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# 2023





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**Title:** Local Intraoperative Marrow-Derived Augmentation for Primary Rotator Cuff Repair: An Updated Systematic Review and Meta-Analysis of Studies from 2010-2022

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# Retear rates in rotator cuff repair remain poor despite increasing incidence of repair

- The incidence of RCR has risen dramatically, with one study showing a 188% increase in total RCRs from 2007 to 2015
- Incidence of re-tear varies widely depending on tear size and repair technique, ranging from 11 – 94%



# Biologic augmentation of RCR is proposed to improve healing and reduce retear

- Marrow stimulation via microfracture and marrow venting, as well as use of vented anchors, are methods of stimulating elution of marrow elements via breaks/pores in the proximal humeral cortex at the site of RCR



# Purpose and Hypothesis

## Purpose

To provide a focused, updated systematic review and meta-analysis of intraoperative marrow stimulation techniques in the clinical setting.

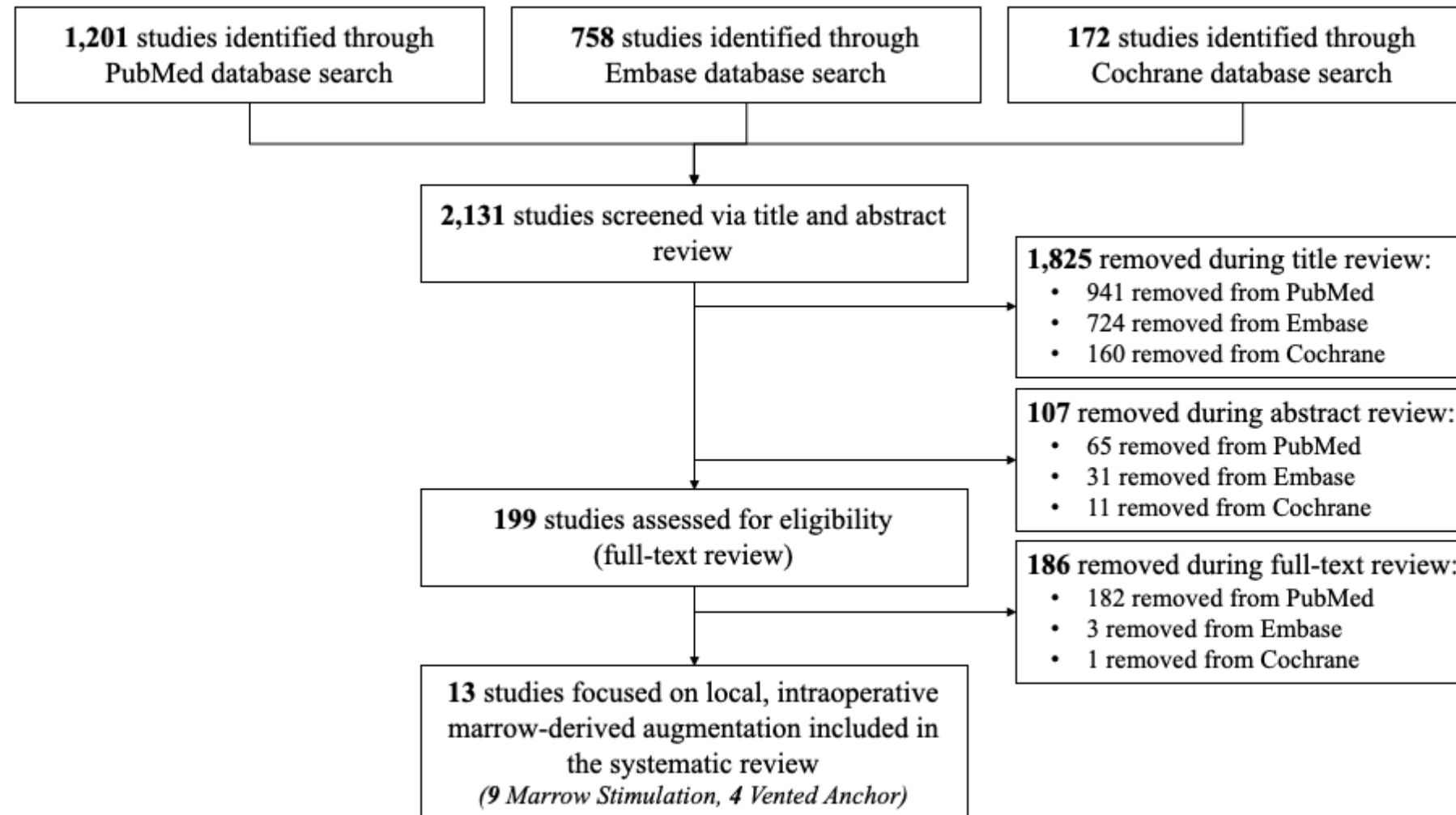
## Hypothesis

Marrow stimulation and vented anchors will demonstrate improvements in retear rates and functional outcomes, as preclinical evidence suggests improvement in biomechanical and histological parameters with operative marrow-elution techniques.





