2017)	Study re Mean 15.72	esults SD 6.08	N (Matches)		litions Sex Men	Playing Level	Comment Australian Open 2012-2016 Cumulative 4 rounds - overhead smashes	Meta-analysis Included in MA	Reason for exclusion from MA Cumulative 4 rounds
Group Men International Hard (best-of-5-sets)	Author (Year) Whiteside and Reid (2017) Whiteside and Reid (2017)	Mean	SD		Surface	Sex		Comment Australian Open 2012-2016 Cumulative 4 rounds - overhead smashes Australian Open 2012-2016 Cumulative 4 rounds - overhead smashes	Included in MA	Reason for exclusion from MA Cumulative 4 rounds Cumulative 4 rounds
Group Men International Hard (best-of-5-sets) Women International Hard	Whiteside and Reid (2017)	Mean 15.72	SD 6.08	49	Surface Hard	Sex Men	International	Australian Open 2012-2016 Cumulative 4 rounds - overhead smashes	Included in MA No	Cumulative 4 rounds
Group Men International Hard (best-of-5-sets) Women International Hard	Whiteside and Reid (2017)	Mean 15.72 8.95 Study re	SD 6.08 5.18 esults	49 64	Surface Hard Hard Study cond	Sex Men Men	International International	Australian Open 2012-2016 Cumulative 4 rounds - overhead smashes Australian Open 2012-2016 Cumulative 4 rounds - overhead smashes	Included in MA No No Meta-analysis	Cumulative 4 rounds Cumulative 4 rounds
Group Men International Hard (best-of-5-sets) Women International Hard 6.8 Serves per Set (#) Group Men International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016)	Mean 15.72 8.95 Study re Mean 43	SD 6.08 5.18 esults SD 8	49 64 N (Matches)	Surface Hard Hard Study cond Surface Hard	Sex Men Men litions Sex Men	International International Playing Level International	Australian Ogen 2012-2012 Cumulative 4 rounds - overhead smahes Australian Ogen 2012-2016 Cumulative 4 rounds - overhead smahes Comment US Ogen 2013 - 2014	Included in MA No No Meta-analysis Included in MA No	Cumulative 4 rounds Cumulative 4 rounds Reason for exclusion from MA Nr of matches missing, only one study for analysis
Group Mon International Hard (best-of-5-sets) Women International Hard 6.8 Serves per Set (#) Group Mon International Hard Junior Men International Hard Women International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Myers et al. (2016) Myers et al. (2016)	Mean 15.72 8.95 Study re Mean 43 40 42	SD 6.08 5.18 esults SD 8 8 8 7	49 64 N (Matches) NR NR NR	Surface Hard Hard Study cond Surface Hard Clay Hard	Sex Men Men Sex Men Men Women	International International Playing Level International National International	Australian Ogen 2012-2015 Cumulative 4 rounds - overhead smahes Australian Ogen 2012-2016 Cumulative 4 rounds - overhead smahes Comment US Ogen 2013 - 2014 Orange Bowl 2014 OS Ogen 2013 - 2014	Included in MA No No Meta-analysis Included in MA No No No	Comutative 4 rounds Comutative 4 rounds Reason for esclusion from MA Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis
Group Mer International Hard (best-of-S-sets) Women International Hard 6.8 Serves per Set (#) Group Men International Hard Women International Hard Women International Hard Women International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Myers et al. (2016)	Mean 15.72 8.95 Study re Mean 43 40	SD 6.08 5.18 esults SD 8 8 8	49 64 N (Matches) NR NR	Surface Hard Hard Study cond Surface Hard Clay	Sex Men Men litions Sex Men Men	International International Playing Level International National	Australian Open: 2012-2015 Cumulative 4 rounds - overhead smakes Australian Open: 2012-2016 Cumulative 4 rounds - overhead smakes Comment US Open: 2013-2014 Orange Bow 2014	Included in MA No No Meta-analysis Included in MA No	Cumulative 4 rounds Cumulative 4 rounds Reason for exclusion from MA. Nr of matche mixing, only one study for analysis Nr of matche mixing, only one study for analysis
Group Main International Hard (Sear of 5-sets) Women International Hard S.S.Sroves per Set (#) Group Main International Hard Women International Hard Women International Hard Women International Hard Notes: NR = Not Reported	Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Myers et al. (2016) Myers et al. (2016)	Mean 15.72 8.95 Study re Mean 43 40 42	SD 6.08 5.18 esults SD 8 8 8 7	49 64 N (Matches) NR NR NR	Surface Hard Hard Study cond Surface Hard Clay Hard	Sex Men Men Sex Men Men Women	International International Playing Level International National International	Australian Ogen 2012-2015 Cumulative 4 rounds - overhead smahes Australian Ogen 2012-2016 Cumulative 4 rounds - overhead smahes Comment US Ogen 2013 - 2014 Orange Bowl 2014 OS Ogen 2013 - 2014	Included in MA No No Meta-analysis Included in MA No No No	Comutative 4 rounds Comutative 4 rounds Reason for esclusion from MA Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis
Group Men International Hard (best-of 5-sets) Women International Hard 6.8 Serves per 5et (#) Group Men International Hard Jusior Men International Hard Women International Hard Notes: NR - Not Reported 6.9 Strokes per Game - Total (#)	Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Myers et al. (2016) Myers et al. (2016)	Mean 15.72 8.95 Study m 43 40 42 38 Study m	SD 6.08 6.08 5.18 5.18 8 8 8 7 8 8 8 9 8	49 64 N (Matches) NR NR NR NR NR	Surface Hard Hard Study cond Surface Hard Clay Hard Clay Study cond	Sex Men Men Sex Men Women Women	International International Playing Level International National National	Australian Ogen 2012-2015 Cumulative 4 rounds - overhead smahes Australian Ogen 2012-2016 Cumulative 4 rounds - overhead smahes Comment US Ogen 2013 - 2014 Orange Bowl 2014 OS Ogen 2013 - 2014	Included in MA No No Meta-analysis Included in MA No No No No No	Comutative 4 rounds Comutative 4 rounds Reason for esclusion from MA Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis
