The Effect of Time on Root Coverage Outcomes: A Network Meta-Analysis

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Appendix

Search Strategy

The search strategy was performed respectively in MEDLINE/Pubmed, EMBASE and Cochrane Central Register of Controller Trials (CENTRAL):

- ("gingival recession/surgery"[Mesh Terms] OR "gingival recession/therapy"[Mesh Terms]) AND ("randomized controlled trial"[Publication Type] OR "randomized controlled trials as topic"[MeSH Terms] OR "randomized controlled trial"[All Fields] OR "randomised controlled trial"[All Fields])
- gingival AND recession AND randomized AND controlled AND trial
- “Gingival recession” [Search All Text] AND “root coverage” [Search All Text]

In addition, an electronic screening of Medicine Gray Literature Report was performed to identify ongoing or unpublished studies (http://greylit.org).

Furthermore, a manual search through periodontics-related journals, including *Journal of Dental Research, Journal of Clinical Periodontology, Journal of Periodontology, Journal of Periodontal Research and International Journal of Periodontics & Restorative Dentistry*, from January 2016 to December 2017, was performed. The references of all the articles were reviewed in full text to identify all other available articles. Finally, previous systematic reviews investigating root coverage procedures were screened for article identification (Al-Hamdan et al. 2003; Atieh et al. 2016; Buti et al. 2013; Cairo et al. 2014; Cairo et al. 2016b; Chambrone et al. 2008; Chambrone et al. 2012; Chambrone et al. 2009; Chambrone and Tatakis 2015; Chambrone and Chambrone 2009; Cheng et al. 2015; Cheng et al. 2007; Clauser et al. 2003; Gapski et al. 2005; Graziani et al. 2014; Hwang and Wang 2006; Oates et al. 2003; Pagliaro et al. 2003; Roccuzzo et al. 2002; Tatakis et al. 2015)

Data extraction

Studies were excluded by screening the titles and abstracts and full-text reading by two separate investigators (L.T., S.B.) using a predetermined data extraction form to confirm the eligibility of each study based on the aforementioned criteria. The primary outcomes were mid-facial REC at different time points, and the secondary outcomes were KTW and CAL at different follow-up intervals. Data was independently extracted by the same two authors (L.T. and S.B.). Patient characteristics, the treatments and clinical

outcomes were registered. When clinical data was lacking, authors of the trials were contacted. At each stage, any debates between the reviewers were resolved through discussion and consensus. If a disagreement persisted, the judgment of a third reviewer (F.C.) was decisive.

Bias assessment scale and related parameters for the evaluation of risk of bias

The Cochrane Risk of Bias Tool for Randomized Controlled Trials was used to evaluate randomized controlled trials (RCTs) (Higgins et al. 2011), by addressing the following items:

1. Random sequence generation. Selection bias (biased allocation to interventions) due to inadequate generation of a randomized sequence).
2. Allocation concealment. Selection bias (biased allocation to interventions) due to inadequate concealment of allocations prior to assignment.
3. Blinding of participants and personnel. Performance bias due to knowledge of the allocated interventions by participants and personnel during the study.
4. Blinding of outcome assessment. Detection bias due to knowledge of the allocated interventions by outcome assessors.
5. Incomplete outcome data addresses. Attrition bias due to amount, nature or handling of incomplete outcome data.
6. Selective reporting. Reporting bias due to selective outcome reporting.
7. Other bias. Bias due to problems not covered elsewhere in the table.

The potential risk of bias was categorized as low if a study provided detailed information on the above parameters. Moderate risk was considered if a study failed to provide information on only one of the parameters, whereas if a study showed missing information pertaining to >2 parameters, it was categorized as exhibiting a high risk of bias.

Appendix Table 1. Characteristics and references of the excluded articles

Rationale for exclusion (n)	Reference
Data extraction not possible (n=8)	(Alkan and Parlar 2013; Burkhardt and Lang 2005; Dandu and Murthy 2016; Godavarthi et al. 2016; Jahnke et al. 1993; Keceli et al. 2008; Lops et al. 2015; Salhi et al. 2014)
Follow-up < 6 months (n=15)	(Al-Zahrani et al. 2004; Baghele and Pol 2012; Barbosa et al. 2009; De Toledo Lourenço et al. 2009; Harris et al. 2005; Ibbott et al. 1985; Lafzi et al. 2011; Lafzi et al. 2007; Laney et al. 1992; Oles et al. 1985; Papageorgakopoulos et al. 2008; Pini et al. 2000; Pini-Prato et al. 1999; Shepherd et al. 2009; Toledo et al. 2009)
No RCTs (n=17)	(Bellver-Fernandez et al. 2016; Berlucchi et al. 2005; Cummings et al. 2005; Dembowska and Drozdzik 2007; Erley et al. 2006; Hirsch et al. 2005; McGuire and Scheyer 2006; Moses et al. 2006; Nemcovsky et al. 2004; Novaes and de Barros 2008; Nunn and Miyamoto 2013; Ozcan et al. 1997; Pini et al. 1996; Pini et al. 1992; Pini-Prato et al. 2010; Trombelli et al. 1995; Wennström and Zucchelli 1996)
Only cases with NCCL included (n=5)	(Santamaria et al. 2009a; Santamaria et al. 2013; Santamaria et al. 2009b; Santamaria et al. 2008; Santamaria et al. 2010)
Only outcomes at baseline and final follow-up provided (n=111)	(Ahmedbeyli et al. 2014; Aichelmann-Reidy et al. 2001; Alves et al. 2012; Andrade et al. 2008; Andrade et al. 2010; Aroca et al. 2013; Ayub et al. 2012; Banihashemrad et al. 2009; Bansal et al. 2016; Barros et al. 2004; Barros et al. 2005; Barros et al. 2015; Berlucchi et al. 2002; Bittencourt et al. 2012; Bittencourt et al. 2006; 2007; Borghetti et al. 1999; Borghetti and Louise 1994; Bouchard et al. 1994; Caffesse et al. 2000; Cardaropoli and Cardaropoli 2009; Cardaropoli et al. 2012; Cardaropoli et al. 2014; Cheung and Griffin 2004; Cordioli et al. 2001; Côrtes et al. 2004; da Silva et al. 2004; De Queiroz Côrtes et al. 2004; de Souza et al. 2008; Deshpande et al. 2014; Dilsiz et al. 2010; Dodge et al. 2000; Doğan et al. 2015; Duval et al. 2000; Eren and Atilla 2014; Felipe et al. 2007; Francetti et al. 2005; Gilbert et al. 2015; Gobbato et al. 2016; Gumus and Buduneli 2014; Han et al. 2008; Harris 1997; 1998; 2000; Huang et al. 2005; Huynh et al. 1995; Jankovic et al. 2012; Jankovic et al. 2010; Jepsen et al. 1998; Joly et al. 2007; Kassab et al. 2006; Kimble et al. 2004; Kuru and Yildirim 2013; Lins et al. 2003; Lucchesi et al. 2007; Mahajan et al. 2012; Mahajan et al. 2007; Matarasso et al. 1998; Mazzocco et al. 2011; McGuire et al. 2009; Milinkovic et al. 2015; Modica et al. 2000; Muller et al. 1999; Nazareth and Cury 2011; Nizam et al. 2015; Ozcelik et al. 2011; Ozcelik et al. 2016; Ozcelik et al. 2015; Ozenci et al. 2015; Ozturan et al. 2011; Paolantonio 2002; Paolantonio et al. 1997; Paolantonio et al. 2002; Pilloni et al. 2006; Pourabbas et al. 2009; Rahmani and Lades 2006; Rasperini et al. 2011; Ricci et al. 1996; Roccuzzo et al. 1996; Rosetti et al. 2000; Santana et al. 2010a; Santana et al. 2010b; Santana et al. 2010c; Schlee and Esposito 2011; Silva et al. 2004; Singh et al. 2015; Spahr et al. 2005; Tal et al. 2002; Tatakis and Trombelli 2000; Thombre et al. 2013; Tonetti et al. 2018; Tözüm et al. 2005; Trabulsi et al. 2004; Trivedi et al. 2014; Trombelli et al. 1998; Trombelli et al. 1996; Ucak et al. 2017; Wang et al. 2001; Wang et al. 2014; Wang et al. 2015; Woodyard et al. 2004; Yilmaz et al. 2014; Zanwar et al. 2014; Zucchelli et al. 2003; Zucchelli et al. 1998; Zucchelli et al. 2012; Zucchelli et al. 2014a; Zucchelli et al. 2009a; Zucchelli et al. 2010; Zucchelli et al. 2014b; Zucchelli et al. 2009b)
Only smoking patients included (n=2)	(Costa et al. 2016; Reino et al. 2012)

Appendix Table 2. General overview of the included studies

Study	Study design	Country	Patients and Recessions (N)	Age (mean in years)	Smoking patients included	Recession type	Setting and funding
(Abolfazli et al. 2009)	Split-mouth	Iran	12 and 24	34.5	No	Single	University, NR
(Alkan and Parlar 2011)	Split-mouth	Turkey	12 and 24	NA	No	Single	University, support from University
(Amarante et al. 2000)	Split-mouth	Norway	20 and 40	38.4	Yes	Single	University, partially supported by a company
(Aroca et al. 2009)	Split-mouth	Hungary	21 and 134	31.7	Yes if ≤20 cig./day	Multiple	University, self-supported
(Aroca et al. 2010)	Split-mouth	Hungary	20 and 139	31.7	No	Multiple	University, self-supported
(Ayub et al. 2014)	Split-mouth	Brazil	15 and 30	45	No	Single	University, supported by a grant
(Azaripour et al. 2016)	Parallel	Germany	40 and 71	38.6	No	Single/ Multiple	University, self-supported
(Barker et al. 2010)	Split-mouth	United States of America	14 and 52	42.6	No	Multiple	University, partially supported by a company
(Bednarz et al. 2016)	Parallel	Poland	30 and 137	NA	No	Multiple	University, NR
(Bherwani et al. 2014)	Parallel	India	20 and 75	NA	No	Multiple	University, NR

(Bittencourt et al. 2009)	Split-mouth	Brazil	17 and 34	33.5	No	Single	University, supported by a research funding
(Byun et al. 2009)	Parallel	United States of America	20 and 20	42.6	No	Single	University, supported by a research funding
(Cairo et al. 2016a)	Parallel	Italy	32 and 74	53.1	Yes if ≤10 cig./day	Multiple	University, self-supported
(Cairo et al. 2012)	Parallel	Italy	29 and 29	45.9	Yes if ≤20 cig./day	Single	University, self-supported
(Cairo et al. 2015)	Parallel	Italy	24 and 24	53.1	Yes if ≤20 cig./day	Single	University, self-supported
(Carney et al. 2012)	Split-mouth	United States of America	17 and 40	49.4	No	Multiple	University, self-supported
(Castellanos et al. 2006)	Parallel	Mexico	22 and 44	42.5	No	Single	University, NR
(Cetiner et al. 2003)	Parallel	Turkey	22 and 60	NA	Yes if < 10 cig./day	Single	University, NR
(Cieslik-Wegemund et al. 2016)	Parallel	Poland	28 and 106	35	No	Multiple	University, NR
(Cordaro et al. 2012b)	Split-mouth	Italy	10 and 58	NA	Yes if ≤ 10 cig./day	Multiple	University, NR
(Cortellini et al. 2009)	Parallel	Italy	85 and 85	37.8	Yes if ≤ 20 cig./day	Single	University, self-supported
(Cueva et al. 2004)	Split-mouth	United States of America	17 and 58	39	Yes	Single/ Multiple	University, partially supported by a company

(De Queiroz Côrtes et al. 2006)	Split-mouth	Brazil	13 and 26	32.8	No	Single	University, NR
(Del Pizzo et al. 2005)	Split-mouth	Italy	15 and 30	39.5	No	Single	University, NR
(Deliberador et al. 2015)	Split-mouth	Brazil	12 and 24	41	No	Single	University, NR
(Fernandes-Dias et al. 2015)	Parallel	Brazil	40 and 40	40.2	No	Single	University, supported by a grant
(Ghahroudi et al. 2013)	Parallel	Iran	22 and 71	45.3	NA	Single/ Multiple	University, self-supported
(Hägewald et al. 2002)	Split-mouth	Germany	36 and 72	36	Yes if < 10 cig./day	Single	University, supported by a company
(Haghighati et al. 2009)	Split-mouth	Iran	16 and 32	NA	No	Multiple	University, self-supported
(Henderson et al. 2001)	Split-mouth	United States of America	10 and 20	42.2	No	Multiple	Private Practice, supported by a company
(Henriques et al. 2010)	Split-mouth	Brazil	12 and 24	42.7	No	Single	University, NR
(Ito et al. 2000)	Parallel	Japan	6 and 8	34	NA	Multiple	University, NR
(Jain et al. 2017)	Parallel	India	30 and 30	29.6	No	Single	University, NR
(Jepsen et al. 2013)	Split-mouth	Germany, Italy, Sweden, Spain	45 and 90	39.5	Yes if ≤ 10 cig./day	Single	University, supported by a company

(Jepsen et al. 2017)	Split-mouth	Germany, Italy	18 and 36	44	Yes if ≤ 10 cig./day	Single	University, supported by a company
(Jhaveri et al. 2010)	Split-mouth	India	10 and 20	36.5	NA	Single	University, partially supported by a research organization
(Köseoğlu et al. 2013)	Split-mouth	Turkey	11 and 22	31	No	Single	University, supported by a research grant
(Kuis et al. 2013)	Split-mouth	Croatia	37 and 114	31.1	No	Single	University, supported by a research grant
(Leknes et al. 2005)	Split-mouth	Norway	20 and 40	38.4	Yes	Single/ Multiple	University, partially supported by a company
(McGuire and Nunn 2003)	Split-mouth	United States of America	17 and 34	44.9	No	Single	Private Practice, supported by a company
(McGuire and Scheyer 2010)	Split-mouth	United States of America	23 and 46	43.7	No	Single	Private Practice, supported by a company
(McGuire and Scheyer 2016)	Split-mouth	United States of America	17 and 34	51.3	No	Single	Private Practice, supported by a company
(McGuire et al. 2012)	Split-mouth	United States of America	9 and 18	55.4	No	Single	Private Practice, supported by a company
(McGuire et al. 2014)	Split-mouth	United States of America	20 and 40	52.5	No	Single	Private Practice, supported by a company
(Moka et al. 2014)	Parallel	India	20 and 20	NA	No	Single	University, NR
(Moreira et al. 2016)	Parallel	Brazil	40 and 40	34.4	No	Single	University, partially supported by a company

(Moslemi et al. 2011a)	Split-mouth	Iran	15 and 30	39.4	No	Single	University, supported by a research grant
(Nickles et al. 2010)	Parallel	Germany	9 and 24	32.2	Yes	Single/ Multiple	University, self-supported
(Novaes et al. 2001)	Split-mouth	Brazil	9 and 30	42	No	Single/ Multiple	University, partially-supported by a company
(Pini Prato et al. 2011a)	Split-mouth	Italy	9 and 18	NA	Yes	Single	University, self-supported
(Rasperini et al. 2018a)	Parallel	Italy	25 and 25	49.7	Yes if ≤ 20 cig./day	Single	University, self-supported
(Reino et al. 2015)	Split-mouth	Brazil	20 and 40	42	NA	Single	University, partially supported by a research grant and by a company
(Romagna-Genon 2001)	Split-mouth	France	20 and 40	37	No	Single	University, NR
(Roman et al. 2013)	Parallel	Romania	42 and 42	31	Yes if ≤ 10 cig./day	Single/ Multiple	University, supported by a research grant
(Rosetti et al. 2013)	Split-mouth	Brazil	12 and 24	39	No	Single	University, supported by a research grant
(Sangiorgio et al. 2017)	Parallel	Brazil	68 and 68	37.5	No	Single	University, supported by a research grant
(Santamaria et al. 2017)	Parallel	Brazil	42 and 42	40.2	No	Single	University, supported by a research grant
(Shin et al. 2007)	Split-mouth	United States of America	14 and 82	45.4	Yes	Multiple	University, partially supported by companies

