**Table: 2: characteristics of the studies included**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Study ID** | **Implant type** | **Surface characteristics** | | | **Cell proliferation** | **ALP activity** | **Biofilm thickness** | **Other outcomes** |
| **Spectra** | **Contact angle** | **Surface roughness** |
|  | Hazel Paloma Reis  Corado 2022 [7] | 1.Ti  2. Ti-GO  3. Ti-NB.  4. Ti-NBGO. | EDS spectra | 1.Ti: 50.74 ± 4.6  2. Ti-GO: 100.35 ±10.85  3. Ti-NB.: 44.33 ± 10.0  4. Ti-NBGO:  55.86 ± 6.1 | 0.52 ± 0.06  0.44 ± 0.03  0.47 ± 0.04  0.64± 0.47 | NA | NA | NA | **Surface energy**  51.61 ± 4.79  40.80 ± 13.47  12.94 ± 9.33  46.10 ± 6.38 |
|  | Shin YC 2022 [8] | 1. ST (control)  2. rhBMP-2-immobilized ST (BI-ST), 3. rhBMP-2-treated ST (BT-ST),  4. rGO-coated ST (R-ST). | Raman shift | ST:  79.3 ± 0.9 nm  R-ST discs:  7.1 ± 1.8 nm, |  | 21 days:  ST: 400  BI-ST: 395  BT-ST: 395  R-ST: 500 | 21 days:  ST: 15  BI-ST: 25  BT-ST: 50  R-ST: 98 |  | Cell attachment:  ST: 100  BI-ST: 100  BT-ST: 120  R-ST: 150 |
|  | Cui Guo 2021 [9] | 1. PEEK (P)  2. PEEK PDA (PA)  3. PEEK PDA GO (PAG) | PAG coated  PEEK materials | 1. P: 83.5⁰ ± 0.74  2. PA: 68⁰ ±3.1  3. PAG:  53⁰ ± |  |  |  |  |  |
| 4 | Moon sung Kang;  2021 [10] | 1. Intact Ti  2. rGO Ti | rGO Ti showed strong Raman peak  successfully coated rGO on Ti substrates | 1. Intact Ti:  127.4 ± 1.0  2. rGO Ti:  76.3 ± 2.4 | **Surface energy**  1. Intact Ti:  8.0 ± 0.5  2. rGO Ti:  37.7 ± 1.1 | 1. Intact Ti:  400  2. rGO Ti:  500 | 1. Intact Ti: 10  2. rGO Ti:  25 |  | Mineralization:  1. Intact Ti: 250  2. rGO Ti:  1000 |
| 5 | Sunho Park; 2020  [11] | 1. Chitosan implant  2. Graphene chitosan  1%  3%  5% | Surfaces of hybrid  Implants showed  GO integration  compared to  Chitosn implants. | 1. Chitosan:  61.5°  2. GC 1%:  56.2°,  3% GC :  54.6°, and  5% GC :  54.5°. | 1. Chitosan:  114.6 ± 7.9 nm  2. GC 1%:  124.6 ± 4.7 nm  3% GC :  140.7 ± 8.8 nm  and  5% GC:  149.0 ± 7.2 nm | 1. Chitosan implant:  1 abr unit  2. GC:  1%: 1.8  3%:1.5  5%: 1.5 |  | 1. Chitosan:  18 m  2. Graphene chitosan  1%: 10m  3%: 15m  5%: 10m05 | antibacterial effect:  1% GC > 3% GC > 5% GC > chitosan) |
| 6 | M. Mazaheri, 2014  [12] | 1. Chitosan  2. GO(1.5 wt%)–chitosan  3. GO(3 wt%)–chitosan  4. GO(6 wt%)–chitosan |  |  | 1. Chitosan: 1.6 ± 0.1  2. GO(1.5 wt%) chitosan: 2.4 ± 0.2  3. GO(3 wt%)–chitosan: 12.9 ± 1.1  4. GO(6 wt%+)–chitosan  17.5 ± 2.9 |  |  | NA |  |