Group Men International Hard (best-of 5-sets) Women International Hard 6.8 Serves per 5et (#) Group Men International Hard Jusior Men International Hard Women International Hard Notes: NR - Not Reported 6.9 Strokes per Game - Total (#)	Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Author (Year) Johnson and McHugh (2006)	Mean 15.72 8.95 Study rr Mean 43 40 42 38 Study rr Mean 17.9	SD 6.08 6.08 5.18 5.18 5 essults 5 8 8 7 8 8 8 7 5 8 5 9 12.1	49 64 NR NR NR NR NR NR NR NR	Surface Hard Hard Study cond Surface Hard Clay Clay Study cond Surface Hard Hard Hard Hard Hard	Sex Men Men Sex Men Women Women Women	International International Playing Level International National National Playing Level International International	Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltes Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltes Comment US Open 2013-2014 Orange Bowl 2014 US Open 2013-2014 Orange Bowl 2014 Comment US Open 2023 - structure game	Included in MA No No Meta-analysis Included in MA No No No No No No No No No No	Comulative 4 rounds Comulative 4 rounds Reason for exclusion from MA Nr of antiches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Reason for exclusion from MA. Only two studies for analysis, rr of matches missing
Group Men International Hard (best-of-5-uets) Women International Hard 6.3 Serves per Set (#) Group Men International Hard Momen International Hard Momen International Hard Momen International Hard Notes: NR - Not Reported 6.9 Strokes per Game - Total (#) Group	Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Myers et al. (2016) Idenson and McHugh (2006) Johnson and McHugh (2006) Whiteside and Reid (2017)	Mean 15.72 8.95 Study m Mean 43 40 42 38 Study m Mean 17.9 12.2 15.0	SD 6.08 5.18 esults SD 8 8 8 8 7 8 8 8 8 8 9 7 8 8 9 12.1 10.0 3.1	49 64 NR NR NR NR NR NR NR NR 13	Surface Hard Hard Study cond Surface Hard Clay Hard Clay Study cond Surface Hard Hard Hard Hard	Sex Men	International International Playing Level International National Playing Level International International International International International	Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltee Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltes Comment US Open 2013 - 2014 Orange Bowl 2014 US Open 2013 - 2014 Orange Bowl 2014 Comment US Open 2013 - service game US Open 2013 - service game US Open 2013 - round game US Open 2013 - service game US Open 2013 - round game	Included in MA No No Meta-analysis Included in MA No No Meta-analysis Included in MA No No No No No	Canulative 4 rounds Canulative 4 rounds Reason for exclusion from MA Wr of matches mixing, only one study for analysis Wr of matches mixing, only one study for analysis
Group Men International Hard (best-of-5-uets) Wenne International Hard 64.8 Serves per Set (#) Group Men International Hard Women International Hard Women International Hard Notes: NR = Not Reported 64.9 Stroles per Game - Tetal (#)	Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Myers et al. (2016) Myers et al. (2016) Author (Year) Johnson and Metsugh (2006) Johnson and Metsugh (2006)	Mean 15.72 8.95 Study rr Mean 43 40 42 38 Study rr Mean 17.9 12.2	SD 6.08 5.18 5.18 5.18 5.0 8 8 7 8 8 7 8 8 8 7 8 8 12.1 10.0 12.1 10.0 <	49 64 NR NR NR NR NR NR NR NR NR	Surface Hard Hard Study cond Surface Hard Clay Hard Clay Study cond Surface Hard Hard	Sex Men Men Sex Men Women Women Women Women Men Men	International International International Playing Level International National National Playing Level International International	Australian Ogen 2012-2012 Cumulative 4 rounds - overhead smahes Australian Ogen 2012-2016 Cumulative 4 rounds - overhead smahes Comment US Ogen 2013-2014 Orange Bowl 2014 Orange Bowl 2014 Orange Bowl 2014 Orange Bowl 2014 Orange Bowl 2014	Included in MA No No Meta-analysis Included in MA No No Meta-analysis Included in MA No No No	Candiate 4 rounds Candiate 4 rounds Candiate 4 rounds Reason for exclusion from MA Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Reason for exclusion from MA Only two studies for analysis, rof matches missing Only two studies for analysis, rof matches missing
Group Men international Hard (best-of-5-vets) Women International Hard E4.Sorves per Set (#) Group Men International Hard Women International Hard Women International Hard Sets: NR = Not Reported E5.Strokes per Game - Total (#) Group Men International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Myers et al. (2016) Myers et al. (2016) Myers et al. (2016) Author (Year) Johnson and MeHugh (2026) Johnson and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017)	Mean 15.72 8.95 Study re Mean 43 40 42 38 Study re Mean 17.9 12.2 15.0 15.5 17.4 18.7	SD 6.08 5.18 esults SD 8 8 8 7 8 8 8 8 7 8 8 9 12.1 10.0 3.1 3.3	49 64 NR NR NR NR NR NR NR NR 13 13	Surface Hard Hard Study cond Surface Hard Clay Clay Study cond Surface Hard Hard Hard Hard	Sex Men Men ittions Sex Men Women Women Women Men Men Men Men Men	International International International Playing Level International International National Playing Level International International International International International	Australian Ogen 2012-2012 Cumulative 4 rounds - overhead smahes Australian Ogen 2012-2016 Cumulative 4 rounds - overhead smahes Comment US Ogen 2013-2016 Cumulative 4 rounds - overhead smahes Orange Bowl 2014 Orange Bowl 2014 Orange Bowl 2014 Orange Bowl 2014 Orange Bowl 2014 Orange Bowl 2014 Orange Towl 2014 O	Included in MA No No Meta-analysis Included in MA No No Meta-analysis Included in MA No No No No No No No No No	Candiative 4 rounds Candiative 4 rounds Candiative 4 rounds Reason for exclusion from MA Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Nr of matches missing, only one study for analysis Reason for exclusion from MA Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches missing Only two studies for analysis, it of matches