(Stefanini et al. 2016)	Split-mouth	Germany, Italy, Sweden, Spain	45 and 90	39.5	Yes if ≤ 10 cig./day	Single	University, supported by a company
(Taiyeb Ali et al. 2015)	Parallel	Malaysia	6 and 8	37.8	No	Single/ Multiple	University, supported by a research grant
(Wilson Jr et al. 2005)	Split-mouth	United States of America	13 and 26	47.7	No	Single	Private practice, supported by a company
(Zucchelli et al. 2014c)	Parallel	Italy	50 and 149	33.7	Yes if ≤ 10 cig./day	Multiple	University, self-supported
(Zucchelli et al. 2016)	Parallel	Italy	50 and 50	NA	Yes if ≤ 10 cig./day	Single	University, NR
(Zuhr et al. 2014)	Parallel	Germany	24 and 47	37.9	No	Single/ Multiple	Private practice, self-supported

NR: Not reported. Cig./day: cigarettes per day

Appendix Table 3. General characteristics of the intervention

Study	Follow-up (months)	Treatment group 1, REC results ± SD	Treatment group 2, REC results ± SD	Treatment group 3, REC results ± SD	Treatment group 4, REC results ± SD	Tooth brushing instruction
(Abolfazli et al. 2009)	12, 24	CAF + CTG 0.5 ± 0.19, 0.33 ± 0.14	CAF + EMD 0.83 ± 0.26, 1 ± 0.21	NP	NP	No brushing the area for 3 weeks Patient was given OHI at each visit
(Alkan and Parlar 2011)	6, 12	CAF + CTG 0.42 ± 0.51, 0.42 ± 0.51	CAF + EMD 0.33 ± 0.49, 0.33 ± 0.65	NP	NP	No brushing the area for 2 weeks Brushing instruction given
(Amarante et al. 2000)	3, 6	GTR 1.4 ± 1.3, 1.8 ± 1.4	CAF 1 ± 1.2, 1.1 ± 1.3	NP	NP	No brushing the area for 2 weeks Patients instructed to use a soft toothbrush
(Aroca et al. 2009)	3, 6	CAF 0.4 ± 0.5, 0.6 ± 0.6	CAF + PRF*	NP	NP	No brushing the area for 15 days Patients instructed to use a soft toothbrush and a roll technique
(Aroca et al. 2010)	6, 12	TUN + CTG 0.6 ± 0.8, 0.6 ± 0.9	TUN + CTG + EMD*	NP	NP	No brushing the area for 15 days Patients instructed to use a soft toothbrush and a roll technique
(Ayub et al. 2014)	6, 12	CAF + ADM 0.38 ± 0.25, 0.26 ± 0.22	CAF + ADM 1.14 ± 0.3, 0.71 ± 0.35	NP	NP	No brushing the area for 2 weeks Patients was given OHI.
(Azaripour et al. 2016)	6, 12	CAF + CTG 0.02 ± 0.9, 0.02 ± 0.9	TUN + CTG 0.04 ± 0.1, 0.06 ± 0.1	NP	NP	No brushing the area for 4 weeks Patients instructed to use a soft toothbrush given

(Barker et al. 2010)	3, 6	CAF + ADM 1.08 ± 0.91, 0.67 ± 0.76	CAF + ADM 1.04 ± 0.85, 0.65 ± 0.76	NP	NP	No brushing the area for 2 weeks Brushing instruction given
(Bednarz et al. 2016)	3, 6	TUN + CTG 0.25 ± 0.44, 0.13 ± 0.33	TUN + FL*	NP	NP	NR
(Bherwani et al. 2014)	3, 6	CAF 0.54 ± 0.82, 0.1 ± 0.31	TUN + CTG 0.89 ± 0.71, 0.22 ± 0.42	NP	NP	Patients instructed to use roll technique given
(Bittencourt et al. 2009)	6, 30	CTG 0.1 ± 0.19, 0.07 ± 0.2	SCPF*	NP	NP	Patients instructed to use a non-traumatic technique and a soft toothbrush
(Byun et al. 2009)	3, 6	CAF + CTG 0.25 ± 0.59, 0.1 ± 0.84	CAF + eCTG 0.2 ± 0.72, 0.35 ± 0.85	NP	NP	OHI instruction given at each visit
(Cairo et al. 2016a)	6, 12	CAF 0.6 ± 0.6, 0.6 ± 0.6	CAF + CTG 0.2 ± 0.4, 0.2 ± 0.4	NP	NP	No brushing the area for 2 weeks Patients instructed to use roll technique and a soft toothbrush (and after 3 months a medium-size bristle toothbrush)
(Cairo et al. 2012)	3, 6	CAF 0.4 ± 0.6, 0.8 ± 0.6	CAF + CTG 0.5 ± 0.5, 0.4 ± 0.5	NP	NP	No brushing the area for 2 weeks Patients instructed to use roll technique and a soft toothbrush
(Cairo et al. 2015)	12, 36	CAF 0.7 ± 0.6, 0.9 ± 0.8	CAF + CTG 0.3 ± 0.5, 0.5 ± 0.8	NP	NP	No brushing the area for 2 weeks Patients instructed to use roll technique and a soft toothbrush

(Carney et al. 2012)	3, 6	ADM 0.95 ± 0.98, 0.76 ± 0.84	ADM + rhPDGF*	NP	NP	No brushing the area for 2 weeks Patients instructed to use roll technique and a soft toothbrush (and after 1 a regular toothbrush)
(Castellanos et al. 2006)	6, 12	CAF 0.86 ± 0.92, 0.9 ± 0.95	CAF + EMD 0.27 ± 0.52, 0.36 ± 0.6	NP	NP	No brushing the area for 3 weeks Patient was given OHI.
(Cetiner et al. 2003)	6, 12	CAF + CTG 0.5 ± 0.67, 0.6 ± 0.65	GTR (PLGA membrane) 1.1 ± 0.88, 0.9 ± 0.6	GTR (SDDA membrane) 1.2 ± 0.63, 1.2 ± 0.66	NP	No brushing the area for 8 weeks Brushing technique given
(Cieslik-Wegemund et al. 2016)	3, 6	TUN + CTG 0.4 ± 0.3, 0.4 ± 0.4	TUN + CM 0.2 ± 0.4, 0.2 ± 0.4	NP	NP	No brushing the area for 8 weeks Patients instructed to use roll technique and a soft toothbrush
(Cordaro et al. 2012b)	6, 24	CAF 0.64 ± 0.78, 0.9 ± 0.81	CAF + EMD 0.62 ± 0.58, 0.81 ± 0.56	NP	NP	No brushing the area for 4 weeks Patients instructed to use roll technique and a soft toothbrush
(Cortellini et al. 2009)	3, 6	CAF 0.8 ± 0.8, 0.8 ± 0.8	CAF + CTG 0.4 ± 0.7, 0.6 ± 0.9	NP	NP	No brushing the area for 7-9 days. Patients instructed to use a soft toothbrush for 2 weeks and then a power-driven toothbrush
(Cueva et al. 2004)	3, 6	CAF 0.93 ± 0.71, 0.77 ± 0.69	CAF + EMD 0.33 ± 0.52, 0.19 ± 0.41	NP	NP	No brushing the area for 4 weeks. Patient was given OHI.
(De Queiroz Côrtes et al. 2006)	6, 12, 24	CAF 1.08 ± 0.84, 1.19 ± 0.8, 1.62 ± 1	CAF + ADM 0.88 ± 0.89, 1 ± 0.84, 1.15 ± 0.8	NP	NP	No brushing the area for 1 month. Patients instructed to use roll technique and a soft toothbrush

(Del Pizzo et al. 2005)	6, 12, 24	CAF 0.33 ± 0.62, 0.53 ± 0.83, 0.6 ± 0.83	CAF + EMD 0.27 ± 0.46, 0.27 ± 0.59, 0.4 ± 0.74	NP	NP	No brushing the area for 1 month. Patients instructed to use roll technique
(Deliberador et al. 2015)	3, 6	CAF + CTG 0.92 ± 1.38, 1.08 ± 1.38	CAF + BFPG *	NP	NP	No brushing the area for 2 weeks. Patients instructed to use roll technique and a soft toothbrush
(Fernandes-Dias et al. 2015)	3, 6	CAF + CTG 0.15 ± 0.5, 0.21 ± 0.53	CAF + CTG + LLLT*	NP	NP	No brushing the area for 2 weeks. Patients instructed to use a non-traumatic brushing technique and a soft toothbrush
(Ghahroudi et al. 2013)	3, 6	CAF + CTG 1.54 ± 1.22, 1.88 ± 1.47	CAF + SAAG*	NP	NP	No brushing the area for 1 week. Patient was given OHI.
(Hägewald et al. 2002)	3, 6, 12	CAF 0.8 ± 1.1, 1 ± 1.1, 1 ± 1.2	CAF + EMD 0.3 ± 0.8, 0.8 ± 0.9, 0.8 ± 1	NP	NP	No brushing the area for 3 weeks. Patients instructed to use a soft toothbrush
(Haghighati et al. 2009)	3, 6	CAF + CTG 1.19 ± 0.83, 1.06 ± 0.93	CAF + ADM 0.44 ± 0.65, 0.41 ± 0.66	NP	NP	No brushing the area for 6 weeks. Patients instructed to use roll technique and a soft toothbrush
(Henderson et al. 2001)	3, 6, 12	CAF + ADM 0.4 ± 0.7, 0.15 ± 0.34, 0.15 ± 0.34	CAF + ADM 0.3 ± 0.48, 0.25 ± 0.42, 0.25 ± 0.42	NP	NP	Patient was given OHI
(Henriques et al. 2010)	6, 12	CAF + CTG 1.5 ± 1.31, 1.42 ± 1.16	CAF + CTG + EMD*	NP	NP	No brushing the area for 4 weeks Patient was given OHI
(Ito et al. 2000)	6, 12	GTR 0.63 ± 0.74, 0.88 ± 0.64	FGG*	NP	NP	No brushing the area for 14 days. Patients instructed in toothbrushing with a soft brush

(Jain et al. 2017)	3, 6	CAF + PRF*	CAF + AM*	NP	NP	NR
(Jepsen et al. 2013)	3, 6	CAF 0.89 ± 1.11, 1.02 ± 1.08	CAF + CM 0.84 ± 0.95, 0.87 ± 0.94	NP	NP	No brushing the area for 4 weeks Patients instructed to control traumatic brushing technique
(Jepsen et al. 2017)	6, 12, 36	CAF 1.02 ± 1.08, 0.5 ± 0.57, 0.58 ± 0.6	CAF + CM 0.87 ± 0.94, 0.31 ± 0.49, 0.28 ± 0.39	NP	NP	No brushing the area for 4 weeks Patients instructed to control traumatic brushing technique
(Jhaveri et al. 2010)	3, 6	CAF + CTG 0.4 ± 0.6, 0.5 ± 0.81	CAF + ADM + GF*	NP	NP	No brushing the area for 4 weeks Patients instructed to use roll technique
(Köseoğlu et al. 2013)	3, 6, 12	CAF + CM 0.72 ± 0.6, 0.73 ± 0.55, 0.28 ± 0.49	CAF + CM + GF*	NP	NP	No brushing the area for 4 weeks Patients instructed to gentle toothbrushing using a soft toothbrush
(Kuis et al. 2013)	6, 12, 24, 60	CAF 0.25 ± 0.51, 0.28 ± 0.49, 0.35 ± 0.52, 0.46 ± 0.6	CAF + CTG 0.09 ± 0.34, 0.09 ± 0.34, 0.12 ± 0.38, 0.19 ± 0.44	NP	NP	No brushing the area for 2 weeks Patients instructed to use a soft toothbrush
(Leknes et al. 2005)	6, 12, 72	CAF 1.3 ± 1.3, 1.4 ± 1.3, 2.5 ± 1.4	GTR 2 ± 1.3, 2 ± 1.5, 2.6 ± 1.5	NP	NP	No brushing the area for 2 weeks. Patients instructed to use a non-traumatizing brushing technique and a soft toothbrush
(McGuire and Nunn 2003)	3, 6, 12	CAF + CTG 0.29 ± 0.55, 0.29 ± 0.5, 0.24 ± 0.59	CAF + EMD 0.12 ± 0.57, 0.06 ±0.5, 0.18 ± 0.59	NP	NP	No brushing the area for 3 weeks. Patients instructed to use a non-traumatic brushing technique and, after 4 weeks, a regular tooth brushing technique
(McGuire and Scheyer 2010)	6, 12	CAF + CTG 0.1 ± 0.36, 0.02 ± 0.1	CAF + CM 0.52 ± 0.74, 0.37 ± 0.71	NP	NP	No brushing the area for 3 weeks. Patients instructed to

						use bass brushing technique and a ultrasoft toothbrush
(McGuire and Scheyer 2016)	6, 60	CAF + CTG 0.1 ± 0.36, 0.15 ± 0.88	CAF + CM 0.52 ± 0.74, 0.7 ± 1.11	NP	NP	No brushing the area for 3 weeks. Patients instructed to use bass brushing technique and a ultrasoft toothbrush
(McGuire et al. 2012)	12, 120*	CAF + CTG*	CAF + EMD*	NP	NP	No brushing the area for 3 weeks. Patients instructed to use a non-traumatic brushing technique and, after 4 weeks, a regular tooth brushing technique
(McGuire et al. 2014)	6, 60	CAF + CTG 0.07 ± 0.13	CAF + rhPDGF + βTCP*	NP	NP	Patients were given OHI
(Moka et al. 2014)	3, 6	CAF 0.1 ± 0.21, 0.1 ± 0.21	SCPF*	NP	NP	No brushing the area for 3 weeks. Patients instructed to use a soft bristled toothbrush
(Moreira et al. 2016)	3, 6	CAF 1.15 ± 0.37, 1.2 ± 0.41	CAF + CM 1.4 ± 0.5, 1.1 ± 0.31	NP	NP	No brushing the area for 2 weeks. Patients instructed to use an atraumatic brushing technique and a soft-bristle toothbrush
(Moslemi et al. 2011a)	6, 60	CAF + CTG 1.13 ± 0.91, 1.13 ± 0.91	CAF + ADM 0.3 ± 0.52, 1.27 ± 1.01	NP	NP	No brushing the area for 6 weeks. Patients instructed to use roll technique and a soft-bristle toothbrush
(Nickles et al. 2010)	6, 120*	CTG*	GTR*	NP	NP	No brushing the area for 6 weeks. Patients were given OHI
(Novaes et al. 2001)	3, 6	CAF + CTG 1.07 ± 1.1, 1.13 ± 1.08	CAF + ADM 1.2 ± 1.08, 1.13 ± 1.08	NP	NP	No brushing the area for 15 days. Patients instructed to use roll technique and a soft toothbrush

