

Supplementary Table 1. Databases. Applied search strategy, and numbers of retrieved studies.		
Database of published trials, dissertations and conference proceedings	Search strategy used	Hits
MEDLINE searched via PubMed searched on June 30, 2021th, via www.ncbi.nlm.nih.gov/sites	((("socket-shield technique"[Title/Abstract]) OR ("socket shield"[Title/Abstract]) OR ("root membrane"[Title/Abstract]) OR ("tooth* Socket*"[Title/Abstract]) OR ("tooth Root"[Title/Abstract]) OR ("partial* extraction therapy"[Title/Abstract])) AND (("anterior implant*"[Title/Abstract]) OR ("immediate implant*"[Title/Abstract]) OR ("dental Implant*"[Title/Abstract]) OR ("endosseous implant*"[Title/Abstract]) OR ("single-tooth implant*"[Title/Abstract]) OR implant*[Title/Abstract]))	294
ISI web of science Core Collection was searched via web of knowledge on June 30, 2021th, via apps.webofknowledge.com	TS = ((("socket-shield technique") OR ("socket shield") OR ("root membrane") OR ("tooth Socket") OR ("tooth Root") OR ("partial* extraction therapy")) AND (("anterior implant*") OR ("immediate implant*") OR ("dental Implant*") OR ("endosseous implant*") OR ("single-tooth implant*") OR (implant*))AND LANGUAGE: (English) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.	300
EMBASE searched via Ovid on June 30, 2021th, via http://ovidsp.dc2.ovid.com	((("socket-shield technique":ab,ti) OR ("socket shield":ab,ti) OR ("root membrane":ab,ti) OR ("tooth Socket":ab,ti) OR ("tooth Root":ab,ti) OR ("partial* extraction therapy":ab,ti)) AND (("anterior implant*":ab,ti) OR ("immediate implant*":ab,ti) OR ("dental Implant*":ab,ti) OR ("endosseous implant*":ab,ti) OR ("single-tooth implant*":ab,ti) OR implant*:ab,ti) AND [english]/lim	507
Scopus searched via Scopus on June 30, 2021th, via https://www.scopus.com	TITLE-ABS-KEY ((("socket-shield technique") OR ("socket shield") OR ("root membrane") OR ("tooth Socket") OR ("tooth Root") OR ("partial* extraction therapy")) AND (("anterior implant*") OR ("immediate implant*") OR ("dental Implant*") OR ("endosseous implant*") OR ("single-tooth implant*") OR (implant*))AND (LIMIT-TO (LANGUAGE , "English"))	3046
Cochrane Central Register of Controlled Trials searched via the Cochrane Library Searched on June 30, 2021th, via www.thecochranelibrary.com	((("socket-shield technique") OR ("socket shield") OR ("root membrane") OR ("tooth Socket") OR ("tooth Root") OR ("partial* extraction therapy")) AND (("anterior implant*") OR ("immediate implant*") OR ("dental Implant*") OR ("endosseous implant*") OR ("single-tooth implant*") OR (implant*)) in Title Abstract Keyword - in Trials	347
ProQuest Searched on June 30, 2021th, via https://www.proquest.com/	ab(("socket-shield technique") OR ("socket shield") OR ("root membrane") OR ("tooth Socket") OR ("tooth Root") OR ("partial* extraction therapy")) AND (("anterior implant*") OR ("immediate implant*") OR ("dental Implant*") OR ("endosseous implant*") OR ("single-tooth implant*") OR implant*) Limits applied Databases: 1 databases searched (publicly available content database) , Limited by: Language: English	123
Open gray Searched on June 30, 2021th, via https://www.proquest.com/ http://www.opengrey.eu/	((("socket-shield technique") OR ("socket shield") OR ("root membrane") OR ("tooth Socket") OR ("tooth Root") OR ("partial* extraction therapy")) AND (("anterior implant*") OR ("immediate implant*") OR ("dental Implant*") OR ("endosseous implant*") OR ("single-tooth implant*") OR implant*))	0
Total		4617
Duplicates		2421

Supplementary Table S2-S3: characteristics of Included studies.