Group Men International Hard (Best-of-S-test) Women International Hard S.8.5 Serves per Sct (#) Group Men International Hard Women International Hard Women International Hard Women International Hard Scts: NR - Not Reported S.9.Srokes per Game - Total (#) Group Men International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Myers et al. (2016) Lohnson and Meitugh (2026) Uhiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Uhiteside and Reid (2017) Uhiteside and Reid (2017) Uhiteside and Reid (2017)	Mean 15.72 8.95 Study m Mean 43 40 42 38 Study m Mean 17.9 12.9 15.0 15.5 17.4 18.7 21.0 14.8	SD 6.08 6.08 5.18 SD 8 8 7 8 7 8 7 8 10.0 3.1 3.3 3.7 4.4 10.2 9.2	49 64 NR NR NR NR NR NR 13 13 13 10 NR NR	Surface Hard Hard Study cond Surface Hard Clay Hard Clay Study cond Surface Hard Hard Hard Hard Hard Hard Hard Grass Grass	Sex Men Men Men Sex Mones Sex Men Sex Men	International International International Playing Level International National Playing Level International International International International International International	Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltee Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltes Comment US Open 2013-2014 Orange Bowl 2014 US Open 2013-2014 Orange Bowl 2014 US Open 2013-2014 Orange Bowl 2014 US Open 2013-2014 Orange Bowl 2014 Substance Development Substance Development Substance Development Australian Open 2012-2016-14 round Australian Open 2012-2016-14 round Bolind Girros 2003 - return game	Included in MA No No Meta-analysis Included in MA No No Meta-analysis Included in MA No No No No No No No No No No No No No	Comulates 4 rounds Comulative 4 rounds Comulative 4 rounds Reason for exclusion from MA. Nor of matches missing, only one study for analysis Nor of matches missing, only one study for analysis Nor of matches missing, only one study for analysis Nor of matches missing, only one study for analysis Reason for exclusion from MA. Only two studies for analysis, nr of matches missing Only two studies for analysis, or of matches missing Only two studies for analysis, on of matches missing Only two studies for analysis, on of matches missing Only two studies for analysis, on of matches missing Only two studies for analysis, on of matches missing Only two studies for analysis, on of matches missing Only two studies for analysis Nomber of matches missing Number of matches missing
Group Main International Hard (best-of-5-tests) Women International Hard 5.8 Serves per Set (#) Group Main International Hard Women International Hard Women International Hard Women International Hard Serves per Gene - Total (#) Group Mein International Hard Mein International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Where st al. (2016) Where st al. (2016) Where st al. (2016) Myers et al. (2017) Whiteside and Methygh (2006) Johnson and Methygh (2006)	Mean 15.72 8.95 Study m Mean 43 40 42 38 Study m Mean 17.7 12.2 15.0 15.5 17.4 18.7 21.0 14.8 16.0 10.4	SD 6.08 5.18 5.18 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	49 64 NR NR NR NR NR NR NR 13 13 13 10 NR NR NR NR NR NR NR	Surface Hard Hard Study cond Surface Hard Clay Clay Hard Clay Study cond Surface Hard Hard Hard Hard Hard Hard Hard Hard	Sex Men Men Men Men Sex Men	International International International International National National National National National National National National National National National National International International International International International International International	Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltee Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltes Comment US Open 2013-2014 Orange Bowl 2014 US Open 2013-2014 Orange Bowl 2014 US Open 2013-2014 Orange Bowl 2014 US Open 2013-smoke game US Open 2013-smoke game US Open 2013-smoke game US Open 2013-smoke game Australian Open 2012-2016- 14 round Australian Open 2012-2016- 34 round Australian Open 2012-2016-34 round	Included in MA No No Meta-analysis Included in MA No No No No No No No No No No No No No	Constative 4 rounds Constative 4 rounds Constative 4 rounds Reason for exclusion from MA Nor of matchen missing, only, one study for analysis Nor of matchen missing, only, one study for analysis Nor of matchen missing, only, one study for analysis Nor of matchen missing, only, one study for analysis Nor of matchen missing, only, one study for analysis Only two studies for analysis, nr of matchen missing Only two studies for analysis, or of matchen missing Only two studies for analysis, Only two studies for analysis Nomber of matchen missing Number of matchen missing
Group Men International Hard (Best-of-S-test) Women International Hard S.8.5 Serves per Sct (#) Group Men International Hard Women International Hard Women International Hard Women International Hard Scts: NR - Not Reported S.9.Srokes per Game - Total (#) Group Men International Hard	Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Author (Year) Author (Year) Myers et al. (2016) Myers et al. (2017) Whiteside and Reid (2017)	Mean 15,72 8,95 Study rr Mean 43 40 42 38 Mean 17,9 12,2 15,0 15,5 17,4 18,7 21,0 14,8 160 10,4 17,7 18,2	SD 6.08 6.08 5.18 5.18 5.18 SD 8 7 8 7 8 7 10.0 3.1 3.3 3.7 4.4 9.2 9.2 6.0 3.1 3.7 4.7	49 64 NR NR NR NR NR NR NR NR 13 13 13 13 13 13 13 13 13 13 13 13 13	Surface Hard Hard Study cond Surface Hard Clay Clay Hard Clay Study cond Surface Hard Hard Hard Hard Hard Hard Hard Hard	Sex Men	International International	Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltee Australian Open 2012-2015 Cumulative 4 rounds - overhead smaltes Comment US Open 2013-2014 Orange Bowl 2014 US Open 2013-2014 US Open 2013-2014 Orange Bowl 2014 Comment US Open 2013-2014 Australian Open 2012-2016 - 141 round Australian Open 2012-2016 - 141 round	Included in MA No No No No Meta-analysis Included in MA No	Consultate 4 rounds Consultative 4 rounds Consultative 4 rounds Reason for exclusion from MA Nor of matchen missing, only one study for analysis Nor of matchen missing, only one study for analysis Nor of matchen missing, only one study for analysis Nor of matchen missing, only one study for analysis Consultation of the study of the study for analysis Consultation of the study of the study for analysis Consultation of the study of the study of the study for analysis Consultation of the study of
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Notes: NR = Not Reported