(Pini Prato et al. 2011a)	12, 60, 168*	CAF (root planning) 0.5 ± 0.6, 0.7 ± 0.8	CAF (polishing) 0.6 ± 0.7, 0.9 ± 1.1	NP	NP	No brushing the area for 3 weeks. Patients instructed to use roll technique and a soft toothbrush
(Rasperini et al. 2018a)	12, 108	CAF 0.9 ± 0.4, 1 ± 0.8	CAF + CTG 0.6 ± 0.5, 0.5 ± 0.5	NP	NP	No brushing the area for 7-9 days. Patients instructed to use a soft toothbrush for 2 weeks and then a power-driven toothbrush
(Reino et al. 2015)	3, 6	CAF + CM 1.34 ± 0.6, 1.28 ± 0.54	EFT + CM 0.64 ± 0.6, 0.63 ± 0.44	NP	NP	No brushing the area for 30 days. Patients were given OHI
(Romagna-Genon 2001)	3, 6	CAF + CTG 0.42 ± 0.98, 0.57 ± 1.17	GTR 0.82 ± 1.03, 0.92 ± 1.16	NP	NP	No brushing the area for 15 days. Patients instructed to use a soft toothbrush
(Roman et al. 2013)	3, 6, 12	CAF + CTG 0.44 ± 0.7, 0.41 ± 0.7, 0.41 ± 0.7	CAF + CTG + EMD*	NP	NP	No brushing the area for 3 weeks. Patients were given OHI
(Rosetti et al. 2013)	6, 18, 30	CAF + CTG 0.4 ± 0.6, 0.2 ± 0.3, 0.3 ± 0.65	GTR 1.42 ± 0.97, 1.1 ± 0.9, 0.5 ± 0.6	NP	NP	Patients were given OHI
(Sangiorgio et al. 2017)	3, 6	CAF 0.88 ± 0.77, 1.06 ± 0.86	CAF + CM 0.38 ± 0.51, 0.41 ± 0.49	CAF + EMD 0.31 ± 0.57, 0.37 ± 0.66	CAF + CM + EMD*	No brushing the area for 15 days. Patients instructed to use a soft toothbrush and to modify traumatic toothbrushing
(Santamaria et al. 2017)	3, 6	CAF + CTG 0.4 ± 0.7, 0.4 ± 0.7	TUN + CTG 0.8 ± 0.5, 0.6 ± 0.6	NP	NP	No brushing the area for 2 weeks. Patients instructed to use a non-traumatic brushing technique and a soft toothbrush
(Shin et al. 2007)	3, 6	CAF + ADM 0.93 ± 0.78, 0.94 ± 0.78	CAF + ADM + EMD*	NP	NP	No brushing the area for 2 weeks. Patients instructed to

						use roll technique and a soft toothbrush
(Stefanini et al. 2016)	6, 12	CAF 1.02 ± 1.08, 0.93 ± 1.1	CAF + CM 0.87 ± 0.94, 0.83 ± 0.99	NP	NP	No brushing the area for 4 weeks Patients instructed to control traumatic brushing technique
(Taiyeb Ali et al. 2015)	3, 6	CAF + CTG 1.25 ± 0.65, 1.38 ± 1.03	CAF + ADM 1.25 ± 0.96, 1.25 ± 0.96	NP	NP	NR
(Wilson Jr et al. 2005)	3, 6	CAF + CTG 1.4 ± 0.97, 1.4 ± 1.3	CAF + HF-DDS*	NP	NP	No brushing the area for 3 weeks. Patients instructed to use an atraumatic brushing technique
(Zucchelli et al. 2014c)	6, 12, 60	CAF 0.06 ± 0.22, 0.1 ± 0.26, 0.3 ± 0.57	CAF + CTG 0.1 ± 0.31, 0.13 ± 0.36, 0.09 ± 0.31	NP	NP	No brushing the area for 4 weeks. Patients instructed to use an atraumatic brushing technique
(Zucchelli et al. 2016)	3, 6, 12	CAF (trapezoidal design) 0.03 ± 0.18, 0.13 ± 0.35, 0.16 ± 0.38	CAF (triangular design) 0.2 ± 0.41, 0.2 ± 0.4, 0.3 ± 0.53	NP	NP	No brushing the area for 4 weeks. Patients instructed in mechanical tooth cleaning
(Zuhr et al. 2014)	6, 12	CAF + EMD 0.53 ± 0.47, 0.55 ± 0.49	TUN + CTG 0.02 ± 0.05, 0.04 ± 0.07	NP	NP	No brushing the area for 2 weeks. Patients instructed to use an atraumatic brushing technique with a soft toothbrush

NP: Not performed. NR: Not reported. CAF: Coronally Advanced Flap; CTG: Connective Tissue Graft; EMD: Enamel Matrix Derivative; GTR: Guided Tissue Regeneration; PRF: Platelet-Rich Plasma; TUN: Tunnel technique; ADM: Acellular Dermal Matrix; FL: Fascia Lata Allograft; SCPF: Semilunar Coronally Positioned Flap; eCTG: Connective Tissue Graft with an epithelial collar; rhPDGF: Recombinant Human Platelet-Derived Growth Factor; PLGA: Polylactide/polyglycolide Acid Membrane; SDDA: Solvent Dehydrated Duramater Allograft membrane; CM: Collagen Matrix; BFPG: Buccal Fat Pad Graft; LLLT: Low-Level Laser Therapy; SAAG: Subepithelial Amnion Allograft; AM: Amniotic Membrane; GF: Autogenous gingival Fibroblasts; βTCP: β-tricalcium phosphate; EFT: Extended Flap Technique; HF-DDS: Human Fibroblast-derived dermal substitute. OHI: Oral Hygiene Instructions.
*: treatment not considered in the in the network meta-analysis

Appendix Table 4. Direct and indirect pairwise comparisons of different treatment techniques for REC changes overtime with respect to different references.

	Treatment group	Reference					
		ADM	**CM**	**CTG**	**EMD**	**Flap**	**GTR**
1	**ADM**	/	0.0047† (-0.008, 0.018)	0.0051 (-0.005, 0.015)	-0.0120† (-0.03, 0.005)	0.0003 (-0.01, 0.011)	0.0083† (-0.005, 0.22)
2	**CM**	-0.0047† (-0.018, 0.008)	/	0.0003 (-0.008, 0.009)	**-0.0169 (-0.033, -0.059)**	-0.0043 (-0.013, 0.004)	0.0036† (-0.009, 0.016)
3	**CTG**	-0.0051 (-0.015, 0.005)	-0.0003 (-0.009, 0.008)	/	**-0.0171 (-0.032, -0.002)**	**-0.0047 (-0.008, -0.0007)**	0.0032 (-0.006, 0.013)
4	**EMD**	0.0120† (-0.005, 0.03)	**0.016727 (-0.0001, 0.033)**	**0.0171 (0.002, 0.032)**	/	0.0123 (-0.002, 0.027)	**0.020367† (0.002, 0.037)**
5	**Flap**	-0.0003 (-0.011, 0.106)	0.0043 (-0.004, 0.013)	**0.004 (0.0007, 0.008)**	-0.0123 (-0.027, 0.002)	/	0.0079 (-0.001, 0.017)
6	**GTR**	-0.0083† (-0.022, 0.005)	-0.0036† (-0.016, 0.009)	-0.0032 (-0.013, 0.006)	**-0.0203† (-0.037, -0.002)**	-0.0079 (-0.017, 0.001)	/

Each of the techniques in the rows 1 through 6, is compared to their respective references (head column), therefore, any value in the table reflects the coefficient (with the p values in parentheses) when any treatment technique in a row is compared in a pairwise comparison to the reference head column.
The color green indicates that in that particular comparison, the technique in the reference row provides statistically significant superior stability of the outcomes compared to the reference (column) overtime.
Red indicates that in that particular comparison, the technique in the reference row provides statistically significant inferior stability of the outcomes compared to the reference (column) overtime.
† indicates a purely indirect comparison never before tested in a clinical trial.
Bold signifies statistical significance
The values in the parenthesis display the lower and upper bounds of the 95% confidence intervals

Appendix Table 5. Random effect variances of the network model meta-analysis for the outcome of REC changes.

Name	**Variance**	**Std. Dev.**
Study/arm (intercept)	0.03046	0.174528
Study/arm (time slope)	0.000	0.000000
Study (intercept)	0.09708	0.311573
Study (time slope)	0.000057	0.007588
Residual	0.5666	0.752750

Study arm has a unique value for every arm × study combination
Study has a unique value for every study
(Number of: observations: 234, Study/arm: 91, Studies: 58)

KTW change

The results from the model failed to reveal a significant difference between either of the treatment groups for the changes in KTW over time. Nevertheless, CTG treatment showed a significant improvement in KTW after the recession treatment (0.87 (85% CI [0.57, 1.16]), p<0.001), and the amount of KTW at baseline was also observed to greatly impact the overall treatment effect of all groups. In particular, for the CM group only, a significant correlation was noted with the amount of KTW at baseline and the treatment stability overtime (-0.09 (95% CI [-0.17, -0.02]), p=0.006), indicating that when flap alone was the reference, recession defects with higher KTW at baseline responded better to CM treatment over time when compared to flap alone. When the population characteristics were analyzed, and Europe served as the reference, patients treated in Asia showed a significant estimate (0.77 (95% CI [0.25, 1.29]), p=0.002), indicating a relapse of the KTW overtime.

Appendix Table 6. Direct and indirect pairwise comparisons of different treatment techniques for KTW changes over time with respect to different references.

	Treatment group	Reference					
		ADM	**CM**	**CTG**	**EMD**	**Flap**	**GTR**
1	**ADM**	/	0.017596† (-0.026, 0.062)	0.0193 (-0.023, 0.062)	0.0235† (-0.026, 0.073)	0.0213 (-0.021, 0.063)	0.0162† (-0.028, 0.061)
2	**CM**	-0.0176† (-0.062, 0.026)	/	0.0017 (-0.012, 0.016)	0.0059 (-0.024, 0.036)	0.0037 (-0.011, 0.018)	-0.0013† (-0.022, 0.02)
3	**CTG**	-0.0193 (-0.062, 0.023)	-0.001 (-0.016, 0.012)	/	0.0042 (-0.023, 0.031)	0.0019 (-0.004, 0.008)	-0.0031 (-0.02, 0.013)
4	**EMD**	-0.0235† (-0.073, 0.026)	-0.0059 (-0.036, 0.024)	-0.0042 (-0.031, 0.023)	/	-0.0022 (-0.025, 0.029)	-0.0073† (-0.038, 0.024)
5	**Flap**	-0.0213 (-0.063, 0.021)	-0.0037 (-0.018, 0.011)	-0.0019 (-0.008, 0.004)	0.0022 (-0.025, 0.029)	/	-0.0051 (-0.021, 0.011)
6	**GTR**	-0.0162† (-0.061, 0.028)	0.0013† (-0.02, 0.022)	0.0031 (-0.013, 0.02)	0.007365† (-0.024, 0.038)	0.0051 (-0.011, 0.021)	/

Each of the techniques in the rows 1 through 6, is compared to their respective references (head column), therefore, any value in the table reflects the coefficient (with the p values in parentheses) when any treatment technique in a row is compared in a pairwise comparison to the reference head column.
Note that no statistically significant differences were observed among any of the pair-wise comparisons.
† indicates a purely indirect comparison never before tested in a clinical trial.
Bold signifies statistical significance
The values in the parenthesis display the lower and upper bounds of the 95% confidence intervals

Appendix Table 7. Random effect variances of the network model meta-analysis for the outcome of KTW changes.

Name	Variance	Std. Dev.
Study/arm (intercept)	0.1211868	0.34812
Study/arm (time slope)	0.000	0.000000
Study (intercept)	0.2983870	0.54625
Study (time slope)	0.0001878	0.01371
Residual	1.5156627	1.23112

Study arm has a unique value for every arm × study combination
Study has a unique value for every study
(Number of: observations: 234, Study/arm: 91, Studies: 58)

CAL change

The model demonstrated a statistically significant estimate for treatment with ADM (-0.02 (95% CI [-0.051, -0.0001]), p=0.046), compared to flap alone, indicating that treatment with ADM results in a greater stability and improvement of the post-operative clinical attachment level over time. Baseline recession depth was also found to be a significant predictor to the overall treatment (0.26 (95% CI [0.032, 0.48]), p=0.02), particularly for treatment with ADM (-0.22 (95% CI[-0.33, -0.11], p<0.0001), displaying that when compared to flap alone, a greater recession at baseline responds better to treatment with ADM. And patients treated in South America (0.57 (95% CI [0.16, 0.97]), p=0.006) showed a significant pattern of worsening of CAL when compared to the population treated in Europe.

Appendix Table 8. Direct and indirect pairwise comparisons of different treatment techniques for CAL changes over time with respect to different references.

	Treatment group	Reference					
		ADM	CM	CTG	EMD	Flap	GTR
1	**ADM**	/	-0.0171† (-0.049, 0.015)	-0.0259 (-0.051, -0.0001)	-0.0327† (-0.082, 0.017)	-0.0282 (-0.05, -0.0006)	-0.02612† (-0.06, 0.008)
2	**CM**	0.0171† (-0.015, 0.049)	/	-0.0087 (-0.031, 0.013)	-0.0156 (-0.063, 0.032)	-0.011 (-0.03, 0.011)	0.0089† (-0.022, 0.04)
3	**CTG**	0.0259* (0.001, 0.054)	0.0087 (-0.013, 0.031)	/	-0.0068 (-0.051, 0.037)	-0.0022 (-0.01, 0.014)	-0.0002 (-0.025, 0.025)
4	**EMD**	0.0327† (-0.017, 0.082)	0.0156 (-0.032, 0.063)	0.0068 (-0.037, 0.051)	/	0.0045 (-0.039, 0.048)	0.0066† (-0.042, 0.055)
5	**Flap**	0.0282* (0.001, 0.054)	0.0111 (-0.011, 0.034)	0.0022 (-0.01, 0.014)	-0.0045 (-0.048, 0.039)	/	0.002 (-0.022, 0.027)
6	**GTR**	0.0261† (-0.028, 0.08)	0.0089† (-0.022, 0.04)	0.0002 (-0.025, 0.025)	-0.0066† (-0.055, 0.042)	-0.002 (-0.027, 0.022)	/

Each of the techniques in the rows 1 through 6, is compared to their respective references (head column), therefore, any value in the table reflects the coefficient (with the p values in parentheses) when any treatment technique in a row is compared in a pairwise comparison to the reference head column.
The color green indicates that in that particular comparison, the technique in the reference row provides statistically significant superior stability of the outcomes compared to the reference (column) overtime.
Red indicates that in that particular comparison, the technique in the reference row provides statistically significant inferior stability of the outcomes compared to the reference (column) overtime.
† indicates a purely indirect comparison never before tested in a clinical trial.
Bold signifies statistical significance
The values in the parenthesis display the lower and upper bounds of the 95% confidence intervals

Appendix Table 9. Random effect variances of the network model meta-analysis for the outcome of CAL changes.

