Table 2 **The quality of the studies those were included in the review.**

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| Studies Quality items | Shah and Logani 2012 | Parayani and Kim 2013 | Saoud et al 2014 | Souad et al 2015 | Priya et al 2016 | Saoud 2016 | Nagas 2018 | Nageh 2018 | Jha 2019 | Arslan et al 2019 | El-Kateb et al 2019 |  |  |  |  |  |  |
| Was the research goal clearly defined? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |
| Was the intervention fully described for the intervention group? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |
| Was the intervention fully described  for the control group? | NA | NA | NA | NA | NA | NA | NA | NA | NO | YES |  |  |  |  |  |  |  |
| Was the study population clearly  defined? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Was it stated how subjects were  attained? | N | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Were the subjects clearly defined? | Y | Y | Y | Y | Y | Y | Y | NO | Y | Y |  |  |  |  |  |  |  |
| Was the method of allocation, or  similarity between groups described? | NA | NA | NA | NA | NA | NA | NA | NA | Y | Y |  |  |  |  |  |  |  |
| Were groups compared on any  variables? | NA | NA | NA | NA | NA | NA | NA | NA | Y | Y |  |  |  |  |  |  |  |
| Were the outcome measures  clearly defined? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Were the outcome measures  objective? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Were the outcome measures  tested for validity? | Y | Y? | ? | Y |  | Y! | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Were the outcome measures  tested for reliability? | Y | Y? | ? | Y |  | Y! | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Were the outcome assessors blinded? | DK | DK | DK | DK | DK | DK | DK | DK | Y | Y |  |  |  |  |  |  |  |
| Was the participants blinded? | NO | NO | NO | NO | NO | NO | NO | NO | Y | Y |  |  |  |  |  |  |  |
| Was the statistical analysis  appropriate? | NA | NA | NA | NA | NA | NA | NA | Y | Y | Y |  |  |  |  |  |  |  |
| Was the sample size for each  group given? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Was there a sample size justification? | Y | Y | Y | Y | Y | Y | N | Y | Y | Y |  |  |  |  |  |  |  |
| Was the statistical significance  defined? | NA | NA | NA | NA | NA | NA | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Was drop-out rate given? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Was drop-out rate <10%? | NO | Y | Y | Y | NO | NO | Y | Y | Y | Y |  |  |  |  |  |  |  |
| Were drop-outs accounted for? | - | - | - |  |  |  |  | - | - | - |  |  |  |  |  |  |  |
| Quality score |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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**Characteristics of the Studies**

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| Authors | Study design / sample (n) | Patient age/ kind of teeth | Diagnosis | Dezinfection | Final irrigant | Apical diameter (K file) | Type of intervention | Postoperative Restoration | Clinical outcome (signs and symptoms, vitality response) | Radiographic outcome | Recall time | Level of evidence |  |
| Shah and Logani 2012 | Case series/ 18 cases | 15-76y | AAA or CAA | 2.5% NaOCl | An antimicrobial | 25-30 K file | -Induced bleeding  -Cavit for cervical third | A suitable coronal restoration (not mentioned more specifically) | All teeth healed | Complete resolution or decreased in size periapical lesion was evident | -6 months: 3 cases  -2 years: 5 cases  -2 and ½ years: 5 cases  -3 years: 5 cases |  |  |
| Parayani and Kim 2013 | Case report / 2 cases = 2 Teeth | 14 y girl / #8 | Previously initiated with SAP | -5.25% NaOCl, -Ca(OH)2 | 17% EDTA | 60 | -Induced Bleeding,  -Dusted with ciprofloxacin poweder  -Collacote  -MTA | GIC | -Asymptomatic  -Nomral response to pulp tests | -Complete resolution of periapical radiolucency  -Thickening of the root canal wall | 22 months |  |  |
|  |  | 11y girl / #9 | Necrosis and AAP | -5.25% NaOCl, -17% EDTA  -Ciprofloxacin powder | 17% EDTA | 60 | Induced Bleeding,  -Dusted with ciprofloxacin poweder  -Collacote  -MTA | GIC | -Asymptomatic  - No response to pulp tests | -Complete resolution of periapical radiolucency  -No thickening of the root canal walls | 18 months |  |  |
| Saoud et al 2014 | Case report/ 1 case =  2 teeth | 23 y female / #8 | Trauma, AAA | -2.5% NaOCL  -TAP | Saline | 100 | -Induced Bleeding,  -MTA | GIC | -Asymptomatic  -No response to pulp tests | - Complete resolution of periapical radiolucency | 1 year |  |  |
|  |  | Same patient / #7 | Trauma,  SAP | -2.5% NaOCL  -TAP | Saline | 35 | -Induced Bleeding,  -MTA | GIC | -Asymptomatic  -No response to pulp tests | -Hard tissue formation in the canal | 1 year |  |  |