Carboch et al. (2020)

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Men International Grass

Clay Men

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International

International International

Wimbledon 2003-2004 Wimbledon 2017 - New Balls Wimbledon 2017 - Used Ball

No

Yes

Subgroup analysis (Carboch et al 2019) Subgroup analysis (Carboch et al 2019)

6.13 Forehand Gr Author (Year)
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 No
 Nr of matches missing
 Mean SD 4.3 4.3 Sex Mer Comment US Open 2003 - service game - topspir Johnson and McHugh (2006) Johnson and McHugh (2006) Johnson and McHugh (2006) Johnson and McHugh (2006) Reid et al. (2016) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) US Open 2003 - service game - topspin US Open 2003 - service game - slice US Open 2003 - return game - topspin US Open 2003 - return game - topspin US Open 2003 - return game - slice Australian Open 2012-2016 Australian Open 2012-2016 - 1arl round Australian Open 2012-2016 - Jarl round 0.3 3.8 Men Men Men Men Men Men Nr of matches n Nr of matches n 0.1 3.2 Nr of matches missing Only one study for analysis Subgroup analysis and overlapping data (field et al 2016) Subgroup analysis and overlapping data (field et al 2016) Subgroup analysis and overlapping data (field et al 2016) Subgroup analysis and overlapping data (field et al 2016) Nr of matches missing Nr of matches missing Nr of matches missing Nr of matches missing No No No Men International Hard Whiteside and keid (2017) Whiteside and keid (2017) Johnson and McHugh (2006) Johnson and McHugh (2006) Johnson and McHugh (2006) Hard Clay Clay Clay Men Men Men Men International International International International Australian Open 2012-2016 - 3rd round Australian Open 2012-2016 - 4th round Roland Garros 2003 - service game - topspin Roland Garros 2003 - service game - slice Roland Garros 2003 - return game - topspin Roland Garros 2003 - service game - topspin Roland Garros 2003 - service game - topspin Roland Garros 2003 - service game - topspin 6.0 0.4 3.2 4.2 1.3 3.8 NR NR NR Men International Clay Johnson and McHugh (2006 Inhnson and McHugh (2006 NR NR NR Clay Grass nternationa Johnson and McHugh (2006) Johnson and McHugh (2006) Men International Grass 0.1 2.0 0.3 2.2 Grass Roland Garros 2003 - service game Roland Garros 2003 - return game Nr of matches miss Nr of matches miss N of matches missing N of matches missing Only one study for analysis Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Johnson and McHugh (2006) Johnson and McHugh (2006) Reid et al. (2016) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Grass Hard Men International Roland Garros 2003 - return game - slice Australian Open 2012-2014 0.1 5.2 4.6 4.8 5.1 0.4 1.8 1.6 2.0 1.9 NR 82 16 16 International International International Australian Open 2012-2014 Australian Open 2012-2016 - 1st round Australian Open 2012-2016 - 2nd round Australian Open 2012-2016 - 3rd round Hard Hard Hard No hiteside and Reid (2017) Australian Open 2012-2016 - 4th round International es: NR = Not Rep 6.14 Forehand Returns per G Study result Study co Meta-an Author (Year)
 Study results