Name	Variance	Std. Dev.
Study/arm (intercept)	0.04574	0.2139
Study/arm (time slope)	0.000	0.000000
Study (intercept)	0.78747	0.8874
Study (time slope)	0.01770	0.1330
Residual	1.30745	1.1434

Study arm has a unique value for every arm × study combination
Study has a unique value for every study
(Number of: observations: 234, Study/arm: 91, Studies: 58)

Appendix Table 10. Bias risk assessment for the included RCTs using The Cochrane Risk of Bias Tool for Randomized Controlled Trials

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data addresses	Selective reporting	Other bias	Overall risk of bias
(Abolfazli et al. 2009)	low	unclear	low	low	low	low	low	moderate
(Alkan and Parlar 2011)	low	unclear	unclear	low	low	low	low	high
(Amarante et al. 2000)	low	high	unclear	low	low	low	low	high
(Aroca et al. 2009)	low	low	low	low	low	low	low	low
(Aroca et al. 2010)	low	low	low	low	low	low	low	low
(Ayub et al. 2014)	low	low	low	low	low	low	low	low
(Azaripour et al. 2016)	low	low	low	low	low	low	low	low
(Barker et al. 2010)	low	unclear	low	low	low	low	low	moderate
(Bednarz et al. 2016)	low	low	unclear	unclear	low	low	low	high
(Bherwani et al. 2014)	low	low	low	low	low	unclear	unclear	high
(Bittencourt et al. 2009)	low	low	low	low	low	low	low	low
(Byun et al. 2009)	low	low	low	low	low	low	unclear	moderate
(Cairo et al. 2016a)	low	low	low	low	low	low	low	low
(Cairo et al. 2012)	low	low	low	low	low	low	low	low
(Cairo et al. 2015)	low	low	low	low	low	low	low	low
(Carney et al. 2012)	low	low	low	low	low	low	low	low
(Castellanos et al. 2006)	low	high	unclear	low	low	low	low	high
(Cetiner et al. 2003)	low	low	unclear	low	low	low	low	moderate
(Cieslik-Wegemund et al. 2016)	low	low	low	low	unclear	low	low	moderate
(Cordaro et al. 2012b)	low	unclear	low	low	low	low	low	moderate

(Cortellini et al. 2009)	low	low	low	low	low	low	low	low
(Cueva et al. 2004)	low	low	unclear	low	low	low	low	moderate
(De Queiroz Côrtes et al. 2006)	low	low	unclear	low	low	low	low	moderate
(Del Pizzo et al. 2005)	low	low	low	low	low	low	low	low
(Deliberador et al. 2015)	low	unclear	unclear	low	low	low	low	high
(Fernandes-Dias et al. 2015)	low	low	low	low	low	low	low	low
(Ghahroudi et al. 2013)	low	low	low	low	low	low	unclear	moderate
(Hägewald et al. 2002)	low	low	low	low	low	low	low	low
(Haghighati et al. 2009)	low	low	unclear	unclear	low	low	low	high
(Henderson et al. 2001)	low	unclear	low	low	low	low	low	moderate
(Henriques et al. 2010)	low	unclear	low	low	low	low	low	moderate
(Ito et al. 2000)	low	unclear	unclear	unclear	low	low	low	high
(Jain et al. 2017)	low	low	unclear	unclear	low	low	low	high
(Jepsen et al. 2013)	low	low	low	low	low	low	low	low
(Jepsen et al. 2017)	low	low	low	low	low	low	low	low
(Jhaveri et al. 2010)	low	low	low	low	low	low	low	low
(Köseoğlu et al. 2013)	low	low	low	unclear	low	low	low	moderate
(Kuis et al. 2013)	low	low	low	low	low	low	low	low
(Leknes et al. 2005)	low	high	unclear	low	low	low	low	high
(McGuire and Nunn 2003)	low	low	low	low	low	low	low	low
(McGuire and Scheyer 2010)	low	low	low	low	low	low	low	low
(McGuire and Scheyer 2016)	low	low	low	low	low	low	low	low
(McGuire et al. 2012)	low	low	low	low	low	low	low	low
(McGuire et al. 2014)	low	low	low	low	low	low	low	low

(Moka et al. 2014)	low	unclear	unclear	unclear	low	low	low	high
(Moreira et al. 2016)	low	low	low	low	low	low	low	low
(Moslemi et al. 2011a)	low	low	unclear	unclear	low	low	high	high
(Nickles et al. 2010)	low	unclear	low	low	low	low	low	moderate
(Novaes et al. 2001)	low	unclear	unclear	unclear	low	low	low	high
(Pini Prato et al. 2011a)	low	low	low	high	low	low	low	high
(Rasperini et al. 2018a)	low	low	low	low	low	low	low	low
(Reino et al. 2015)	low	low	low	low	low	low	low	low
(Romagna-Genon 2001)	low	low	unclear	low	low	low	low	moderate
(Roman et al. 2013)	low	low	low	low	low	low	low	low
(Rosetti et al. 2013)	low	low	unclear	unclear	low	low	low	high
(Sangiorgio et al. 2017)	low	low	low	low	low	low	low	low
(Santamaria et al. 2017)	low	low	low	low	low	low	low	low
(Shin et al. 2007)	low	unclear	low	high	low	low	low	high
(Stefanini et al. 2016)	low	low	low	low	low	low	low	low
(Taiyeb Ali et al. 2015)	low	low	unclear	unclear	low	low	low	high
(Wilson Jr et al. 2005)	low	low	low	low	low	low	low	low
(Zucchelli et al. 2014c)	low	low	low	low	low	low	low	low
(Zucchelli et al. 2016)	low	low	low	low	low	low	low	low
(Zuhr et al. 2014)	low	low	low	low	low	low	unclear	moderate

Agreements and Disagreements with Previous Studies

In the literature, systematic reviews and meta-analyses were presented for evaluating the efficacy of periodontal plastic surgery in the treatment of localized or multiple GR defects (Buti et al. 2013; Cairo et al. 2014; Chambrone et al. 2012; Graziani et al. 2014; Oates et al. 2003; Roccuzzo et al. 2002). However, no review has previously focused on the stability of the root coverage outcomes. Buti and coworkers investigated the outcomes of periodontal plastic surgery through a network meta-analysis (Buti et al. 2013). Based on data derived from RCTs, they formed 9 direct and 12 indirect comparisons and ranked them according to their efficacy. In line with our results, the authors found that in the short term (6-12 months), CTG and EMD were the best options for recession reduction and complete root coverage, respectively (Buti et al. 2013). Similar results supporting CTG as the best treatment option in the localized and multiple GRs were also obtained by Cairo et al. and Graziani et al. (Cairo et al. 2014; Graziani et al. 2014). Our results are based on a NMA model constructed specifically for focusing on the effect on time on the stability of the outcomes, while considering possible influential parameters and data derived solely from RCTs with a minimum follow-up of 3 months, and those that evaluated clinical data in at least 2 time points.

From our results it seems that several factors, including baseline recession depth, KTW at the earliest recall, population and post-operative maintenance, are able to affect the stability of the gingival margin over time. However, when adjusted for all these variables, the NMA model showed that, except for CTG and GTR, all the surgical techniques tend to have a relapse of the gingival margin throughout time. A moderate incidence of GRs recurrence following flap alone (Pini Prato et al. 2011b; Pini Prato et al. 2018; Rasperini et al. 2018b), ADM (Harris 2004; Moslemi et al. 2011b) and EMD (Cordaro et al. 2012a) has been shown in several clinical trials, as well as the role of CTG as a biologic filler that improves soft tissue thickness and its stability in the long-term (Rasperini et al. 2018b; Zucchelli et al. 2018; Zucchelli et al. 2014d). The present NMA further corroborated these findings and showed, for the first time, the role of population and KTW at the earliest recall in the stability of the gingival margin.

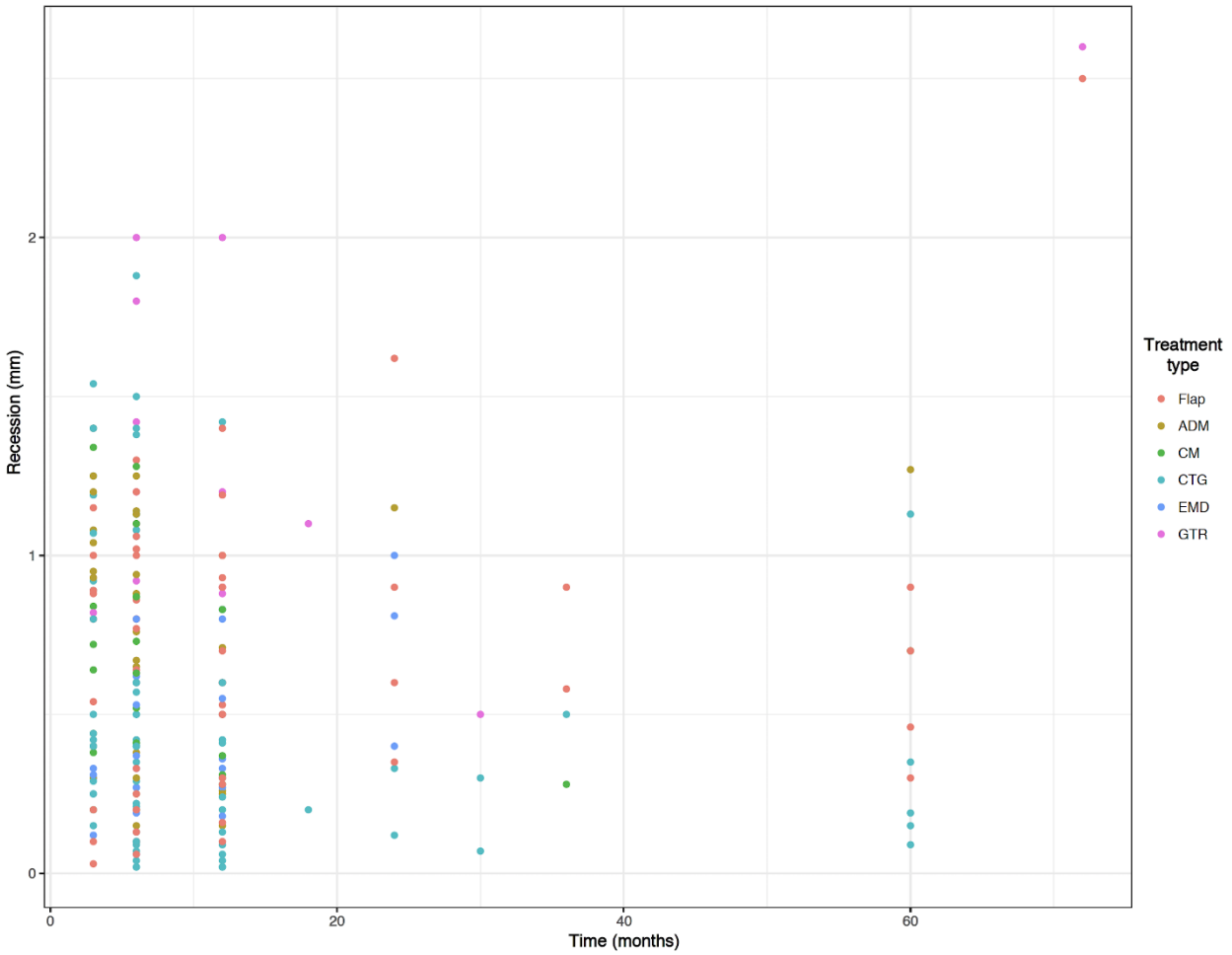
Implications for clinicians

Clinicians should be aware that root coverage procedures are significantly effective. However, time has a significant impact on the recurrence of gingival recessions. CTG-based techniques seem to be the best treatment option both in the treatment of GRs and in the stability of the gingival margin over time. Several predictors of stability, including baseline recession depth, KTW at the earliest recall and population were identified, and therefore should be taken into consideration when choosing the surgical approach. In particular, given its predictive value, increasing KTW, should be considered an outcome of the surgery.

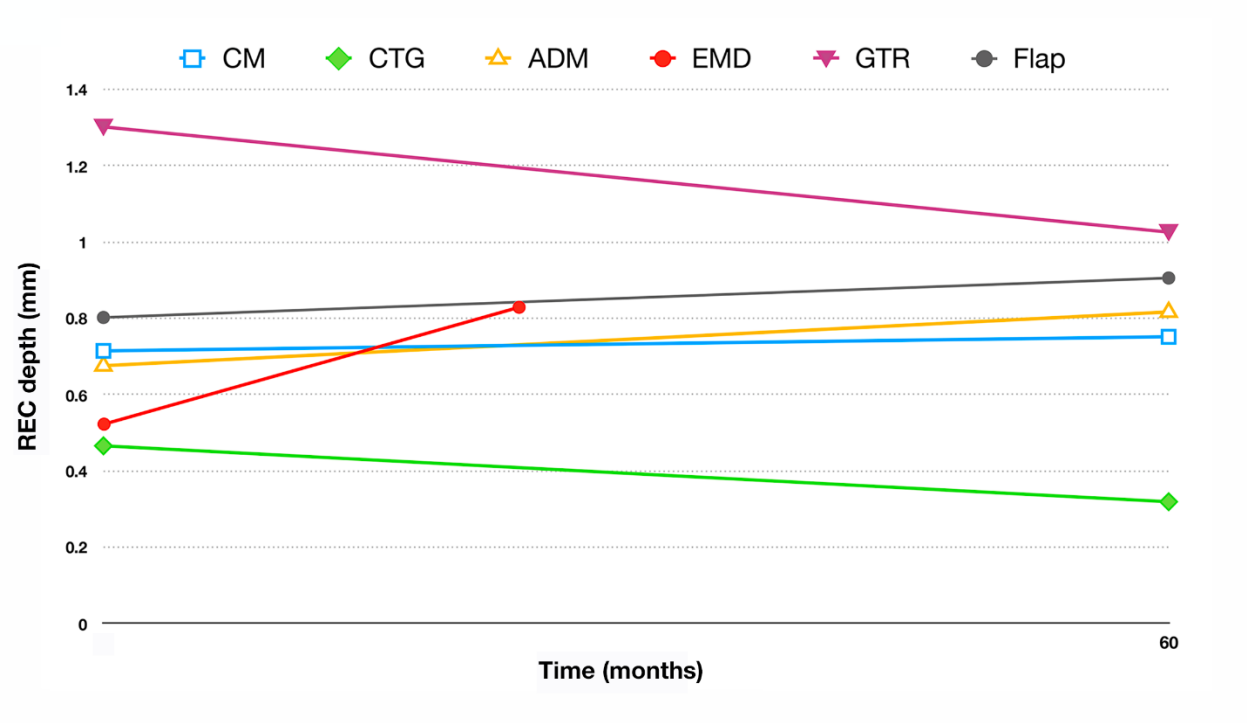
Recommendations for Future Research

Increasing the number of RCTs evaluating the efficacy of root coverage procedures with longer follow-up recalls and the evaluation of clinical outcomes at every examination is strongly encouraged. In addition, assessment and reporting of patients' biotype, gingival thickness and individual patient data including tooth location is highly recommended in research articles.

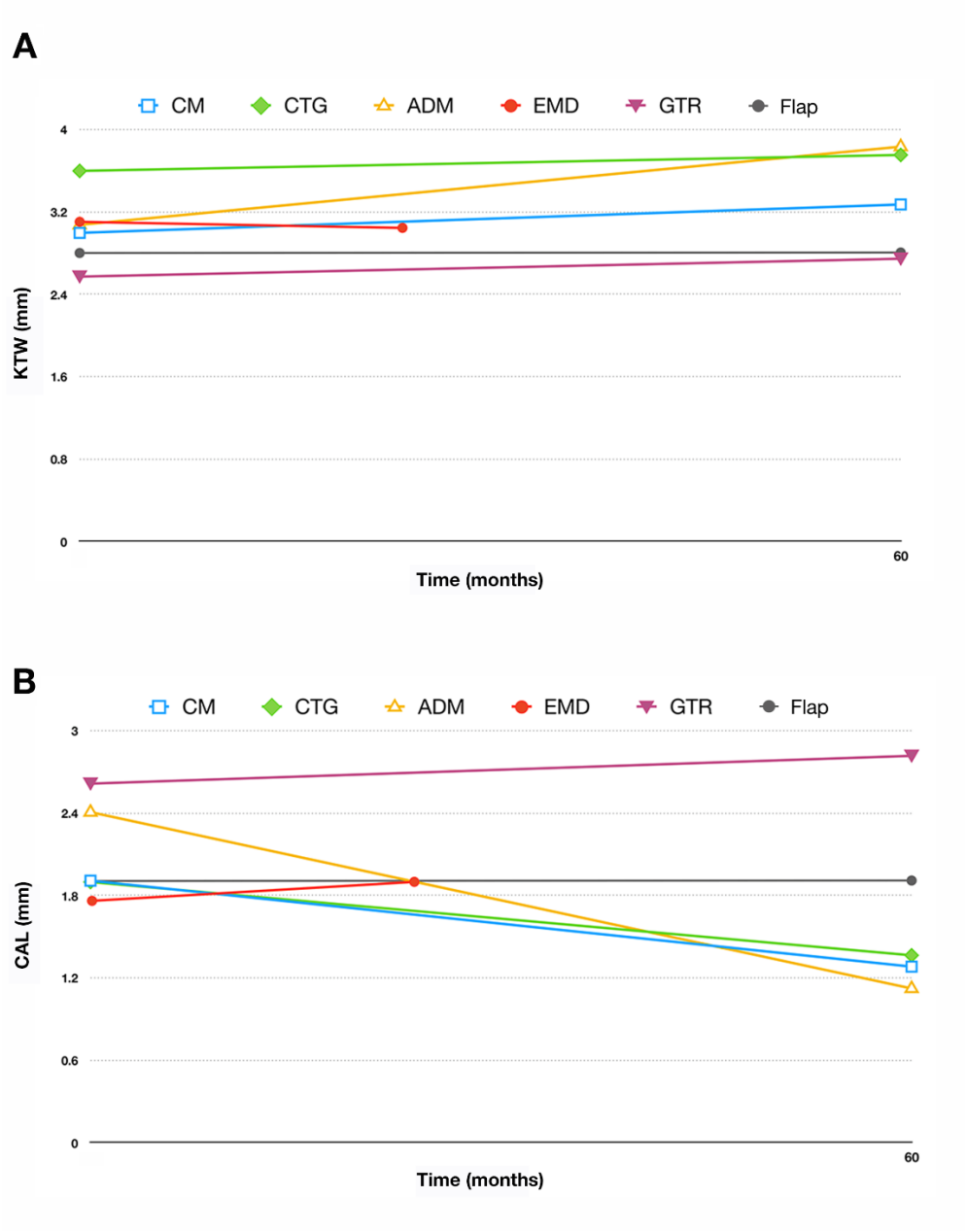
Appendix Figure 1. Scatter plot including the study summaries of the included randomized clinical trials for the outcome of REC. Note that studies beyond 80 months are not shown as they were not included in the network model. Additionally, this plot is not adjusted for repeated measures, baseline covariates and weights (as requested by reviewer).