| Souad et al 2015 | Case report/ 2 Cases= 2 teeth | 26 y male / #9 | -Trauma 10 years ago  -Previously treated with AAA | -2.5% NaOCL  -Saline  -Metapaste | 17% EDTA | 60 | -Induced Bleeding,  -MTA | Composite | - Asymptomatic  -No response to pulp tests | -Apical closure  -Thickening of the root canal wal | 13 months |  |  |
|  |  | 12y boy / #19 | Previously treated with CAA | -Carrene Gutta-percha solvent  -2.5% NaOCl  -Metapaste | 17% EDTA | 40 distal and 30 mesials | -Induced Bleeding,  -MTA | IRM | - Asymptomatic  -No response to pulp tests | Complete resolution of periapical radiolucency for the distal root and reduced in size mesial | 14 months |  |  |
| Priya et al 2016 | Case report / 1 case | 11y boy / #9 | Avulsion and replantation | -Saline  -5.5% NaOCl | saline | 150-200 | PRP and GIC | GIC | -Asymptomatic  -Physiologic mobiloty  -Nomral response to pulp test | -Resolution of apical radiolucency  -Resorption that remained stable after the first 6 months | 12 months |  |  |
| Saoud 2016 | Case series / 6 patients = 7 teeth | 8-21 y , 6 males and 4 females /  4 anterior and 3 molars | -3 with AAA  - 2 SAP  -1 AAP  -1 CAA | -2.5% NaOCl  -Metapaste  -IRM | 17% EDTA | -F5 for # 8 and #9  -F3 for #25  -F2 for mesials canals and F4 for distal canals for #19 and #30 | -Induced Bleeding,  -MTA | Composite or amalgam | All teeth asymptomatic  And did not respond to pulp tests | Criteria by Orstarvic et al 1986 and 1996:  2 healed  5 healing | 8 to 26 months |  |  |
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| Arslan et al 2019 (2) | Case report  1 patient / 2 teeth | 20 y old / central incisors #8 and #9 | Not written, from symptoms the diagnosis is necrosis with AAA | 1% NaOCl,  5% EDTA | saline | Size #80 | -Induced bleeding  -MTA | composite | All teeth asymptomatic  -Response to electric pulp tests | Resolved radiolucency for both teeth | 3 years and 5 months |  |  |
| Arslan et al 2019 | RCT / 49 patients=  56 teeth | -56 teeth = 28 treated with CRCT and 28 with REP  -Single canal teeth (anterior or premolars) | Nonvital with periapical lesion score >=3 (Orstavik et al 1986) | -2ml of 1% NaOCl after each file and 5ml last irrigation followed by  -5% EDTA  - CRCT group:  Ca(OH)2  -REP group: TAP | -5% EDTA | 5 or 6 sizes larger than the first binding file size | -CRCT group: GP cone and epoxy resin-based sealer with cold lateral compaction technique  -REP group: Induced Bleeding and MTA | Composite | -20 from CRCT and 26 from REP were followed up  -Success: 80% of the CRCT/4 failed  And 92.3% of the REP (2 failed)  - | Absence or reduction of the radiolucency for the CRCT was 85% and for REP 92.4% | 12 months |  |  |
| El-Kateb et al 2019 | RCT/  18 teeth | 20-34 y/  AAA or CAA  - Maxilary anterior teeth | AAA or CAA  13 caused by trauma and 5 because of defective restoration | -20ml NaOCl  -Ca(OH)2 | -5% EDTA | -Test group: 9 teeth  Instrumented to PTN X3  -Control group: 9 teeth instrumented to X5 | Induced Bleeding and Biodentine | Composite | All teeth asymptomatic  -77.8% in the X3,  88.9% in the X5 regained sensitivity in 12 months | No significant difference with MRI for the 2 groups in 12 months | 12 months |  |  |
| Nageh 2018 | Case series | 18-40 years old/ 15 upper central incisors | Necrosis with and without AP | 1.5%NaoCl  - DAP (500mg metronidazole, 500mg ciprofloxacin) | 20ml 17% EDTA followed by saline | 60-80 K files | 1st visit: K file #60-80,  5ml of patient’s blood, PRF clot and red blood cells at the bottom.PRF was placed inside the canal, 3mm of MTA | Composite | No pain, swelling or fistula  9 sensitivity on cold | Teeth with preoperative apical radiolucency showed radiographic  resolution of apical periodontitis, and no teeth without preoperative  Radiolucency showed any bony changes after 12 months of follow-up. | 1year |  |  |
| Jha 2019 | RCT | 30 mature teeth/ 9-15 years | AP | 2.5% NaoCl  -1st group TAP | 17 % EDTA | 1st group: 25-30 K files  2nd: Protaper universal | 1st group: first visit: Seal bio tehnique, Calcium sulfate- based cement (cavit G) condensed into the cervical third of root canal.  2nd group: instrumentation and on second visit cold lateral obturation | Suitable coronal restoration | None persisting pain | Timewise: statistically significant difference with the 1st group to have 20.57 min less mean time than 2nd.  No difference in PAI score. 13 of 15 in group I were completely healed, 12 of 15 in group II | 18 months |  |  |
| Nagas 2018 | Case report | 21 year old/ 2 central incisors | Previously traumatised with AP | -20ml 5.25% NaOCl  -TAP | 17% EDTA | Unknown- no instrumentation | -Induced Bleeding  -ProRoot MTA | Composite | Asymptomatic, no sensitivity to percussion and palpation, From the initial visit, non-responsive to cold or electric test | Complete resolution of radiolucency and regeneration of periradicular tissues | 60 months |  |  |