 Mean
 SD

 2.2
 0.6

 2.9
 0.8

 2.8
 0.8

 3.0
 0.7

 3.1
 0.8
 Playing Level International International International International International Comment Australian Open 2012-2014 Australian Open 2012-2016 - 1st round Australian Open 2012-2016 - 2nd round Australian Open 2012-2016 - 3rd round Australian Open 2012-2016 - 3rd round Australian Open 2012-2016 - 1st round Australian Open 2012-2016 - 2nd round Australian Open 2012-2016 - 2nd round Australian Open 2012-2016 - 2nd round N (Matches) Surface 88 Hard 13 Hard 13 Hard 13 Hard Sex Men Men Men Men
 Meta-analysis
 Included in MA
 Reason for exclusion from MA

 No
 Only one study for analysis
 Subgroup analysis and overlapping data (Reid et al 2016)

 No
 Subgroup analysis and overlapping data (Reid et al 2016)
 Subgroup analysis and overlapping data (Reid et al 2016)

 No
 Subgroup analysis and overlapping data (Reid et al 2016)
 Subgroup analysis and overlapping data (Reid et al 2016)
 Author (Vear) Reid et al. (2016) Whiteside and Reid (2017) No No Men International Hard Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Only one study for analysis Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Men Women Women Hard Hard Hard Hard Hard 2.8 3.5 3.9 3.2 3.6 0.9 1.1 1.0 International International Women International Hard Australian Open 2012-2016 - 3rd rou Australian Open 2012-2016 - 4th rou Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) 6.15 Backhands per Game (#) Study co Comment US Open 2003 - service game - topspin US Open 2003 - service game - take US Open 2003 - return game - topspin US Open 2003 - return game - topspin Australian Open 2012-2016 - 14 round Australian Open 2012-2016 - 4th round Roland Garros 2003 - service game - tops Roland Garros 2003 - service game - tops Meta-analysis Included in MA. Resum for exclusion from MA. No Not di matches missing No Not di matches missing No Not di matches missing No Orby one study for analysis No Subgroup analysis and overluoping data [Reid et al 2016] No Subgroup analysis and overluoping data [Reid et al 2016] No Subgroup analysis and overluoping data [Reid et al 2016] No Subgroup analysis and overluoping data [Reid et al 2016] No Subgroup analysis and overluoping data [Reid et al 2016] No Subgroup analysis and overluoping data [Reid et al 2016] No No Art matches missing Author (Year) NR Hard NR Hard NR Hard NR Hard NR Hard 13 Hard 13 Hard 13 Hard Author (rear) Johnson and McHugh (2006) Johnson and McHugh (2006) Johnson and McHugh (2006) Reid et al. (2016) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Mean 3.4 SD 3.8 Sex Playing Level International International International International International International International International 0.5 2.5 0.9 4.1 3.0 3.1 3.6 Men Men Men Men Men Men 3.5 1.4 1.8 1.5 1.4 1.4 Men International Hard Whiteside and Reid (2017) Whiteside and Reid (2017) Johnson and McHugh (2006) Men nternationa nternationa Anatural Coster Cost 2 cure a write vehicles and a cure cost 2 cure a service pare - ticker Roland Garce 2000 - return garne - ticker Roland Garce 2000 - return garne - ticker Roland Garce 2000 - service garne - ticker Roland Garce 2000 - service garne - ticker Roland Garce 2000 - return garne - ticker Roland Garce 2000 - return garne - ticker Roland Garce 2000 - return garne - ticker Atartalian Open 2012-2016 - 141 round Australian Open 2012-2016 - 141 round Australian Open 2012-2016 - 341 round Australian Open 2012-2016 - 341 round Australian Open 2012-2016 - 441 round Nr of matches missing Internation Men International Clay 0.7 3.7 1.1 3.7 NR NR Clay Clay Men Men No No nternation 0.7 1.3 0.3 1.8 0.9 1.9 0.7 1.8 NR Grass Grass Men Men International No Men International Grass Johnson and McHugh (2006) Johnson and McHugh (2006) Reid et al. (2016) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) International International International International N of matches missing Only one study for analysis Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) 0.8 4.6 4.2 4.4 4.3 1.6 1.8 1.5 1.6 Hard Hard Hard Women Women Women No No No Women International Hard Subgroup analysis and overlapping data (Reid et al 2016) 4.8 Notes: NR = Not Reported 6.16 Backhand Returns per Game (#) Study condition Group Author (Year)
 Mean
 SD