Appendix Figure 2. The slope for recession changes among different approaches in first post-treatment 5 years. The plots models, based on the NMA model which accounts for baseline characteristics, visualize the behavior of the treatments up to a 60-month timepoint post-operatively. Note that time 0 is the treatment outcome at the earliest post-operative recall. Additionally, only for this visual representation, the EMD-treatment does not surpass 24 months due to lack of direct information from clinical trials beyond 24 months of recall.



Appendix Figure 3. The plotted slopes for A) KTW and 2) CAL among different approaches to 5 years post-treatment. Based on the NMA model, accounting for baseline characteristics, the produced plots visualize the behavior of the treatments up to a 60-month timepoint post-operatively. Note that time 0 is the treatment outcome at the earliest recall. Additionally, only for this visual representation, the EMD-treatment does not surpass 24 months due to lack of direct information from clinical trials beyond 24 months of recall.



REFERENCES

Abolfazli N, Saleh-Saber F, Eskandari A, Lafzi A. 2009. A comparative study of the long term results of root coverage with connective tissue graft or enamel matrix protein: 24-month results. Med Oral Patol Oral Cir Bucal. 14(6):E304-309.

Acunzo R, Limiroli E, Pagni G, Dudaite A, Consonni D, Rasperini G. 2016. Gingival margin stability after mucogingival plastic surgery. The effect of manual versus powered toothbrushing: A randomized clinical trial. J Periodontol. 87(10):1186-1194.

Ahmedbeyli C, Ipci SD, Cakar G, Kuru BE, Yilmaz S. 2014. Clinical evaluation of coronally advanced flap with or without acellular dermal matrix graft on complete defect coverage for the treatment of multiple gingival recessions with thin tissue biotype. J Clin Periodontol. 41(3):303-310.

Aichelmann-Reidy M, Yukna R, Evans G, Nasr H, Mayer E. 2001. Clinical evaluation of acellular allograft dermis for the treatment of human gingival recession. J Periodontol 72(8):998-1005.

Al-Hamdan K, Eber R, Sarment D, Kowalski C, Wang HL. 2003. Guided tissue regeneration-based root coverage: Meta-analysis. J Periodontol. 74(10):1520-1533.

Al-Zahrani M, Bissada N, Ficara A, Cole B. 2004. Effect of connective tissue graft orientation on root coverage and gingival augmentation. Int J Periodontics Restorative Dent. 24(1):65-69.

Alkan E, Parlar A. 2011. Emd or subepithelial connective tissue graft for the treatment of single gingival recessions: A pilot study. J Periodontal Res. 46(6):637-642.

Alkan E, Parlar A. 2013. Enamel matrix derivative (emdogain) or subepithelial connective tissue graft for the treatment of adjacent multiple gingival recessions: A pilot study. Int J Periodontics Restorative Dent. 33(5):619-625.

Alves L, Costa P, Scombatti dSS, Moraes GM, Palioto D, Taba JM, Novaes JA. 2012. Acellular dermal matrix graft with or without enamel matrix derivative for root coverage in smokers: A randomized clinical study. J Clin Periodontol. 39(4):393-399.

Amarante ES, Leknes KN, Skavland J, Lie T. 2000. Coronally positioned flap procedures with or without a bioabsorbable membrane in the treatment of human gingival recession. J Periodontol. 71(6):989-998.

Andrade PF, Felipe ME, Novaes AB, Jr., Souza SL, Taba M, Jr., Palioto DB, Grisi MF. 2008. Comparison between two surgical techniques for root coverage with an acellular dermal matrix graft. J Clin Periodontol. 35(3):263-269.

Andrade PF, Grisi MFM, Marcaccini AM, Fernandes PG, Reino DM, Souza SLS, Taba Jr M, Palioto DB, Novaes Jr AB. 2010. Comparison between micro-and macrosurgical techniques for the treatment of localized gingival recessions using coronally positioned flaps and enamel matrix derivative. J Periodontol. 81(11):1572-1579.

Aroca S, Keglevich T, Barbieri B, Gera I, Etienne D. 2009. Clinical evaluation of a modified coronally advanced flap alone or in combination with a platelet-rich fibrin membrane for the treatment of adjacent multiple gingival recessions: A 6-month study. J Periodontol. 80(2):244-252.

Aroca S, Keglevich T, Nikolidakis D, Gera I, Nagy K, Azzi R, Etienne D. 2010. Treatment of class iii multiple gingival recessions: A randomized-clinical trial. J Clin Periodontol. 37(1):88-97.

Aroca S, Molnár B, Windisch P, Gera I, Salvi G, Nikolidakis D, Sculean A. 2013. Treatment of multiple adjacent miller class i and ii gingival recessions with a modified coronally advanced tunnel (mcat) technique and a collagen matrix or palatal connective tissue graft: A randomized, controlled clinical trial. J Clin Periodontol. 40(7):713-720.

Atieh MA, Alsabeeha N, Tawse-Smith A, Payne AG. 2016. Xenogeneic collagen matrix for periodontal plastic surgery procedures: A systematic review and meta-analysis. J Periodontal Res. 51(4):438-452.

Ayub L, Ramos U, Reino D, Grisi M, Taba M, Souza S, Palioto D, Novaes A. 2012. A randomized comparative clinical study of two surgical procedures to improve root coverage with the acellular dermal matrix graft. J Clin Periodontol. 39(9):871-878.

Ayub L, Ramos U, Reino D, Grisi M, Taba M, Souza S, Palioto D, Novaes A. 2014. A modified surgical technique for root coverage with an allograft: A 12-month randomized clinical trial. J Periodontol. 85(11):1529-1536.

Azaripour A, Kissinger M, Farina VS, Van Noorden CJ, Gerhold-Ay A, Willershausen B, Cortellini P. 2016. Root coverage with connective tissue graft associated with coronally advanced flap or tunnel technique: A randomized, double-blind, mono-centre clinical trial. J Clin Periodontol. 43(12):1142-1150.

Baghele O, Pol D. 2012. An evaluation of the effectiveness and predictability of transpositional flap vs connective tissue graft for coverage of miller's class-i and class-ii facial marginal tissue recession lesions: A clinical study. Indian J Dent Res. 23(2):195-202.

Banihashemrad A, Aghassizadeh E, Radvar M. 2009. Treatment of gingival recessions by guided tissue regeneration and coronally advanced flap. N Y State Dent J. 75(1):54-58.

Bansal A, Kulloli A, Kathariya R, Shetty S, Jain H, Raikar S. 2016. Comparative evaluation of coronally advanced flap with and without bioactive glass putty in the management of gingival recession defects: A randomized controlled clinical trial. J Int Acad Periodontol. 18(1):7-15.

Barbosa FI, Correa DS, Zenobio EG, Costa FO, Shibli JA. 2009. Dimensional changes between free gingival grafts fixed with ethyl cyanoacrylate and silk sutures. J Int Acad Periodontol. 11(2):170-176.

Barker TS, Cueva MA, Rivera-Hidalgo F, Beach MM, Rossmann JA, Kerns DG, Crump TB, Shulman JD. 2010. A comparative study of root coverage using two different acellular dermal matrix products. J Periodontol. 81(11):1596-1603.

Barros R, Novaes A, Grisi M, Souza S, Taba M, Palioto D. 2004. A 6-month comparative clinical study of a conventional and a new surgical approach for root coverage with acellular dermal matrix. J Periodontol. 75(10):1350-1356.

Barros R, Novaes A, Grisi M, Souza S, Taba M, Palioto D. 2005. New surgical approach for root coverage of localized gingival recession with acellular dermal matrix: A 12-month comparative clinical study. J Esthetic Restor Dent. 17(3):156-164; discussion 164.

Barros RR, Macedo GO, de Queiroz AC, Novaes AB, Jr. 2015. A modified surgical flap for root coverage in association with grafting materials. J Esthet Restor Dent. 27(2):84-91.

Bednarz W, Zurek J, Gedrange T, Dominiak M. 2016. A preliminary clinical comparison of the use of fascia lata allograft and autogenous connective tissue graft in multiple gingival recession coverage based on the tunnel technique. Adv Clin Exp Med. 25(3):587-598.

Bellver-Fernandez R, Martinez-Rodriguez A-M, Gioia-Palavecino C, Caffesse R-G, Penarrocha M. 2016. Surgical treatment of localized gingival recessions using coronally advanced

flaps with or without subepithelial connective tissue graft. Med Oral Patol Oral Cir Bucal. 21(2):e222-e228.
Berlucchi I, Francetti L, Del Fabbro M, Testori T, Weinstein RL. 2002. Enamel matrix proteins (emdogain) in combination with coronally advanced flap or subepithelial connective tissue graft in the treatment of shallow gingival recessions. Int J Periodontics Restoratice Dent. 22(6):583-593.
Berlucchi I, Francetti L, Fabbro M, Basso M, Weinstein R. 2005. The influence of anatomical features on the outcome of gingival recessions treated with coronally advanced flap and enamel matrix derivative: A 1-year prospective study. J Periodontol. 76(6):899-907.
Bherwani C, Kulloli A, Kathariya R, Shetty S, Agrawal P, Gujar D, Desai A. 2014. Zucchelli's technique or tunnel technique with subepithelial connective tissue graft for treatment of multiple gingival recessions. J Int Acad Periodontol. 16(2):34-42.
Bittencourt S, Del Peloso Ribeiro E, Sallum EA, Nociti FH, Jr., Casati MZ. 2012. Surgical microscope may enhance root coverage with subepithelial connective tissue graft: A randomized-controlled clinical trial. J Periodontol. 83(6):721-730.
Bittencourt S, Del Peloso Ribeiro É, Sallum EA, Sallum AW, Nociti Jr FH, Casati MZ. 2006. Comparative 6-month clinical study of a semilunar coronary positioned flap and subepithelial connective tissue graft for the treatment of gingival recession. J Periodontol. 77(2):174-181.
Bittencourt S, Del Peloso Ribeiro É, Sallum EA, Sallum AW, Nociti Jr FH, Casati MZ. 2007. Root surface biomodification with edta for the treatment of gingival recession with a semilunar coronally repositioned flap. J Periodontol. 78(9):1695-1701.
Bittencourt S, Ribeiro EDP, Sallum EA, Sallum AW, Nociti Jr FH, Casat MZ. 2009. Semilunar coronally positioned flap or subepithelial connective tissue graft for the treatment of gingival recession: A 30-month follow-up study. J Periodontol. 80(7):1076-1082.
Borghetti A, Glise J, Monnet-Corti V, Dejou J. 1999. Comparative clinical study of a bioabsorbable membrane and subepithelial connective tissue graft in the treatment of human gingival recession. J Periodontol. 70(2):123-130.
Borghetti A, Louise F. 1994. Controlled clinical evaluation of the subpedicle connective tissue graft for the coverage of gingival recession. J Perioodntol. 65(12):1107-1112.
Bouchard P, Etienne D, Ouhayoun JP, Nilvéus R. 1994. Subepithelial connective tissue grafts in the treatment of gingival recessions. A comparative study of 2 procedures. J Periodontol. 65(10):929-936.
Burkhardt R, Lang N. 2005. Coverage of localized gingival recessions: Comparison of micro- and macrosurgical techniques. J Clin Periodontol. 32(3):287-293.
Buti J, Baccini M, Nieri M, La Marca M, Pini-Prato GP. 2013. Bayesian network meta-analysis of root coverage procedures: Ranking efficacy and identification of best treatment. J Clin Periodontol. 40(4):372-386.
Byun HY, Oh TJ, Abuhussein HM, Yamashita J, Soehren SE, Wang HL. 2009. Significance of the epithelial collar on the subepithelial connective tissue graft. J Periodontol. 80(6):924-932.
Caffesse RG, De LaRosa M, Garza M, Munne-Travers A, Mondragon JC, Weltman R. 2000. Citric acid demineralization and subepithelial connective tissue grafts. J Periodontol. 71(4):568-572.
Cairo F, Cortellini P, Pilloni A, Nieri M, Cincinelli S, Amunni F, Pagavino G, Tonetti MS. 2016a. Clinical efficacy of coronally advanced flap with or without connective tissue

graft for the treatment of multiple adjacent gingival recessions in the aesthetic area: A randomized controlled clinical trial. J Clin Periodontol. 43(10):849-856.
Cairo F, Cortellini P, Tonetti M, Nieri M, Mervelt J, Cincinelli S, Pini-Prato G. 2012. Coronally advanced flap with and without connective tissue graft for the treatment of single maxillary gingival recession with loss of inter-dental attachment. A randomized controlled clinical trial. J Clin Periodontol. 39(8):760-768.
Cairo F, Cortellini P, Tonetti M, Nieri M, Mervelt J, Pagavino G, Pini-Prato GP. 2015. Stability of root coverage outcomes at single maxillary gingival recession with loss of interdental attachment: 3-year extension results from a randomized, controlled, clinical trial. J Clin Periodontol. 42(6):575-581.
Cairo F, Nieri M, Pagliaro U. 2014. Efficacy of periodontal plastic surgery procedures in the treatment of localized facial gingival recessions. A systematic review. J Clin Periodontol. 41 Suppl 15:S44-62.
Cairo F, Pagliaro U, Buti J, Baccini M, Graziani F, Tonelli P, Pagavino G, Tonetti MS. 2016b. Root coverage procedures improve patient aesthetics. A systematic review and bayesian network meta-analysis. J Clin Periodontol. 43(11):965-975.
Cardaropoli D, Cardaropoli G. 2009. Healing of gingival recessions using a collagen membrane with a hemineralized xenograft: A randomized controlled clinical trial. Int J Periodontics Restorative Dent. 29(1):59-67.
Cardaropoli D, Tamagnone L, Roffredo A, Gaveglio L. 2012. Treatment of gingival recession defects using coronally advanced flap with a porcine collagen matrix compared to coronally advanced flap with connective tissue graft: A randomized controlled clinical trial. J Periodontol. 83(3):321-328.
Cardaropoli D, Tamagnone L, Roffredo A, Gaveglio L. 2014. Coronally advanced flap with and without a xenogenic collagen matrix in the treatment of multiple recessions: A randomized controlled clinical study. Int J Periodontics Restorative Dent. 34:s97-s102.
Carney CM, Rossmann JA, Kerns DG, Cipher DJ, Rees TD, Solomon ES, Rivera-Hidalgo F, Beach MM. 2012. A comparative study of root defect coverage using an acellular dermal matrix with and without a recombinant human platelet-derived growth factor. J Periodontol. 83(7):893-901.
Castellanos A, de la Rosa M, de la Garza M, Caffesse RG. 2006. Enamel matrix derivative and coronal flaps to cover marginal tissue recessions. J Periodontol. 77(1):7-14.
Cetiner D, Parlar A, Baloş K, Alpar R. 2003. Comparative clinical study of connective tissue graft and two types of bioabsorbable barriers in the treatment of localized gingival recessions. J Periodontol. 74(8):1196-1205.
Chambrone L, Chambrone D, Pustiglioni FE, Chambrone LA, Lima LA. 2008. Can subepithelial connective tissue grafts be considered the gold standard procedure in the treatment of miller class i and ii recession-type defects? J Dent. 36(9):659-671.
Chambrone L, Pannuti CM, Tu YK, Chambrone LA. 2012. Evidence-based periodontal plastic surgery. Ii. An individual data meta-analysis for evaluating factors in achieving complete root coverage. J Periodontol. 83(4):477-490.
Chambrone L, Sukekava F, Araujo MG, Pustiglioni FE, Chambrone LA, Lima LA. 2009. Root coverage procedures for the treatment of localised recession-type defects. Cochrane Database Syst Rev. (2):CD007161.
Chambrone L, Tatakis DN. 2015. Periodontal soft tissue root coverage procedures: A systematic review from the aap regeneration workshop. J Periodontol. 86(2 Suppl):S8-51.

