Table S1. Data from the selected studies.

Author (year)	Purpose	Study design	Methods	Zirconia type	Porosity	Main outcomes
Malmstrom et al., (2009)[6]	Evaluation of the effect of material and microporosity on bone ingrowth and osseointegration of zirconia and hydroxyapatite scaffolds.	*In vivo* 12 patients (6 men and 6 women, 48–72 years old) subjected to dental implant placemet in the maxilla	Biopsies SEM x-ray diffraction (XRD) Photography (Nikon digital camera) Histomorphometry ((Eclipse E600 light microscope) and connected computer software) CAD	3% Y_2O_3 and 97% Z_rO_2 (YTZP), (Tosoh, Japan)	Interconnected pore channels with 350 μm diameter. 40% porosity	Microporous Hap revealed four times larger bone ingrowth and seven times larger bone contact as compared with YTZP scaffolds.
Kim, et al., (2008)[2]	Investigation the in vivo performance of the engineered bioceramic scaffolds using a rabbit calvarial defect model.	*InVivo* Eighteen male New Zealand white rabbits weighing 2.5–3 kg	SEM Compressive strength test (Instron (Model 3344, USA))	(ZrO_2 with 3 mol % Y_2O_3, Cerac Inc., WI)	45 ppi large pore; 60 ppi small pore; ~~ 84-87% high porosity ~~75% low porosity	The scaffold with relatively high porosity exhibited better bone regeneration ratio, but the pore size of the scaffolds did not have any significant influence on their bone regeneration ability.

Malmstrom et al., (2008)[1]	Evaluation of the effects of material composition and surface topography on bone ingrowth and bone contact	*InVivo* Eight female adult New Zealand white rabbits, weighing 4.4–5.6 kg	CAD XRD SEM Optical Interferometry (MicroXam™, PhaseShift, Tucson, USA) Morphometry ((Eclipse E600 light microscope) and connected computer software)	3% Y_2O_3 and 97% Z_rO_2 (YTZP) (Tosoh, Japan)	Interconnected pore channels with a size around 350 μm 50% porosity	The bone contact in scaffolds of zirconia and hydroxyapatite was not found to be influenced by the two different surface topographies.
Grandfield et al., (2010)[4]	Evaluation of the bone-bonding abilities of HA and Z_rO_2 scaffolds produced by free-form fabrication in the human maxilla at 3 months and 7 months.	*InVivo* Patients between the ages of 20 years	CAD tool (Solid Works, Concord, MA, USA) Biopsies SEM TEM	3% Y_2O_3 and 97% Z_rO_2 (YTZP) (Tosoh, Japan)	Interconnected channels (approximately 350 μm) 0,7% porosity	In HA scaffolds implanted for 3 months, images reveal the in vivo formation of an interfacial apatite layer that exhibits intimate contact with bone along the interface region.
Song et al., (2014)[5]	Evaluation of the properties of a porous zirconia scaffold coated with bioactive materials and compare the *in vitro* cellular behavior of	*InVitro*	SEM XRD Energy disperse x-ray spectrometer (XFlash Detector 5010, Brunker, Fitchburg, WI, USA)	3% Y_2O_3 and 97% Z_rO_2 (LAVA™ Zirconia Block, 3M ESPE, Neuss, Germany)	200-500 μm	Zirconia had greater osteoblast cell activity than titanium. The interconnecting pores of the zirconia scaffolds showed enhanced proliferation and cell differentiation. The activity of osteoblast was more affected by microstructure than by coating materials.

	MC3T3-E1 preosteoblastic cells to titanium and zirconia disks and porous zirconia scaffolds					
Balagangadharan et al., (2018)[26]	Synthesizion and characterizion biocomposite scaffolds containing chitosan (CS), nano-hydroxyapatite (nHAp) and nano zirconium dioxide (nZ_rO_2) along with microRNA (miRNA) for BTE applications.	*InVitro*	Biocomposite scaffolds were fabricated using freeze-drying method. SEM XRD	Sigma Aldrich, MO, USA.	Interconnected 55–65μm	The prepared $CS/nHAp/nZ_rO_2$ biocomposite scaffolds showed osteoinductive property, and the addition of bioactive molecule such as miR-590-5p to the scaffolds further increased osteoblast differentiation.
Shao et al., (2016)[7]	Evaluation of the effects of porous gradient composites with hydroxyapatite/zirconia and autologous iliac in repair of lumbar vertebra body defects in dogs.	*InVivo* 18 adult beagle dogs, aged five to eight months and weighted 10–13 kg.	X-ray Biopsies	Produced by School of Materials Science and Enginnering, Shanghai University	150 and 300 μm	Histomorphologic study showed that the amount of bone within pores of the porous gradient hydroxyapatite/zirconia composites increased continuously with a prolonged implantation time, and that partial composites were degradated and replaced by new-bone trabeculae.
Kim et al., (2003)[31]	Fabrication of various calcium phosphate coatings of single	*InVitro*	XRD SEM	(3 mol % Y_2O_3, Cerac Inc., WI)	500–700 μm ~90%	For all coated scaffolds, the cells spread well and migrated deep into the pore channels, suggesting the