 2.8
 0.6

 4.1
 1.0

 4.0
 1.0

 4.0
 0.7

 N (Matches)
 Surface

 88
 Hard

 13
 Hard

 13
 Hard

 13
 Hard

 13
 Hard

 13
 Hard
 Included in MA. Reason for exclusion from MA. Included in MA. Reason for exclusion from MA. No Subgroup analysis and overlapping data (Reid et al 2016) No Subgroup analysis and overlapping data (Reid et al 2016) No Subgroup analysis and overlapping data (Reid et al 2016) Playing Level International Comment Australian Open 2012-2014 Sex Men Reid et al. (2016) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Australian Open 2012-2014 Australian Open 2012-2016 - 1st round Australian Open 2012-2016 - 2nd round Australian Open 2012-2016 - 3rd round Men Men Men International International Men International Hard Whiteside and Reid (2017) Reid et al. (2016) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) 0.9 0.8 1.2 1.0 1.0 Australian Open 2012-2016 - 4th round Australian Open 2012-2014 Subgroup analysis and overlapping data (Reid et al 2016) Dnly one study for analysis Men Womer Internationa Internationa 3.8 2.9 4.3 3.9 Hard Only one study for analysis Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Subgroup analysis and overlapping data (Reid et al 2016) Internatio Internatio Australian Open 2012-2014 Australian Open 2012-2016 - 1st round Australian Open 2012-2016 - 2nd round Australian Open 2012-2016 - 3rd round 13 13 13 Hard Hard Australian Open 2012-2016 - 4th round iteside and Reid (2017) 1.2 6.17 Overhead Smashes per Game (#) Group Study result Meta-analysis Included in MA Reason for exclusion from MA Author (Year) N (Matches) Surface
 Study results

 Mean
 SD

 0.08
 0.08

 0.10
 0.06

 0.13
 0.09

 0.13
 0.09

 0.07
 0.06

 0.09
 0.11

 0.12
 0.09

 0.14
 0.12
 Playing Level International International International Comment Australian Open 2012-2016 - 1st round - backhand groundstroke Australian Open 2012-2016 - 2nd round - backhand groundstroke Australian Open 2012-2016 - 3rd round - backhand groundstroke Whiteside and Reid (2017) Sex Mer Only one study for analysis Men Men national Hard No No Australian Open 2012-2016 - 3rd round - backhand groundstrok Australian Open 2012-2016 - 4th round - backhand groundstrok Australian Open 2012-2016 - 1st round - forehand groundstrok Australian Open 2012-2016 - 2nd round - forehand groundstrok International International International Hard Hard Hard Hard Women International Hard hiteside and Reid (2017) hiteside and Reid (2017) Australian Open 2012-2016 - 3rd round - foreh Australian Open 2012-2016 - 4th round - backt 6.18 Forehand Volleys per Game (#) Study (Mean 0.20 0.04 0.16 0.20 0.27 Study co Author (Year) Meta-analysis Included in MA Reason for exclusion from MA Group SD 0.40 0.20 0.08 0.08 0.13 0.12 Sex Men Men Men Men Men Playing Level International International International International International International Comment US Open 2003 - retrive game Australia Open 2012 - 2016 - 114 Australia Open 2012 - 2016 - 114 Australia Open 2012 - 2016 - 2014 cound - backhand groundstroke Australian Open 2012 - 2016 - 2014 cound - backhand groundstroke Roland Garos 2003 - service game N (Matches) Surface NR Hard NR Hard 13 Hard 13 Hard 13 Hard Author (Year) Johnson and McHugh (2000 Johnson and McHugh (2000 Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Johnson and McHugh (2000 Johnson and McHugh (2000 Johnson and McHugh (2000 Number of matches missing Number of matches missing Only two studies for analysi Only two studies for analysi Only two studies for analysi No No No Only two studies for analysis Only two studies for analysis Number of matches missing Number of matches missing 0.20 Roland Garros 2003 - service gam Roland Garros 2003 - return gam Roland Garros 2003 - service marros Men International Clay 0.40 0.09 Men International Grass Johnson and McHugh (200 Johnson and McHugh (200 Whiteside and Reid (2017) 0.60 0.09 0.21 0.16 0.22 0.21 0.30 0.13 0.12 0.11 0.10 Roland Garro Su03 - service game Roland Garro Su03 - return game Australian Open 2012-2016 - 1st round - forehand groundstroke Australian Open 2012-2016 - 2nd round - forehand groundstroke Australian Open 2012-2016 - 4th round - backhand return Number of matches missing Number of matches missing Only one study for analysis Only one study for analysis Only one study for analysis Grass Hard Hard Hard Hard Men International International International International International Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Nomen International Hard Only one study for analy Only one study for analy 6.19 Backhand Volleys per Game (#) Study co Author (Year) Study results Meta-anal
 Study results