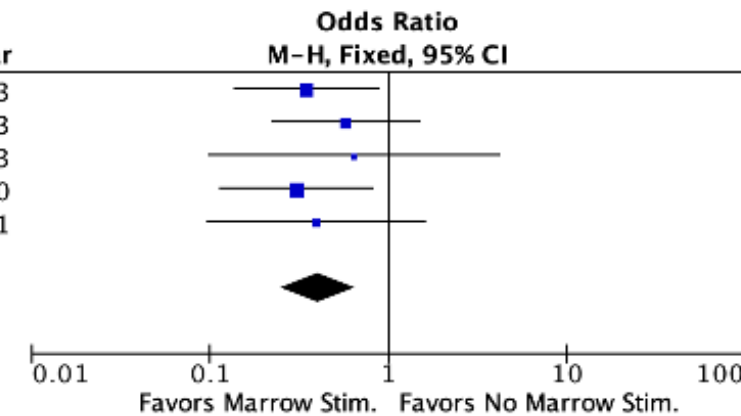
# We identified 13 clinical studies; 9 were focused on marrow stimulation and 4 on vented anchors.



# Marrow stimulation demonstrates significant improvements in retear and Constant Score

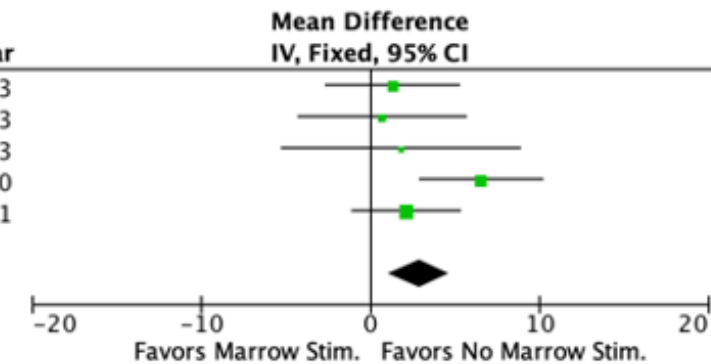
## A) Retear rate in patients undergoing RCR +/- marrow stimulation

Study or Subgroup	Marrow Stim.		No Marrow Stim.		Weight	Odds Ratio M-H, Fixed, 95% CI	Year
	Events	Total	Events	Total			
Jo 2013 <sup>18</sup>	10	45	19	42	28.9%	0.35 [0.14, 0.88]	2013
Milano 2013 <sup>24</sup>	12	35	18	38	21.5%	0.58 [0.23, 1.49]	2013
Osti 2013 <sup>28</sup>	2	28	3	28	5.3%	0.64 [0.10, 4.17]	2013
Pulatkan 2020 <sup>31</sup>	6	44	27	79	31.6%	0.30 [0.11, 0.81]	2020
Toro 2021 <sup>38</sup>	3	62	7	61	12.7%	0.39 [0.10, 1.59]	2021
<b>Total (95% CI)</b>		<b>214</b>		<b>248</b>	<b>100.0%</b>	<b>0.40 [0.25, 0.66]</b>	
Total events	33		74				
Heterogeneity: $\text{Chi}^2 = 1.23$ , $\text{df} = 4$ ( $P = 0.87$ ); $I^2 = 0\%$							
Test for overall effect: $Z = 3.63$ ( $P = 0.0003$ )							



## B) Constant Score in patients undergoing RCR +/- marrow stimulation

Study or Subgroup	Marrow Stim.			No Marrow Stim.			Weight	Mean Difference IV, Fixed, 95% CI	Year
	Mean	SD	Total	Mean	SD	Total			
Osti 2013 <sup>28</sup>	92.3	7.7	28	91	7.3	28	21.5%	1.30 [-2.63, 5.23]	2013
Jo 2013 <sup>18</sup>	76.28	13.53	57	75.61	14.67	67	13.5%	0.67 [-4.30, 5.64]	2013
Milano 2013 <sup>24</sup>	94.5	14	35	92.7	16.7	38	6.7%	1.80 [-5.25, 8.85]	2013
Pulatkan 2020 <sup>31</sup>	79.8	8.4	44	73.28	11.9	79	25.5%	6.52 [2.91, 10.13]	2020
Toro 2021 <sup>38</sup>	92.9	5.9	62	90.8	11.23	61	32.9%	2.10 [-1.08, 5.28]	2021
<b>Total (95% CI)</b>			<b>226</b>			<b>273</b>	<b>100.0%</b>	<b>2.84 [1.02, 4.66]</b>	
Heterogeneity: $\text{Chi}^2 = 5.60$ , $\text{df} = 4$ ( $P = 0.23$ ); $I^2 = 29\%$									
Test for overall effect: $Z = 3.05$ ( $P = 0.002$ )									