Chambrone LA, Chambrone L. 2009. Treatment of miller class i and ii localized recession defects using laterally positioned flaps: A 24-month study. Am J Dent. 22(6):339-344.
Cheng GL, Fu E, Tu YK, Shen EC, Chiu HC, Huang RY, Yuh DY, Chiang CY. 2015. Root coverage by coronally advanced flap with connective tissue graft and/or enamel matrix derivative: A meta-analysis. J Periodontal Res. 50(2):220-230.
Cheng YF, Chen JW, Lin SJ, Lu HK. 2007. Is coronally positioned flap procedure adjunct with enamel matrix derivative or root conditioning a relevant predictor for achieving root coverage? A systemic review. J Periodontal Res. 42(5):474-485.
Cheung W, Griffin T. 2004. A comparative study of root coverage with connective tissue and platelet concentrate grafts: 8-month results. J Periodontol. 75(12):1678-1687.
Cieslik-Wegemund M, Wierucka-Mlynarczyk B, Tanasiewicz M, Gilowski L. 2016. Tunnel technique with collagen matrix compared with connective tissue graft for treatment of periodontal recession: A randomized clinical trial. J Periodontol. 87(12):1436-1443.
Clauser C, Nieri M, Franceschi D, Pagliaro U, Pini-Prato G. 2003. Evidence-based mucogingival therapy. Part 2: Ordinary and individual patient data meta-analyses of surgical treatment of recession using complete root coverage as the outcome variable. J Periodontol. 74(5):741-756.
Cordaro L, di Torresanto VM, Torsello F. 2012a. Split-mouth comparison of a coronally advanced flap with or without enamel matrix derivative for coverage of multiple gingival recession defects: 6- and 24-month follow-up. Int J Periodontics Restorative Dent. 32(1):e10-20.
Cordaro L, di Torresanto VM, Torsello F. 2012b. Split-mouth comparison of a coronally advanced flap with or without enamel matrix derivative for coverage of multiple gingival recession defects: 6- and 24-month follow-up. Int J Periodontics Restorative Dent. 32(1):e10-20.
Cordioli G, Mortarino C, Chierico A, Grusovin M, Majzoub Z. 2001. Comparison of 2 techniques of subepithelial connective tissue graft in the treatment of gingival recessions. J Periodontol. 72(11):1470-1476.
Cortellini P, Tonetti M, Baldi C, Francetti L, Rasperini G, Rotundo R, Nieri M, Franceschi D, Labriola A, Prato GP. 2009. Does placement of a connective tissue graft improve the outcomes of coronally advanced flap for coverage of single gingival recessions in upper anterior teeth? A multi-centre, randomized, double-blind, clinical trial. J Clin Periodontol. 36(1):68-79.
Côrtes AQ, Martins A, Nociti F, Sallum A, Casati M, Sallum E. 2004. Coronally positioned flap with or without acellular dermal matrix graft in the treatment of class i gingival recessions: A randomized controlled clinical study. J Periodontol. 75(8):1137-1144.
Costa PP, Alves LB, Souza SL, Grisi MF, Palioto DB, Taba M, Novaes AB. 2016. Root coverage in smokers with acellular dermal matrix graft and enamel matrix derivative: A 12-month randomized clinical trial. Int J Periodontics Restorative Dent. 36(4):525-531.
Cueva MA, Boltchi FE, Hallmon WW, Nunn ME, Rivera-Hidalgo F, Rees T. 2004. A comparative study of coronally advanced flaps with and without the addition of enamel matrix derivative in the treatment of marginal tissue recession. J Periodontol. 75(7):949-956.
Cummings LC, Kaldahl WB, Allen EP. 2005. Histologic evaluation of autogenous connective tissue and acellular dermal matrix grafts in humans. J Periodontol. 76(2):178-186.

da Silva RC, Joly JC, de Lima AFM, Tatakis DN. 2004. Root coverage using the coronally positioned flap with or without a subepithelial connective tissue graft. J Periodontol. 75(3):413-419.
Dandu SR, Murthy KR. 2016. Multiple gingival recession defects treated with coronally advanced flap and either the vista technique enhanced with gem 21s or periosteal pedicle graft: A 9-month clinical study. Int J Periodontics Restorative Dent. 36(2):231-237.
De Queiroz Côrtes A, Martins Â G, Nociti Jr FH, Sallum AW, Casati MZ, Sallum EA. 2004. Coronally positioned flap with or without acellular dermal matrix graft in the treatment of class i gingival recessions: A randomized controlled clinical study. J Periodontol. 75(8):1137-1144.
De Queiroz Côrtes A, Sallum AW, Casati MZ, Nociti Jr FH, Sallum EA. 2006. A two-year prospective study of coronally positioned flap with or without acellular dermal matrix graft. J Clin Periodontol. 33(9):683-689.
de Souza SL, Novaes Jr AB, Grisi DC, Taba Jr M, Grisi MF, de Andrade PF. 2008. Comparative clinical study of a subepithelial connective tissue graft and acellular dermal matrix graft for the treatment of gingival recessions: Six- to 12-month changes. J Int Acad Periodontol. 10(3):87-94.
De Toledo Lourenço AH, De Toledo Lourenço E, Fraga MR, Vitral RWF. 2009. The association of a polydioxanone tent without a guided tissue regeneration membrane to a coronal sliding flap for root coverage. J Periodontol. 80(10):1674-1679.
Del Pizzo M, Zucchelli G, Modica F, Villa R, Debernardi C. 2005. Coronally advanced flap with or without enamel matrix derivative for root coverage: A 2-year study. J Clin Periodontol. 32(11):1181-1187.
Deliberador TM, Trevisani CT, Storrer CL, Santos FR, Zielak JC, de Souza Filho CB, Alfredo E, Giovanini AF. 2015. Non-pedicled buccal fat pad grafts to treatment for class i and ii gingival recessions: A clinical trial. Braz Dent J. 26(6):572-579.
Dembowska E, Drozdzik A. 2007. Subepithelial connective tissue graft in the treatment of multiple gingival recession. Oral Surg Oral Med Oral Path Oral Radiol Endod. 104(3):e1-7.
Deshpande A, Koudale SB, Bhongade ML. 2014. A comparative evaluation of rhpdgf-bb + beta-tcp and subepithelial connective tissue graft for the treatment of multiple gingival recession defects in humans. Int J Periodontics Restorative Dent. 34(2):241-249.
Dilsiz A, Aydin T, Canakci V, Cicek Y. 2010. Root surface biomodification with nd: Yag laser for the treatment of gingival recession with subepithelial connective tissue grafts. Photomed Laser Surg. 28(3):337-343.
Dodge J, Greenwell H, Drisko C, Wittwer J, Yancey J, Rebitski G. 2000. Improved bone regeneration and root coverage using a resorbable membrane with physically assisted cell migration and dfdba. Int J Periodontics Restorative Dent. 20(4):398-411.
Doğan Ş, Dede F, Ballı U, Atalay E, Durmuşlar M. 2015. Concentrated growth factor in the treatment of adjacent multiple gingival recessions: A split-mouth randomized clinical trial. J Clin Periodontol. 42(9):868-875.
Duval B, Maynard J, Gunsolley J, Waldrop T. 2000. Treatment of human mucogingival defects utilizing a bioabsorbable membrane with and without a demineralized freeze-dried bone allograft. J Perioodntol. 71(11):1687-1692.
Eren G, Atilla G. 2014. Platelet-rich fibrin in the treatment of localized gingival recessions: A split-mouth randomized clinical trial. Clin Oral Investig. 18(8):1941-1948.

Erley K, Swiec G, Herold R, Bisch F, Peacock M. 2006. Gingival recession treatment with connective tissue grafts in smokers and non-smokers. J Periodontol. 77(7):1148-1155.
Felipe M, Andrade P, Grisi M, Souza S, Taba M, Palioto D, Novaes A. 2007. Comparison of two surgical procedures for use of the acellular dermal matrix graft in the treatment of gingival recessions: A randomized controlled clinical study. J Periodontol. 78(7):1209-1217.
Fernandes-Dias S, Marco A, Santamaria M, Kerbauy W, Jardini M, Santamaria M. 2015. Connective tissue graft associated or not with low laser therapy to treat gingival recession: Randomized clinical trial. J Clin Periodontol. 42(1):54-61.
Francetti L, Del Fabbro M, Calace S, Testori T, Weinstein RL. 2005. Microsurgical treatment of gingival recession: A controlled clinical study. Int J Periodontics Restorative Den. 25(2):181-188.
Gapski R, Parks CA, Wang HL. 2005. Acellular dermal matrix for mucogingival surgery: A meta-analysis. J Periodontol. 76(11):1814-1822.
Ghahroudi A, Khorsand A, Rokn A, Sabounchi S, Shayesteh Y, Soolari A. 2013. Comparison of amnion allograft with connective tissue graft for root coverage procedures: A double-blind, randomized, controlled clinical trial. J Int Acad Periodontol. 15(4):101-112.
Gilbert L, Lohra P, Mandlik V, Rath S, Jha A. 2015. Comparative evaluation of surgical modalities for coverage of gingival recession: An armed forces medical college perspective. Med J Armed Forces India. 71(1):53-59.
Gobbato L, Nart J, Bressan E, Mazzocco F, Paniz G, Lops D. 2016. Patient morbidity and root coverage outcomes after the application of a subepithelial connective tissue graft in combination with a coronally advanced flap or via a tunneling technique: A randomized controlled clinical trial. Clin Oral Investig. 20(8):2191-2202.
Godavarthi L, Murthy K, Pavankumar S. 2016. A comparison of acellular dermal matrix allograft and periosteal pedicle graft covered by coronally advanced flap in the treatment of gingival recession: 1-year follow-up study. Int J Periodontics Restorative Dent. 36(4):e67-e75.
Graziani F, Gennai S, Roldan S, Discepoli N, Buti J, Madianos P, Herrera D. 2014. Efficacy of periodontal plastic procedures in the treatment of multiple gingival recessions. J Clin Periodontol. 41 Suppl 15:S63-76.
Gumus P, Buduneli E. 2014. Graft stabilization with cyanoacrylate decreases shrinkage of free gingival grafts. Aust Dent J. 59(1):57-64.
Hägewald S, Spahr A, Rompola E, Haller B, Heijl L, Bernimoulin J. 2002. Comparative study of emdogain and coronally advanced flap technique in the treatment of human gingival recessions. A prospective controlled clinical study. J Clin Periodontol. 29(1):35-41.
Haghighati F, Mousavi M, Moslemi N, Kebria M, Golestan B. 2009. A comparative study of two root-coverage techniques with regard to interdental papilla dimension as a prognostic factor. Int J Periodontics Restorative Dent. 29(2):179-189.
Han J, John V, Blanchard S, Kowolik M, Eckert G. 2008. Changes in gingival dimensions following connective tissue grafts for root coverage: Comparison of two procedures. J Periodontol. 79(8):1346-1354.
Harris R. 1997. A comparative study of root coverage obtained with guided tissue regeneration utilizing a bioabsorbable membrane versus the connective tissue with partial-thickness double pedicle graft. J Periodontol. 68(8).

Harris R. 1998. A comparison of 2 root coverage techniques: Guided tissue regeneration with a bioabsorbable matrix style membrane versus a connective tissue graft combined with a coronally positioned pedicle graft without vertical incisions. Results of a series of consecutive cases. J Periodontol. 69(12).
Harris R. 2000. A comparative study of root coverage obtained with an acellular dermal matrix versus a connective tissue graft: Results of 107 recession defects in 50 consecutively treated patients. Int J Periodontol Restorative Dent. 20(1):51-59.
Harris R, Miller L, Harris C, Miller R. 2005. A comparison of three techniques to obtain root coverage on mandibular incisors. J Periodontol. 76(10):1758-1767.
Harris RJ. 2004. A short-term and long-term comparison of root coverage with an acellular dermal matrix and a subepithelial graft. J Periodontol. 75(5):734-743.
Henderson R, Greenwell H, Drisko C, Regennitter F, Lamb J, Mehlbauer M, Goldsmith L, Rebitski G. 2001. Predictable multiple site root coverage using an acellular dermal matrix allograft. J Periodontol. 72(5):571-582.
Henriques P, Pelegrine A, Nogueira A, Borghi M. 2010. Application of subepithelial connective tissue graft with or without enamel matrix derivative for root coverage: A split-mouth randomized study. J Oral Sci. 52(3):463-471.
Higgins JP, Altman DG, Gotzsche PC, Juni P, Moher D, Oxman AD, Savovic J, Schulz KF, Weeks L, Sterne JA et al. 2011. The cochrane collaboration's tool for assessing risk of bias in randomised trials. BMJ. 343:d5928.
Hirsch A, Goldstein M, Goultschin J, Boyan B, Schwartz Z. 2005. A 2-year follow-up of root coverage using sub-pedicle acellular dermal matrix allografts and subepithelial connective tissue autografts. J Periodontol. 76(8):1323-1328.
Huang L, Neiva R, Soehren S, Giannobile W, Wang H. 2005. The effect of platelet-rich plasma on the coronally advanced flap root coverage procedure: A pilot human trial. J Periodontol. 76(10):1768-1777.
Hwang D, Wang HL. 2006. Flap thickness as a predictor of root coverage: A systematic review. J Periodontol. 77(10):1625-1634.
Ibbott C, Oles R, Laverty W. 1985. Effects of citric acid treatment on autogenous free graft coverage of localized recession. J Periodontol. 56(11).
Ito K, Oshio K, Shiomi N, Murai S. 2000. A preliminary comparative study of the guided tissue regeneration and free gingival graft procedures for adjacent facial root coverage. Quintessence Int. 31(5):319-26.
Jahnke P, Sandifer J, Gher M, Gray J, Richardson A. 1993. Thick free gingival and connective tissue autografts for root coverage. J Periodontol. 64(4):315-322.
Jain A, Jaiswal G, Kumatalli K, Kumar R, Singh A, Sarwan A. 2017. Comparative evaluation of platelet rich fibrin and dehydrated amniotic membrane for the treatment of gingival recession- a clinical study. J Clin Diagn Res. 11(8):Zc24-zc28.
Jankovic S, Aleksic Z, Klokkevold P, Lekovic V, Dimitrijevic B, Kenney EB, Camargo P. 2012. Use of platelet-rich fibrin membrane following treatment of gingival recession: A randomized clinical trial. Int J Periodontics Restorative Dent. 32(2):e41-50.
Jankovic S, Aleksic Z, Milinkovic I, Dimitrijevic B. 2010. The coronally advanced flap in combination with platelet-rich fibrin (prf) and enamel matrix derivative in the treatment of gingival recession: A comparative study. Eur J Esthet Dent. 5(3):260-273.