 Mean
 SD

 0.30
 0.70

 0.09
 0.30

 0.18
 0.09

 0.18
 0.10

 0.21
 0.09
 Comment US Open 2003 - service game US Open 2003 - revice game US Open 2003 - revice game Australian Open 2012-2016 - Jar cound - backhand groundstroke Australian Open 2012-2016 - Ser cound - backhand groundstroke Australian Open 2012-2016 - Ser cound - backhand groundstroke Australian Open 2012-2016 - Ser cound - backhand groundstroke Australian Open 2012-2016 - Hir cound - backhand groundstroke N (Matches) Surface NR Hard NR Hard 13 Hard 13 Hard 13 Hard Playing Level International International International International Included in MA Reason for exclusion from MA No. Number of matches missing Johnson and McHugh (2000 Johnson and McHugh (2000 Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) Johnson and McHugh (2000 Sex Men Men Men Men Men Number of matches missing Number of matches missing Only two studies for analysis Only two studies for analysis Only two studies for analysis No No No No ational Hard International Only two studies for analys 0.22 0.16 Men Hard No Men International Clay Johnson and McHugh (2006 Johnson and McHugh (2006 Johnson and McHugh (2006 0.07 0.30 NR 0.90 1.50 NR Clay Clay Grass Men International Roland Garros 2003 - service game Roland Garros 2003 - return game Roland Garros 2003 - service game Number of matches missi Number of matches missi No Men International Grass Johnson and McHugh (2006 Johnson and McHugh (2006 Whiteside and Reid (2017) Whiteside and Reid (2017) Whiteside and Reid (2017) 0.10 0.15 0.14 0.20 0.19 0.50 0.09 0.12 0.16 Grass Hard Hard Hard Internationa Internationa Internationa Nalani Gardo 2003 - server gaine Raland Gardo 2013 - setur gane Australian Open 2012-2016 - 1st round - forehand groundstroke Australian Open 2012-2016 - 2nd round - forehand groundstroke Australian Open 2012-2016 - 4th round - backhand return Number of matches missing Only one study for analysis Only one study for analysis Only one study for analysis Men Women Women No No No Women International Hard Whiteside and Reid (2017) Only one study for analy International Notes: NR = Not Rep 6.20 Strokes per Rally (#) Study c Study result Meta-analy Author (Year) Sex Men Men Men Men Group
 Study results

 Mean
 SD

 4.9
 0.5

 3.4
 0.3

 4.7
 1.4

 5.0^n
 NR

 3.0
 NR
 Playing Level International International International International International
 Comment

 Australian Open 2017

 ITF Men's World Tennis Tournament

 ATP (21.4)

 Australian Open 2012-2017

 ATP (18.3)

 Created Fam
 Meta-analysis Included in MA Reason for exclusion from MA Yes Yes Yes Yes Yes N (Matches) Surface 7 Hard 4 Hard 17 Hard 21 Hard Carboch et al. (2019) Filipcic et al. (2021) Hornery et al. (2007) Kovalchik and Reid (2017) Stare et al. (2015) ATP (16.3) Grand Slem Australian Open 2017 Australian Open 2017 - New Balls Australian Open 2017 - Used Balls Australian Open 2012: 2014 Top ranked 1st serve Australian Open 2012: 2014 Top ranked 1st serve Australian Open 2012: 2014 Top ranked 2nd serve Duplicate data (Carboch et al 2019) Subgroup analysis (Carboch et al 2019) Subgroup analysis (Carboch et al 2019) Subgroup analysis (Reid et al 2016) Subgroup analysis (Reid et al 2016) Subgroup analysis (Reid et al 2016) Takahashi et al. (2006) 3.8 Hard Men International Yes 4.5 4.9 4.4 5.0 3.7 4.0 5.5 Men International Hard International International International International International Carboch et al. (2018) Carboch et al. (2020) Carboch et al. (2020) Whiteside et al. (2015) Whiteside et al. (2015) Whiteside et al. (2015) 0.5 0.6 0.7 1.0 1.2 1.2 Hard Hard Hard Hard Hard Men Men Men Men Men No No No No /hiteside et al. (2015) /hiteside et al. (2015) arboch et al. (2019) ornery et al. (2007) fendez-Villanueva et International International Australian Open 2012-2014 Lower ranked 2nd serve Roland Garros 2017 Subgroup analysis (Reid et al 2016) Han Roland Garros 2017 ATP (21.4 y) ATP (27 y) Roland Garros 2003-2004 Roland Garros 2017 - New Balls Roland Garros 2017 - Used Balls Wimbledon 2017 Clay Clay Clay 4.5 2.7 2.0 2.2 Internatio Internatio nal Clav Takahashi et al. (2006) Carboch et al. (2020) Clay Internation 4.4 1.4 0.7 Subgroup analysis (Carboch et al 2019) Subgroup analysis (Carboch et al 2019)