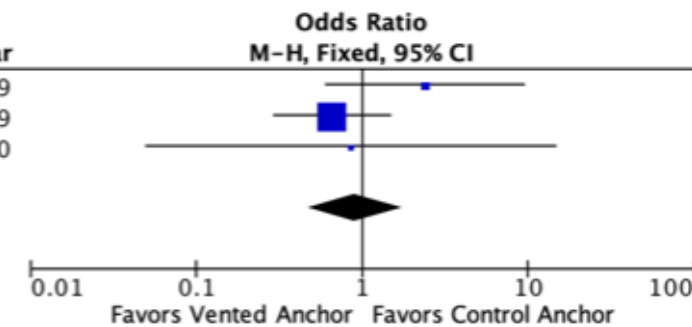




# Use of vented anchors in RCR did not significantly impact retear rate or Constant Score.

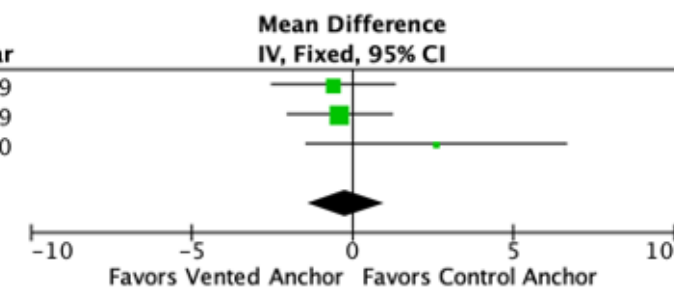
## A) Retear rate in patients undergoing RCR +/- vented anchor

Study or Subgroup	Vented Anchor		Control Anchor		Weight	Odds Ratio M-H, Fixed, 95% CI	Year
	Events	Total	Events	Total			
Sarmiento 2019 <sup>33</sup>	8	18	5	20	13.8%	2.40 [0.61, 9.49]	2019
Ro 2019 <sup>32</sup>	9	40	53	173	80.8%	0.66 [0.29, 1.48]	2019
Kim 2020 <sup>19</sup>	1	22	1	19	5.4%	0.86 [0.05, 14.71]	2020
<b>Total (95% CI)</b>		<b>80</b>		<b>212</b>	<b>100.0%</b>	<b>0.91 [0.47, 1.75]</b>	
Total events	18		59				
Heterogeneity: Chi <sup>2</sup> = 2.53, df = 2 (P = 0.28); I <sup>2</sup> = 21%							
Test for overall effect: Z = 0.29 (P = 0.77)							



## B) Constant Score in patients undergoing RCR +/- vented anchor

Study or Subgroup	Vented Anchor			Control Anchor			Weight	Mean Difference IV, Fixed, 95% CI	Year
	Mean	SD	Total	Mean	SD	Total			
Ro 2019 <sup>32</sup>	72	5.3	40	72.6	6.6	173	38.3%	-0.60 [-2.51, 1.31]	2019
Sarmiento 2019 <sup>33</sup>	76.9	2.6	18	77.3	2.5	20	53.1%	-0.40 [-2.03, 1.23]	2019
Kim 2020 <sup>19</sup>	88	8.5	36	85.4	8.6	33	8.6%	2.60 [-1.44, 6.64]	2020
<b>Total (95% CI)</b>			<b>94</b>			<b>226</b>	<b>100.0%</b>	<b>-0.22 [-1.40, 0.97]</b>	
Heterogeneity: Chi <sup>2</sup> = 2.07, df = 2 (P = 0.36); I <sup>2</sup> = 3%									
Test for overall effect: Z = 0.36 (P = 0.72)									





# Key Takeaways

1

Marrow stimulation **reduces retear rate** (OR 0.40; 95% CI, 0.25-0.66; P=0.0003, I<sup>2</sup>=0%) and **improves Constant Score** (Mean diff. 2.84; 95% CI, 1.02-4.66; P=0.002, I<sup>2</sup>=29%) relative to control.

2

Vented anchors **improved ossification and bone density** at the anchor site, but **no difference** in Constant Score (Mean diff. -0.22; 95% CI, -1.40 – 0.97; P = 0.36, I<sup>2</sup> = 3%) or retear (OR 0.91; 95% CI, 0.47 – 1.75; P = 0.28, I<sup>2</sup> = 21%).

3

Further evaluation of vented anchors is necessary to elucidate potential effects, given **relatively low number of patients (n = 94)** treated with vented anchors across the three included studies





# Limitations

- Only **three comparative studies** evaluating vented anchors in RCR were included in the meta-analysis
- Differences in repair techniques, marrow stimulation techniques, control anchor selection and limitations on concomitant procedures promote **heterogeneity**
- Patient comorbidities and other baseline characteristics **were not controlled for** in this study, given limited publication of such data in the included studies





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