	phases (HA, FA, TCP) and their mixtures (HA+ FA, HA + TCP) over Z_rO_2 porous scaffolds using the powder slurry method and investigation of their *in vitro* dissolution behaviors and the cellular responses to them.					osteoconducting characteristics of the porous scaffolds.
An et al., (2012)[8]	Evaluation of the usefulness of the porous Z_rO_2/HAp composite material for bone tissue repair, in this study was investigated physical properties and cellular compatibility of the material. Moreover, it was also implanted cell-loaded porous Z_rO_2 /HAp scaffolds in critical-size bone defects to evaluate the effect of the	*InVivo* Eight-week-old male SD rats (320–360g)	SEM TEM XRD	3% Y_2O_3 and 97% Z_rO_2, (Tosoh, Japan)	70-90 µm Interconnected pores channels 2,5-2,8% porosity	Scaffolds containing more than 80% Z_rO_2 showed less affinity to cells than did scaffolds containing less Z_rO_2. Cell proliferation study indicated that higher contents of HAp (≤30%) in the composite enhanced cell proliferation.

	material for bone tissue repair.					
Matsumoto et al., (2011)[20]	Fabrication of a composite material that has mechanical properties similar to biocortical bone and high bioaffinity by compounding hydroxyapatite (HAp) with the base material zirconia (Z_rO_2), which possesses high mechanical properties and low toxicity toward living organisms. The material characteristics including the cellular and tissue affinity of the fabricated material were investigated in this study.	*InVivo* SD rats (6-week-old, male) (*n* = 5)	TEM SEM XRD Compression test (AGS-500D, crosshead speed = 1mm/s, Shimadzu, Japan)	3% Y_2O_3 and 97% Z_rO_2, (Tosoh, Japan)	10μm	In this study, while Z_rO_2 showed poor cell adhesion, HAp and the Z_rO_2 /HAp composite specimens showed favorable cell adhesions.
Hadjicharalambous et al., (2015)	Fabrication and characterization the mechanical properties of	*InVitro*	SEM XRD Compression tests Instron-1185	Z_rO_2 (3 mol. % Y_2O_3) Siberian Enterprise	100μm 50% porosity	This study demonstrates the suitability of all three porous ceramic materials for osteoblast proliferation, differentiation and matrix mineralization, with the

	medium porosity (50–60%) and bimodal pore size scaffolds: alumina (A-61), yttria-stabilized zirconia (Z-50) and zirconia–alumina composite (ZA-60) (80 wt% Zr(Y)O –20 wt% Al O), and comparing the proliferation, morphology and differentiation of MC3T3 pre-osteoblasts on these materials.		Universal Testing Machine with 100kN capacity at a strain rate of $3x10^{-4}s^{-1}$.	Chemical Group		zirconia-containing materials Z-50 and ZA-60 displaying a better cellular response.
Aboushelib et al., (2017)[23]	Evaluation of osteogenesis ability of CAD/CAM porous zirconia scaffolds enriched with hydroxy apatite used to augment large boney defects in a dog model.	*InVivo* 2-year-old healthy male Beagle dogs (weighing 10–12 kg)	Cone beam CT radiographic imaging CAD/CAM Pore Sizer (Porosimeter, Micromeritics 9320, USA) Energy dispersive X-ray (EDX) XRD	3% Y_2O_3 and 97% Z_rO_2, (Tosoh, Japan)	Interconnected pores 85 ± 24 µm	HA enriched zirconia scaffolds revealed significantly higher volume of new bone formation (33% ± 14) compared to the controls (21% ± 11). New bone deposition started by coating the pore cavity walls and proceeded by filling the entire pore volume. Bone ingrowth started from the surface of the scaffold and propagated towards the scaffold core. Islands of entrapped hydroxy apatite particles were observed in mineralized bone matrix.

Zhu et al., (2015)[11]	Evaluation of the relationship between porosity, pore size, mechanical strength, cell adhesion, and cell proliferation in the zirconia scaffolds.	*InVitro*	SEM XRD Micro-CT Compression tests computer-controlled Universal Testing Machine (Instron-3365, USA)	3% Y_2O_3 and 97% Z_rO_2, (Tosoh, Japan)	830–577 µm 92,7-68,0% porosity	The zirconia scaffold with a porosity of 75.2% possesses favorable mechanical and biological properties for future applications in bone tissue engineering.
Shao et al., (2018)[10]	Evaluation the effects of porous gradient composites with hydroxyapatite/zirconia and autologous iliac in repair of lumbar vertebra body defects in dogs.	*InVivo* Twenty-four healthy rhesus monkeys (5-7 years old, 5-8 kg)	Micro-CT Histomorphometry Biomechanical testing X-ray	Produced by School of Materials Science and Enginnering, Shanghai University	150-300 µm	The results of biomechanical testing indicated that the vertebral body compression strength of the PGHC implant was lower than the other implants. RT-PCR and western-blot analyses showed that the expression of bone-related proteins in the BGS implant was significantly higher than in the PGHC implant. The BGS displayed reparative effects similar to autologous bone. Therefore, BGS use in vertebral bone defect repair appears promising.