An International - Court surface NR	Yusoff & Krasilshchikov (2021)	6.1	45	7	NR	Men	International	International tennis tournaments semi-finals and finals 2016 - 2017	No	Only one study for analysis
nior Men International Hard	Kovalchik and Reid (2017)	4.8^	NR	12	Hard	Men	International	Australian Open 2012-2017 - juniors	No	Only one study for analysis Only one study for analysis, international juniors
		6.1	4.4	12	NR	Men	International			
nior Men International - Court surface NR	Yusoff & Krasilshchikov (2021)			/				International tennis tournaments semi-finals and finals 2016 - 2017	No	Only one study for analysis
lunior Men National Hard	Filipcic et al. (2021)	4.7	1.8	6	Hard	Men	National	National Championships (13.9 y)	Yes	
	Gallo-Salazar et al. (2019)	2.9	0.4	12	Hard	Men	National	Juniors (14.5 y) Morning	Yes	
	Gallo-Salazar et al. (2019)	2.9	0.3	12	Hard	Men	National	Juniors (14.5 y) Afternoon	Yes	
	Kilit and Arslan (2018)	5.2	4.1	13	Hard	Men	National	Juniors (13 y)	Yes	
	Stare et al. (2015)	5.3	NR	6	Hard	Men	National	Juniors (13.8 y)	Yes	
	Torres-Luque et al. (2011)	5.9	0.1	8	Hard	Men	National	Juniors (15.6 y)	Yes	
lunior Men National Clay	Kilit and Arslan (2017)	5.7	4.2	14	Clay	Men	National	Juniors (12.2 y)	Yes	
nor men nacional enty	Kilit and Arslan (2018)	7.1	3.9	13	Clay	Men	National	Juniors (13 y)	Yes	
Women International Hard	Carboch et al. (2018)	4.5	0.7	23	Hard	Women	International	Australian Open 2017	Yes	
	Fernandez-Fernandez et al. (2007)	2.8	1.7	7	Hard	Women	International	WTA (17.3 y)	Yes	
	Kovalchik and Reid (2017)	4.6^	NR	21	Hard	Women	International	Australian Open 2012-2017	Yes	
	Carboch and Plachá (2018)	4.7	0.2	16	Hard	Women	International	Australian Open 2017 - 1st - 4th round	No	Subgroup analysis (Carboch et al 2018)
	Carboch and Plachá (2018)	4.0	0.4	7	Hard	Women	International	Australian Open 2017 - QF - Finals	No	Subgroup analysis (Carboch et al 2018)
	Carboch et al. (2020)	4.2	0.9	23	Hard	Women	International	Australian Open 2017 - New balls	No	Subgroup analysis (Carboch et al 2018)
	Carboch et al. (2020)	4.6	1.1	23	Hard	Women	International	Australian Open 2017 - Used balls	No	Subgroup analysis (Carboch et al 2018)
nior Women International Hard	Kovalchik and Reid (2017)	4.4^	NR	6	Hard	Women	International	Australian Open 2012-2017 - juniors	No	Junior international
omen International Clay	Fernandez-Fernandez et al. (2008)	2.5	1.6	7	Clay	Women	International	WTA (17 y)	Yes	
Junior Women National Hard	Torres-Luque et al. (2011)	5.5	0.2	8	Hard	Women	National	Juniors (15.6 y)	No	Only one study contributes a SD
	Stare et al. (2015)	4.3	NR	5	Hard	Women	National	Juniors (14.1)	No	SD is missing

6.21 Strokes per Second (#)

Group	Author (Year)	Study results		Study conditions					Meta-analysis	
		Mean	SD	N (Matches)	Surface	Sex	Playing Level	Comment	Included in MA	Reason for exclusion from MA
	Morante and Brotherhood (2005)	0.73	0.01	12	Hard	Men	International	Australian Open 2005	No	Only two studies for analysis
Men International Hard	O'Donoghue and Ingram (2001)	0.81	0.04	24	Hard	Men	International	Australian Open 1997-1999	No	Only two studies for analysis
	O'Donoghue and Ingram (2001)	0.84	0.05	35	Hard	Men	International	US Open 1997-1999	No	Only two studies for analysis
Men International Clay	O'Donoghue and Ingram (2001)	0.75	0.04	22	Clay	Men	International	Roland Garros 1997-1999	No	Only two studies for analysis
Men International Gras	Morante and Brotherhood (2005)	0.75	0.02	12	Grass	Men	International	Wimbledon 2005	No	Only two studies for analysis
Men International Grass	O'Donoghue and Ingram (2001)	0.92	0.05	26	Grass	Men	International	Wimbledon 1997-1999	No	Only two studies for analysis
	Morante and Brotherhood (2005)	0.70	0.05	9	Hard	Women	International	Australian Open 2005	No	Only two studies for analysis
Women International Hard	O'Donoghue and Ingram (2001)	0.76	0.03	18	Hard	Women	International	Australian Open 1997-1999	No	Only two studies for analysis
	O'Donoghue and Ingram (2001)	0.76	0.04	23	Hard	Women	International	US Open 1997-1999	No	Only two studies for analysis
Women International Clay	O'Donoghue and Ingram (2001)	0.71	0.04	14	Clay	Women	International	Roland Garros 1997-1999	No	Only two studies for analysis
Women International Gras	Morante and Brotherhood (2005)	0.74	0.02	6	Grass	Women	International	Wimbledon 2005	No	Only two studies for analysis
	O'Donoghue and Ingram (2001)	0.78	0.05	13	Grass	Women	International	Wimbledon 1997-1999	No	Only two studies for analysis
Junior Men and Women International Hard	Murphy et al. (2016)	0.23	0.06	36-144	Hard	Men/women	International	Junior ITF Tournament (16 y)	No	No separate data for men and women, SD missing