Jepsen K, Heinz B, Halben J, Jepsen S. 1998. Treatment of gingival recession with titanium reinforced barrier membranes versus connective tissue grafts. J Periodontol. 69(3):383-391.
Jepsen K, Jepsen S, Zucchelli G, Stefanini M, de Sanctis M, Baldini N, Greven B, Heinz B, Wennstrom J, Cassel B et al. 2013. Treatment of gingival recession defects with a coronally advanced flap and a xenogeneic collagen matrix: A multicenter randomized clinical trial. J Clin Periodontol. 40(1):82-89.
Jepsen K, Stefanini M, Sanz M, Zucchelli G, Jepsen S. 2017. Long-term stability of root coverage by coronally advanced flap procedures. J Periodontol. 88(7):626-633.
Jhaveri H, Chavan M, Tomar G, Deshmukh V, Wani M, Miller P. 2010. Acellular dermal matrix seeded with autologous gingival fibroblasts for the treatment of gingival recession: A proof-of-concept study. J Periodontol. 81(4):616-625.
Joly J, Carvalho A, Silva R, Ciotti D, Cury P. 2007. Root coverage in isolated gingival recessions using autograft versus allograft: A pilot study. J Periodontol. 78(6):1017-1022.
Kassab M, Cohen R, Andreana S, Dentino A. 2006. The effect of edta in attachment gain and root coverage. Compend Contin Educ Dent. 27(6):353-360; quiz 361.
Keceli H, Sengun D, Berberoğlu A, Karabulut E. 2008. Use of platelet gel with connective tissue grafts for root coverage: A randomized-controlled trial. J Clin Periodontol. 35(3):255-262.
Kimble K, Eber R, Soehren S, Shyr Y, Wang H. 2004. Treatment of gingival recession using a collagen membrane with or without the use of demineralized freeze-dried bone allograft for space maintenance. J Periodontol. 75(2):210-220.
Köseoğlu S, Duran İ, Sağlam M, Bozkurt S, Kırtıloğlu O, Hakkı S. 2013. Efficacy of collagen membrane seeded with autologous gingival fibroblasts in gingival recession treatment: A randomized, controlled pilot study. J Periodontol. 84(10):1416-1424.
Kuis D, Sciran I, Lajnert V, Snjaric D, Prpic J, Pezelj-Ribaric S, Bosnjak A. 2013. Coronally advanced flap alone or with connective tissue graft in the treatment of single gingival recession defects: A long-term randomized clinical trial. J Periodontol. 84(11):1576-1585.
Kuru B, Yildirim S. 2013. Treatment of localized gingival recessions using gingival unit grafts: A randomized controlled clinical trial. J Periodontol. 84(1):41-50.
Lafzi A, Chitsazi M, Farahani R, Faramarzi M. 2011. Comparative clinical study of coronally advanced flap with and without use of plasma rich in growth factors in the treatment of gingival recession. Am J Dent. 24(3):143-147.
Lafzi A, Mostofi Zadeh Farahani R, Abolfazli N, Amid R, Safaiyan A. 2007. Effect of connective tissue graft orientation on the root coverage outcomes of coronally advanced flap. Clin Oral Investig. 11(4):401-408.
Laney J, Saunders V, Garnick J. 1992. A comparison of two techniques for attaining root coverage. J Periodontol. 63(1):19-23.
Leknes KN, Amarante ES, Price DE, Boe OE, Skavland RJ, Lie T. 2005. Coronally positioned flap procedures with or without a biodegradable membrane in the treatment of human gingival recession. A 6-year follow-up study. J Clin Periodontol. 32(5):518-529.
Lins L, Lima A, Sallum A. 2003. Root coverage: Comparison of coronally positioned flap with and without titanium-reinforced barrier membrane. J Periodontol. 74(2):168-174.
Lops D, Gobbato L, Nart J, Guazzo R, Ho D, Bressan E. 2015. Evaluation of root coverage with and without connective tissue graft for the treatment of single maxillary gingival

recession using an image analysis system: A randomized controlled clinical trial. Int J Periodontics Restorative Dent. 35(2):247-254.
Lucchesi J, Santos V, Amaral C, Peruzzo D, Duarte P. 2007. Coronally positioned flap for treatment of restored root surfaces: A 6-month clinical evaluation. J Periodontol. 78(4):615-623.
Mahajan A, Bharadwaj A, Mahajan P. 2012. Comparison of periosteal pedicle graft and subepithelial connective tissue graft for the treatment of gingival recession defects. Aust Dent J. 57(1):51-57.
Mahajan A, Dixit J, Verma UP. 2007. A patient-centered clinical evaluation of acellular dermal matrix graft in the treatment of gingival recession defects. J Periodontol. 78(12):2348-2355.
Matarasso S, Cafiero C, Coraggio F, Vaia E, de Paoli S. 1998. Guided tissue regeneration versus coronally repositioned flap in the treatment of recession with double papillae. Int J Periodontics Restorative Dent. 18(5):444-453.
Mazzocco F, Comuzzi L, Stefani R, Milan Y, Favero G, Stellini E. 2011. Coronally advanced flap combined with a subepithelial connective tissue graft using full- or partial-thickness flap reflection. J Periodontol. 82(11):1524-1529.
McGuire M, Nunn M. 2003. Evaluation of human recession defects treated with coronally advanced flaps and either enamel matrix derivative or connective tissue. Part 1: Comparison of clinical parameters. J Periodontol. 74(8):1110-1125.
McGuire M, Scheyer E. 2006. Comparison of recombinant human platelet-derived growth factor-bb plus beta tricalcium phosphate and a collagen membrane to subepithelial connective tissue grafting for the treatment of recession defects: A case series. Int J Periodontics Restorative Dent 26(2):127-133.
McGuire M, Scheyer E. 2010. Xenogeneic collagen matrix with coronally advanced flap compared to connective tissue with coronally advanced flap for the treatment of dehiscence-type recession defects. J Periodontol. 81(8):1108-1117.
McGuire M, Scheyer E. 2016. Long-term results comparing xenogeneic collagen matrix and autogenous connective tissue grafts with coronally advanced flaps for treatment of dehiscence-type recession defects. J Periodontol. 87(3):221-227.
McGuire M, Scheyer E, Nunn M. 2012. Evaluation of human recession defects treated with coronally advanced flaps and either enamel matrix derivative or connective tissue: Comparison of clinical parameters at 10 years. J Periodontol. 83(11):1353-1362.
McGuire M, Scheyer E, Schupbach P. 2009. Growth factor-mediated treatment of recession defects: A randomized controlled trial and histologic and microcomputed tomography examination. J Periodontol. 80(4):550-564.
McGuire M, Scheyer E, Snyder M. 2014. Evaluation of recession defects treated with coronally advanced flaps and either recombinant human platelet-derived growth factor-bb plus β-tricalcium phosphate or connective tissue: Comparison of clinical parameters at 5 years. J Periodontol. 85(10):1361-1370.
Milinkovic I, Aleksic Z, Jankovic S, Popovic O, Bajic M, Cakic S, Lekovic V. 2015. Clinical application of autologous fibroblast cell culture in gingival recession treatment. J Periodontal Res. 50(3):363-370.
Modica F, Pizzo M, Roccuzzo M, Romagnoli R. 2000. Coronally advanced flap for the treatment of buccal gingival recessions with and without enamel matrix derivative. A split-mouth study. J Periodontol. 71(11):1693-1698.

Moka L, Boyapati R, Mutthineni R, Putcha M, Gunturu K, Nagubandi K. 2014. Comparision of coronally advanced and semilunar coronally repositioned flap for the treatment of gingival recession. J Clin Diagn Res. 8(6):Zc04-zc08.
Moreira A, Santamaria M, Silverio K, Casati M, Nociti JF, Sculean A, Sallum E. 2016. Coronally advanced flap with or without porcine collagen matrix for root coverage: A randomized clinical trial. Clin Oral Investig. 20(9):2539-2549.
Moses O, Artzi Z, Sculean A, Tal H, Kozlovsky A, Romanos G. 2006. Comparative study of two root coverage procedures: A 24-month follow-up multicenter study. J Periodontol. 77(2):195-202.
Moslemi N, Mousavi Jazi M, Haghighati F, Morovati SP, Jamali R. 2011a. Acellular dermal matrix allograft versus subepithelial connective tissue graft in treatment of gingival recessions: A 5-year randomized clinical study. J Clin Periodontol. 38(12):1122-1129.
Muller H, Stahl M, Eger T. 1999. Root coverage employing an envelope technique or guided tissue regeneration with a bioabsorbable membrane. J Periodontol. 70(7):743-751.
Nazareth CA, Cury PR. 2011. Use of anorganic bovine-derived hydroxyapatite matrix/cell-binding peptide (p-15) in the treatment isolated class i gingival recession of defects: A pilot study. J Periodontol. 82(5):700-707.
Nemcovsky C, Artzi Z, Tal H, Kozlovsky A, Moses O. 2004. A multicenter comparative study of two root coverage procedures: Coronally advanced flap with addition of enamel matrix proteins and subpedicle connective tissue graft. J Periodontol. 75(4):600-607.
Nickles K, Ratka-Krüger P, Neukranz E, Raetzke P, Eickholz P. 2010. Ten-year results after connective tissue grafts and guided tissue regeneration for root coverage. J Periodontol. 81(6):827-836.
Nizam N, Bengisu O, Sonmez S. 2015. Micro- and macrosurgical techniques in the coverage of gingival recession using connective tissue graft: 2 years follow-up. J Esthet Restor Dent. 27(2):71-83.
Novaes A, Grisi D, Molina G, Souza S, Taba M, Grisi M. 2001. Comparative 6-month clinical study of a subepithelial connective tissue graft and acellular dermal matrix graft for the treatment of gingival recession. J Periodontol. 72(11):1477-1484.
Novaes AB, Jr., de Barros RR. 2008. Acellular dermal matrix allograft. The results of controlled randomized clinical studies. J Periodontol. 10(4):123-129.
Nunn ME, Miyamoto T. 2013. Coronally advanced flaps (caf) plus connective tissue graft (ctg) is the gold standard for treatment of miller class i and ii gingival defects. J Evid Based Dent Pract. 13(4):157-159.
Oates TW, Robinson M, Gunsolley JC. 2003. Surgical therapies for the treatment of gingival recession. A systematic review. Ann Periodontol. 8(1):303-320.
Oles R, Ibbott C, Laverty W. 1985. Effects of citric acid treatment on pedicle flap coverage of localized recession. J Periodontol. 56(5).
Ozcan G, Kurtis B, Balos K. 1997. Combined use of root conditioning, fibrin-fibronectin system and a collagen membrane to treat a localized gingival recession: A 10-case report. J Marmara Univ Dent Fac. 2(4):588-598.
Ozcelik O, Haytac M, Seydaoglu G. 2011. Treatment of multiple gingival recessions using a coronally advanced flap procedure combined with button application. J Clin Periodontol. 38(6):572-580.

Ozcelik O, Seydaoglu G, Haytac C. 2016. Diode laser for harvesting de-epithelialized palatal graft in the treatment of gingival recession defects: A randomized clinical trial. J Clin Periodontol. 43(1):63-71.
Ozcelik O, Seydaoglu G, Haytac MC. 2015. Prediction of root coverage for single recessions in anterior teeth: A 6-month study. J Clin Periodontol. 42(9):860-867.
Ozenci I, Ipci SD, Cakar G, Yilmaz S. 2015. Tunnel technique versus coronally advanced flap with acellular dermal matrix graft in the treatment of multiple gingival recessions. J Clin Periodontol. 42(12):1135-1142.
Ozturan S, Durukan SA, Ozcelik O, Seydaoglu G, Haytac MC. 2011. Coronally advanced flap adjunct with low intensity laser therapy: A randomized controlled clinical pilot study. J Clin Periodontol. 38(11):1055-1062.
Pagliaro U, Nieri M, Franceschi D, Clauser C, Pini-Prato G. 2003. Evidence-based mucogingival therapy. Part 1: A critical review of the literature on root coverage procedures. J Periodontol. 74(5):709-740.
Paolantonio M. 2002. Treatment of gingival recessions by combined periodontal regenerative technique, guided tissue regeneration, and subpedicle connective tissue graft. A comparative clinical study. J Periodontol. 73(1):53-62.
Paolantonio M, di Murro C, Cattabriga A, Cattabriga M. 1997. Subpedicle connective tissue graft versus free gingival graft in the coverage of exposed root surfaces. A 5-year clinical study. J Clin Periodontol. 24(1):51-56.
Paolantonio M, Dolci M, Esposito P, D'Archivio D, Lisanti L, Di Luccio A, Perinetti G. 2002. Subpedicle acellular dermal matrix graft and autogenous connective tissue graft in the treatment of gingival recessions: A comparative 1-year clinical study. J Periodontol. 73(11):1299-1307.
Papageorgakopoulos G, Greenwell H, Hill M, Vidal R, Scheetz J. 2008. Root coverage using acellular dermal matrix and comparing a coronally positioned tunnel to a coronally positioned flap approach. J Periodontol. 79(6):1022-1030.
Pilloni A, Paolantonio M, Camargo P. 2006. Root coverage with a coronally positioned flap used in combination with enamel matrix derivative: 18-month clinical evaluation. J Periodontol. 77(12):2031-2039.
Pini PG, Clauser C, Cortellini P, Tinti C, Vincenzi G, Pagliaro U. 1996. Guided tissue regeneration versus mucogingival surgery in the treatment of human buccal recessions. A 4-year follow-up study. J Periodontol. 67(11):1216-1223.
Pini PG, Pagliaro U, Baldi C, Nieri M, Saletta D, Cairo F, Cortellini P. 2000. Coronally advanced flap procedure for root coverage. Flap with tension versus flap without tension: A randomized controlled clinical study. J Periodontol. 71(2):188-201.
Pini PG, Tinti C, Vincenzi G, Magnani C, Cortellini P, Clauser C. 1992. Guided tissue regeneration versus mucogingival surgery in the treatment of human buccal gingival recession. J Periodontol. 63(11).
Pini Prato G, Rotundo R, Franceschi D, Cairo F, Cortellini P, Nieri M. 2011a. Fourteen-year outcomes of coronally advanced flap for root coverage: Follow-up from a randomized trial. J Clin Periodontol. 38(8):715-720.
Pini Prato G, Rotundo R, Franceschi D, Cairo F, Cortellini P, Nieri M. 2011b. Fourteen-year outcomes of coronally advanced flap for root coverage: Follow-up from a randomized trial. J Clin Periodontol. 38(8):715-720.

Pini Prato GP, Magnani C, Chambrone L. 2018. Long-term evaluation (20 years) of the outcomes of coronally advanced flap in the treatment of single recession-type defects. J Periodontol. 89(3):265-274.

Pini-Prato G, Baldi C, Pagliaro U, Nieri M, Saletta D, Rotundo R, Cortellini P. 1999. Coronally advanced flap procedure for root coverage. Treatment of root surface: Root planning versus polishing. J Periodontol. 70(9):1064-1076.

Pini-Prato G, Cairo F, Nieri M, Franceschi D, Rotundo R, Cortellini P. 2010. Coronally advanced flap versus connective tissue graft in the treatment of multiple gingival recessions: A split-mouth study with a 5-year follow-up. J Clin Periodontol. 37(7):644-650.

Pourabbas R, Chitsazi M, Kosarieh E, Olyaee P. 2009. Coronally advanced flap in combination with acellular dermal matrix with or without enamel matrix derivatives for root coverage. Indian J Dent Res. 20(3):320-325.

Rahmani ME, Lades MA. 2006. Comparative clinical evaluation of acellular dermal matrix allograft and connective tissue graft for the treatment of gingival recession. J Contemp Dent Pract. 7(2):63-70.

Rasperini G, Acunzo R, Pellegrini G, Pagni G, Tonetti M, Pini Prato GP, Cortellini P. 2018. Predictor factors for long-term outcomes stability of coronally advanced flap with or without connective tissue graft in the treatment of single maxillary gingival recessions: 9 years results of a randomized controlled clinical trial. J Clin Periodontol. 45(9):1107-1117.

Rasperini G, Roccuzzo M, Francetti L, Acunzo R, Consonni D, Silvestri M. 2011. Subepithelial connective tissue graft for treatment of gingival recessions with and without enamel matrix derivative: A multicenter, randomized controlled clinical trial. Int J Periodontics Restorative Dent. 31(2):133-139.

Reino D, Maia L, Fernandes P, Souza S, Taba JM, Palioto D, Grisi M, Novaes A. 2015. A randomized comparative study of two techniques to optimize the root coverage using a porcine collagen matrix. Braz Dent J. 26(5):445-450.