	Abd-Elrahman. Et al. 2020	Barakat et al. 2017	Bramanti et al. 2018	Fattouh 2018	Hana and Omar 2020	Mathew et al. 2020	de Oliveira et al. 2021	Sun et al. 2020	Tiwari et al. 2020	Atef et al. 2021
Study design	RCT (parallel group)	RCT (parallel group)	RCT (parallel group)	RCT (parallel group)	RCT (parallel group)	RCT (parallel group)	RCT (parallel group)	RCT (parallel group)	RCT (parallel group)	RCT (Parallel group)
Number of (patients/implants)	25/40	20/20	40/40	20/20	40/40	10/10	27/27	30/30	16/16	42/42
Age (years), Range	20 to 60	20 to 50	NR	NR	28 to 65	25-60	NR	NR	18 to 30	>18
Sex (female/male)	14/11	12/8	NR	12/8	14/26	NR	NR	7/23	NR	30/10
Implant site	maxillary esthetic zone,	maxillary single rooted teeth	2 maxillary/man dibular canines	esthetic zone of the anterior maxilla	esthetic zone of the maxilla	single rooted maxillary anterior teeth	maxillary non-molar teeth	anterior teeth re-placement	maxillary anterior teeth	26 site in the premolar area and 16 sites maxillary anterior teeth.
Implant loading type	Immediate loading	Delayed implant loading at 4 months	Immediate loading	Immediate loading	Immediate loading	Immediate loading	Immediate loading	Immediate loading	Delayed implant loading at 4 months	Delayed implant loading at 4 months
Follow-up	6month	7month	36month	at 1, 4 weeks and 3, 6, and 12 months postoperatively	12month	after 3, 6 and 12 months for the follow up	100 days	24month	12month	6-12 month
Implant system	Dual implant, Titan industries EG, Cairo, Egypt	Superline implant, Dentium, Gangnam-gu, Seoul, Korea	NR	NR	EUROTeknika implant, Sallanches, France	NR	NR	NobelReplace Conical Connection implant, Nobel Biocare, Gothenburg, Sweden	NR	IS II, Neobiotek Co., Seoul, South Korea
implant diameter	3.3, 3.7	3.3, 3.8, 4.3	4.5	4.1	3.5 to 5	NR	NR	3.5, 4.0	NR	NR
Implant length	14, 16	10, 12, 14	NR	13	11 to 14	NR	NR	NR	NR	NR

Number of IIP with SST (patient/implant)	18/20	10/10	20/20	10/10	20/20	5/5	14/14	15/15	8/8	21/21
Number of Conventional IIP (patient/implant)	16/20	10/10	20/20	10/10	20/20	5/5	13/13	15/15	8/8	21/21
use of GBR in conventional IIP	No GBR	No GBR	Buccal gap was filled with xenograft	Buccal gap was filled with xenograftc and resorbable collagen membraned	No GBR	Buccal gap was filled with alloplastic graft material	No GBR	Buccal gap of more than 1 mm was filled with xenograft c	No GBR	Buccal gap was filled with bovine cancellous xenograft and a collagen plug
Method of assessment	CBCT, resonance frequency analysisi	CBCT, Standardized radiograph, panoramic radiograph, resonance frequency analysisi	Standardized radiograph, photographs	Standardized radiograph,	CBCT, periodontal Probe,PA	CBCT, OPG, IOPAR	CBCT	CBCT, photographs, resonance frequency analysis	CBCT	CBCT, Rubber base impressions, Clinical photographs

	Abd-Elrahman. Et al. 2020	Barakat et al. 2017	Bramanti et al. 2018	Fattouh 2018	Hana and Omar 2020	Mathew et al. 2020	de Oliviera et al. 2021	Sun et al. 2020	Tiwari et al. 2020	Atef et al. 2021
Changes in width of buccal bone (3-4 month)										
IIP with SST	NR	-0.05+0.02	NR	NR	NR	NR	-0.06+1.1	NR	-0.002+0.002	NR
IIP without SST		-0.22+0.14					1.02+1.15		-0.055+0.026	
Changes in width of buccal bone (6-7 month)										
IIP with SST	-0.12+0.07	-0.10+0.03	NR	NR	NR	NR	NR	-0.22+0.09	-0.002+0.003	-0.29+0.34
IIP without SST	-0.28+0.15	-0.34+0.11						-0.53+0.05	-0.098+0.032	-1.45+0.72
Changes in width of buccal bone (12 month)										
IIP with SST	NR		NR	NR	NR	NR	NR	NR	-0.002+0.003	NR
IIP without SST									-0.101+0.301	
Changes in buccal bone height (3-4 month)										
IIP with SST	NR	-0.16+0.13	-0.315+0.047	-0.418+0.138	NR	NR	-0.15+1.3	NR	NR	NR
IIP without SST		-0.86+0.76	-0.79+0.084	-0.619+0.118			-0.95+1.12			
Changes in buccal bone height (6-7 month)										
IIP with SST	-0.34+0.12	-0.44+0.24	-0.54+0.055	-0.639+0.116	NR	NR	NR	-0.28+0.08	NR	-0.36+0.62
IIP without SST	-0.77+0.35	-1.61+0.78	-1.015+0.098	-0.979+0.169				-0.87+0.12		-1.71+1.02

Changes in buccal bone height (12 month)	NR	NR	NR	NR	NR	-0.68+0.083	NR	NR	NR	NR
IIP with SST						-0.88+0.083				
IIP without SST										
PES at placement	11.45+1.5	NR	NR	NR	12.5+1.04	NR	NR	12.53+1.1	NR	NR
IIP with SST	4				12.6+1.34			9		
IIP without SST	12.6+1.19							12.6+1.45		
PES at 3month	NR	NR	12.5+0.94	11.4+0.843	NR	NR	NR	NR	NR	NR
IIP with SST			11.45+1.6	10.6+0.699						
IIP without SST										
PES at 6 month	12+1.12	NR	12.3+0.86	11.2+0.918	NR	NR	NR	12+1.77	NR	NR
IIP with SST	8.85+1.81		11.05+1.53	10.3+0.483				11.73+1.6		
IIP without SST								7		
PES at 12 month	NR	NR	NR	11.1+0.737	12.26+1.0	12.2+0.837	NR	12.2+1.57	NR	12.12+0.
IIP with SST				10.2+0.421	4	10.8+0.837		11.53+1.7		64
IIP without SST					9.63+1.34			3		11.86+0.35
Implant stability at placement			NR	NR	NR	NR	NR	76.01+1.3	NR	NR
IIP with SST	68.6+3.81	60.3+6.43						1		
IIP without SST	66.4+5.64	57.2+9.15						75.56+1.0		
Implant stability at 4 month	NR	69.8+3.77	NR	NR	NR	NR	NR	NR	NR	NR
IIP with SST		65.6+5.66								
IIP without SST										
Implant stability at 6month	76.71+3.4	NR	NR	NR	NR	NR	NR	NR	NR	NR
IIP with SST	9									
IIP without SST	75.5+4.4									
Implant failure rate N (%)										0(0)
IIP with SST	0(0)	0(0)	0(0)	0(0)	1(5)	0(0)	0(0)	0(0)	0(0)	0(0)
IIP without SST	0(0)	0(0)	0(0)	0(0)	1(5)	0(0)	0(0)	0(0)	0(0)	

Supplementary Table 4. Regression-based Egger's test and the Begg's rank test for quantitative measurement of publication bias using the

Groups	Egger's regression	P-value	Kendall's tau	P-value
BPW 3 m	2.59	0.0013	1	≥ 0.999
BPW 6 m	6.3	0.0000	2	0.8065
BPH 3 m	1.14	0.2687	-2	≥ 0.999
BPH 6m	3.31	0.0017	7	0.2597
BPH 12m	-	-	-	-
PES immediately	-0.55	0.9622	-1	1.7037
PES 3m	-	-	-	-
PES 6m	-1.38	0.835	0	≥ 0.999
PES 12m	1.52	0.5915	2	0.8065
ISQ	1.14	0.2132	1	≥ 0.999

-; inadequate observation so the test could not been conducted

Supplementary Table Table 5: Trim and Fill analysis results of studies publication bias based on the outcomes

Outcome:	Observed		Observed+ imputed	
	Mean difference (95%CI)	N. of studies	Mean difference (95%CI)	N. of studies
PES 3m	0.903 (95%CI: 0.382_1.424)	2	0.800 (95%CI: 0.361_1.239)	2+1
ISQ	0.846 (95%CI: -0.492_2.184)	3	0.450 (95%CI: -0.323_1.233)	3+2

-, no missing (unpublished) studies were detected