Reino D, Novaes JA, Maia L, Palioto D, Grisi M, Taba JM, Souza S. 2012. Treatment of gingival recessions in heavy smokers using two surgical techniques: A controlled clinical trial. Braz Dent J. 23(1):59-67.

Ricci G, Silvestri M, Tinti C, Rasperini G. 1996. A clinical/statistical comparison between the subpedicle connective tissue graft method and the guided tissue regeneration technique in root coverage. Int J Periodontics Restorative Dent. 16(6):538-545.

Roccuzzo M, Bunino M, Needleman I, Sanz M. 2002. Periodontal plastic surgery for treatment of localized gingival recessions: A systematic review. J Clin Periodontol. 29 Suppl 3:178-194; discussion 195-176.

Roccuzzo M, Lungo M, Corrente G, Gandolfo S. 1996. Comparative study of a bioresorbable and a non-resorbable membrane in the treatment of human buccal gingival recessions. J Periodontol. 67(1):7-14.

Romagna-Genon C. 2001. Comparative clinical study of guided tissue regeneration with a bioabsorbable bilayer collagen membrane and subepithelial connective tissue graft. J Periodontol. 72(9):1258-1264.

Roman A, Soancă A, Kasaj A, Stratul S. 2013. Subepithelial connective tissue graft with or without enamel matrix derivative for the treatment of miller class i and ii gingival recessions: A controlled randomized clinical trial. J Periodontal Res. 48(5):563-572.

Rosetti E, Marcantonio E, Zuza E, Marcantonio R. 2013. Root coverage stability of the subepithelial connective tissue graft and guided tissue regeneration: A 30-month follow-up clinical trial. J Dent. 41(2):114-120.
Rosetti E, Marcantonio R, Rossa C, Chaves E, Goissis G, Marcantonio E. 2000. Treatment of gingival recession: Comparative study between subepithelial connective tissue graft and guided tissue regeneration. J Dent. 71(9):1441-1447.
Salhi L, Lecloux G, Seidel L, Rompen E, Lambert F. 2014. Coronally advanced flap versus the pouch technique combined with a connective tissue graft to treat miller's class i gingival recession: A randomized controlled trial. J Clin Periodontol. 41(4):387-395.
Sangiorgio JPM, Neves F, Rocha Dos Santos M, Franca-Grohmann IL, Casarin RCV, Casati MZ, Santamaria MP, Sallum EA. 2017. Xenogenous collagen matrix and/or enamel matrix derivative for treatment of localized gingival recessions: A randomized clinical trial. Part i: Clinical outcomes. J Periodontol. 88(12):1309-1318.
Santamaria M, Ambrosano G, Casati M, Nociti JF, Sallum A, Sallum E. 2009a. Connective tissue graft plus resin-modified glass ionomer restoration for the treatment of gingival recession associated with non-carious cervical lesion: A randomized-controlled clinical trial. J Clin Periodontol. 36(9):791-798.
Santamaria M, Silva FD, Casati M, Nociti F, Sallum A, Sallum E. 2013. Randomized controlled clinical trial evaluating connective tissue graft plus resin-modified glass ionomer restoration for the treatment of gingival recession associated with non-carious cervical lesion: 2-year follow-up. J Periodontol. 84(9):e1-8.
Santamaria M, Silva FD, Nociti F, Casati M, Sallum A, Sallum E. 2009b. Cervical restoration and the amount of soft tissue coverage achieved by coronally advanced flap: A 2-year follow-up randomized-controlled clinical trial. J Clin Periodontol. 36(5):434-441.
Santamaria M, Suaid F, Casati M, Nociti F, Sallum A, Sallum E. 2008. Coronally positioned flap plus resin-modified glass ionomer restoration for the treatment of gingival recession associated with non-carious cervical lesions: A randomized controlled clinical trial. J Periodontol. 79(4):621-628.
Santamaria MP, Ambrosano GM, Casati MZ, Nociti FH, Jr., Sallum AW, Sallum EA. 2010. The influence of local anatomy on the outcome of treatment of gingival recession associated with non-carious cervical lesions. J Periodontol. 81(7):1027-1034.
Santamaria MP, Neves F, Silveira CA, Mathias IF, Fernandes-Dias SB, Jardini MAN, Tatakis DN. 2017. Connective tissue graft and tunnel or trapezoidal flap for the treatment of single maxillary gingival recessions: A randomized clinical trial. J Clin Periodontol. 44(5):540-547.
Santana R, Mattos C, Dibart S. 2010a. A clinical comparison of two flap designs for coronal advancement of the gingival margin: Semilunar versus coronally advanced flap. J Clin Periodontol. 37(7):651-658.
Santana RB, Furtado MB, Mattos CM, de Mello Fonseca E, Dibart S. 2010b. Clinical evaluation of single-stage advanced versus rotated flaps in the treatment of gingival recessions. J Periodontol. 81(4):485-492.
Santana RB, Mattos CM, Dibart S. 2010c. A clinical comparison of two flap designs for coronal advancement of the gingival margin: Semilunar versus coronally advanced flap. J Clin Periodontol. 37(7):651-658.

Schlee M, Esposito M. 2011. Human dermis graft versus autogenous connective tissue grafts for thickening soft tissue and covering multiple gingival recessions: 6-month results from a preference clinical trial. Eur J Oral Implantol. 4(2):119-125.
Shepherd N, Greenwell H, Hill M, Vidal R, Scheetz JP. 2009. Root coverage using acellular dermal matrix and comparing a coronally positioned tunnel with and without platelet-rich plasma: A pilot study in humans. J Periodontol. 80(3):397-404.
Shin SH, Cueva MA, Kerns DG, Hallmon WW, Rivera-Hidalgo F, Nunn ME. 2007. A comparative study of root coverage using acellular dermal matrix with and without enamel matrix derivative. J Periodontol. 78(3):411-421.
Silva R, Joly J, Lima A, Tatakis D. 2004. Root coverage using the coronally positioned flap with or without a subepithelial connective tissue graft. J Periodontol. 75(3):413-419.
Singh N, Uppoor A, Naik D. 2015. Semilunar coronally advanced flap with or without low level laser therapy in treatment of human maxillary multiple adjacent facial gingival recessions: A clinical study. J Esthet Restor Dent. 27(6):355-366.
Spahr A, Haegewald S, Tsoulfidou F, Rompola E, Heijl L, Bernimoulin J, Ring C, Sander S, Haller B. 2005. Coverage of miller class i and ii recession defects using enamel matrix proteins versus coronally advanced flap technique: A 2-year report. J Periodontol. 76(11):1871-1880.
Stefanini M, Jepsen K, de Sanctis M, Baldini N, Greven B, Heinz B, Wennstrom J, Cassel B, Vignoletti F, Sanz M et al. 2016. Patient-reported outcomes and aesthetic evaluation of root coverage procedures: A 12-month follow-up of a randomized controlled clinical trial. J Clin Periodontol. 43(12):1132-1141.
Taiyeb Ali TB, Shapeen IM, Ahmed HB, Javed F. 2015. Efficacy of acellular dermal matrix and autogenous connective tissue grafts in the treatment of gingival recession defects among asians. J Investig Clin Dent. 6(2):125-132.
Tal H, Moses O, Zohar R, Meir H, Nemcovsky C. 2002. Root coverage of advanced gingival recession: A comparative study between acellular dermal matrix allograft and subepithelial connective tissue grafts. J Periodontol. 73(12):1405-1411.
Tatakis D, Trombelli L. 2000. Gingival recession treatment: Guided tissue regeneration with bioabsorbable membrane versus connective tissue graft. J Periodontol. 71(2):299-307.
Tatakis DN, Chambrone L, Allen EP, Langer B, McGuire MK, Richardson CR, Zabalegui I, Zadeh HH. 2015. Periodontal soft tissue root coverage procedures: A consensus report from the aap regeneration workshop. J Periodontol. 86(2 Suppl):S52-55.
Thombre V, Koudale SB, Bhongade ML. 2013. Comparative evaluation of the effectiveness of coronally positioned flap with or without acellular dermal matrix allograft in the treatment of multiple marginal gingival recession defects. Int J Periodontics Restorative Dent. 33(3):e88-94.
Toledo LA, Toledo LE, Fraga M, Vitral R. 2009. The association of a polydioxanone tent without a guided tissue regeneration membrane to a coronal sliding flap for root coverage. J Periodontol. 80(10):1674-1679.
Tonetti MS, Cortellini P, Pellegrini G, Nieri M, Bonaccini D, Allegri M, Bouchard P, Cairo F, Conforti G, Fourmousis I et al. 2018. Xenogenic collagen matrix or autologous connective tissue graft as adjunct to coronally advanced flaps for coverage of multiple adjacent gingival recession: Randomized trial assessing non-inferiority in root coverage and superiority in oral health-related quality of life. J Clin Periodontol. 45(1):78-88.

Tözüm T, Keçeli H, Güncü G, Hatipoğlu H, Sengün D. 2005. Treatment of gingival recession: Comparison of two techniques of subepithelial connective tissue graft. J Periodontol. 76(11):1842-1848.
Trabulsi M, Oh T, Eber R, Weber D, Wang H. 2004. Effect of enamel matrix derivative on collagen guided tissue regeneration-based root coverage procedure. J Periodontol. 75(11):1446-1457.
Trivedi SR, Bhavsar NV, Dulani K, Trivedi R. 2014. Clinical evaluation of subepithelial connective tissue graft and guided tissue regeneration for treatment of miller's class 1 gingival recession (comparative, split mouth, six months study). J Clin Exp Dent. 6(3):e218-224.
Trombelli L, Scabbia A, Tatakis D, Calura G. 1998. Subpedicle connective tissue graft versus guided tissue regeneration with bioabsorbable membrane in the treatment of human gingival recession defects. J Periodontol. 69(11):1271-1277.
Trombelli L, Scabbia A, Wikesjö U, Calura G. 1996. Fibrin glue application in conjunction with tetracycline root conditioning and coronally positioned flap procedure in the treatment of human gingival recession defects. J Clin Periodontol. 23(9):861-867.
Trombelli L, Schincaglia G, Scapoli C, Calura G. 1995. Healing response of human buccal gingival recessions treated with expanded polytetrafluoroethylene membranes. A retrospective report. J Periodontol. 66(1):14-22.
Ucak O, Ozcan M, Seydaoglu G, Haytac M. 2017. Microsurgical instruments in laterally moved, coronally advanced flap for miller class iii isolated recession defects: A randomized controlled clinical trial. Int J Periodontics Restorative Dent. 37(1):109-115.
Wang H, Bunyaratavej P, Labadie M, Shyr Y, MacNeil R. 2001. Comparison of 2 clinical techniques for treatment of gingival recession. J Periodontol. 72(10):1301-1311.
Wang H, Romanos G, Geurs N, Sullivan A, Suárez-López DAF, Eber R. 2014. Comparison of two differently processed acellular dermal matrix products for root coverage procedures: A prospective, randomized multicenter study. J Periodontol. 85(12):1693-1701.
Wang H, Suárez-López DAF, Layher M, Eber R. 2015. Comparison of freeze-dried and solvent-dehydrated acellular dermal matrix for root coverage: A randomized controlled trial. Int J Periodontics Restorative Dent. 35(6):811-817.
Wennström J, Zucchelli G. 1996. Increased gingival dimensions. A significant factor for successful outcome of root coverage procedures? A 2-year prospective clinical study. J Clin Periodontol. 23(8):770-777.
Wilson Jr TG, McGuire MK, Nunn ME. 2005. Evaluation of the safety and efficacy of periodontal applications of a living tissue-engineered human fibroblast-derived dermal substitute. Ii. Comparison to the subepithelial connective tissue graft: A randomized controlled feasibility study. J Periodontol. 76(6):881-889.
Woodyard J, Greenwell H, Hill M, Drisko C, Iasella J, Scheetz J. 2004. The clinical effect of acellular dermal matrix on gingival thickness and root coverage compared to coronally positioned flap alone. J Periodontol. 75(1):44-56.
Yilmaz E, Ozcelik O, Comert M, Ozturan S, Seydaoglu G, Teughels W, Haytac M. 2014. Laser-assisted laterally positioned flap operation: A randomized controlled clinical trial. Photomed Laser Surg. 32(2):67-74.
Zanwar K, Laxmanrao Bhongade M, Kumar Ganji K, S BK, Gowda P. 2014. Comparative evaluation of efficacy of stem cells in combination with pla/pga membrane versus sub-

epithelial connective tissue for the treatment of multiple gingival recession defects: A clinical study. J Stem Cells. 9(4):253-267.
Zucchelli G, Amore C, Sforza N, Montebugnoli L, Sanctis M. 2003. Bilaminar techniques for the treatment of recession-type defects. A comparative clinical study. J Clin Peridontol. 30(10):862-870.
Zucchelli G, Clauser C, De Sanctis M, Calandriello M. 1998. Mucogingival versus guided tissue regeneration procedures in the treatment of deep recession type defects. J Periodontol. 69(2):138-145.
Zucchelli G, Felice P, Mazzotti C, Marzadori M, Mounssif I, Monaco C, Stefanini M. 2018. 5-year outcomes after coverage of soft tissue dehiscence around single implants: A prospective cohort study. Eur J Oral Implantol. 11(2):215-224.
Zucchelli G, Marzadori M, Mele M, Stefanini M, Montebugnoli L. 2012. Root coverage in molar teeth: A comparative controlled randomized clinical trial. J Clin Periodontol. 39(11):1082-1088.
Zucchelli G, Marzadori M, Mounssif I, Mazzotti C, Stefanini M. 2014a. Coronally advanced flap + connective tissue graft techniques for the treatment of deep gingival recession in the lower incisors. A controlled randomized clinical trial. J Clin Periodontol. 41(8):806-813.
Zucchelli G, Mele M, Mazzotti C, Marzadori M, Montebugnoli L, De Sanctis M. 2009a. Coronally advanced flap with and without vertical releasing incisions for the treatment of multiple gingival recessions: A comparative controlled randomized clinical trial. J Periodontol. 80(7):1083-1094.
Zucchelli G, Mele M, Stefanini M, Mazzotti C, Marzadori M, Montebugnoli L, De Sanctis M. 2010. Patient morbidity and root coverage outcome after subepithelial connective tissue and de-epithelialized grafts: A comparative randomized-controlled clinical trial. J Clin Periodontol. 37(8):728-738.
Zucchelli G, Mounssif I, Mazzotti C, Montebugnoli L, Sangiorgi M, Mele M, Stefanini M. 2014b. Does the dimension of the graft influence patient morbidity and root coverage outcomes? A randomized controlled clinical trial. J Clin Periodontol. 41(7):708-716.
Zucchelli G, Mounssif I, Mazzotti C, Stefanini M, Marzadori M, Petracci E, Montebugnoli L. 2014c. Coronally advanced flap with and without connective tissue graft for the treatment of multiple gingival recessions: A comparative short- and long-term controlled randomized clinical trial. J Clin Periodontol. 41(4):396-403.
Zucchelli G, Mounssif I, Mazzotti C, Stefanini M, Marzadori M, Petracci E, Montebugnoli L. 2014d. Coronally advanced flap with and without connective tissue graft for the treatment of multiple gingival recessions: A comparative short- and long-term controlled randomized clinical trial. J Clin Periodontol. 41(4):396-403.
Zucchelli G, Mounssif I, Stefanini M, Mele M, Montebugnoli L, Sforza NM. 2009b. Hand and ultrasonic instrumentation in combination with root-coverage surgery: A comparative controlled randomize clinical trial. J Periodontol. 80(4):577-585.
Zucchelli G, Stefanini M, Ganz S, Mazzotti C, Mounssif I, Marzadori M. 2016. Coronally advanced flap with different designs in the treatment of gingival recession: A comparative controlled randomized clinical trial. Int J Periodontics Restorative Dent. 36(3):319-327.
Zuhr O, Rebele S, Schneider D, Jung R, Hürzeler M. 2014. Tunnel technique with connective tissue graft versus coronally advanced flap with enamel matrix derivative for root

coverage: A rct using 3d digital measuring methods. Part i. Clinical and patient-centred outcomes. J Clin Periodontol. 41(6):582-592.