



# TRENDS IN MANAGEMENT OF PROXIMAL HUMERUS FRACTURES IN THE UNITED STATES: 1998-2009

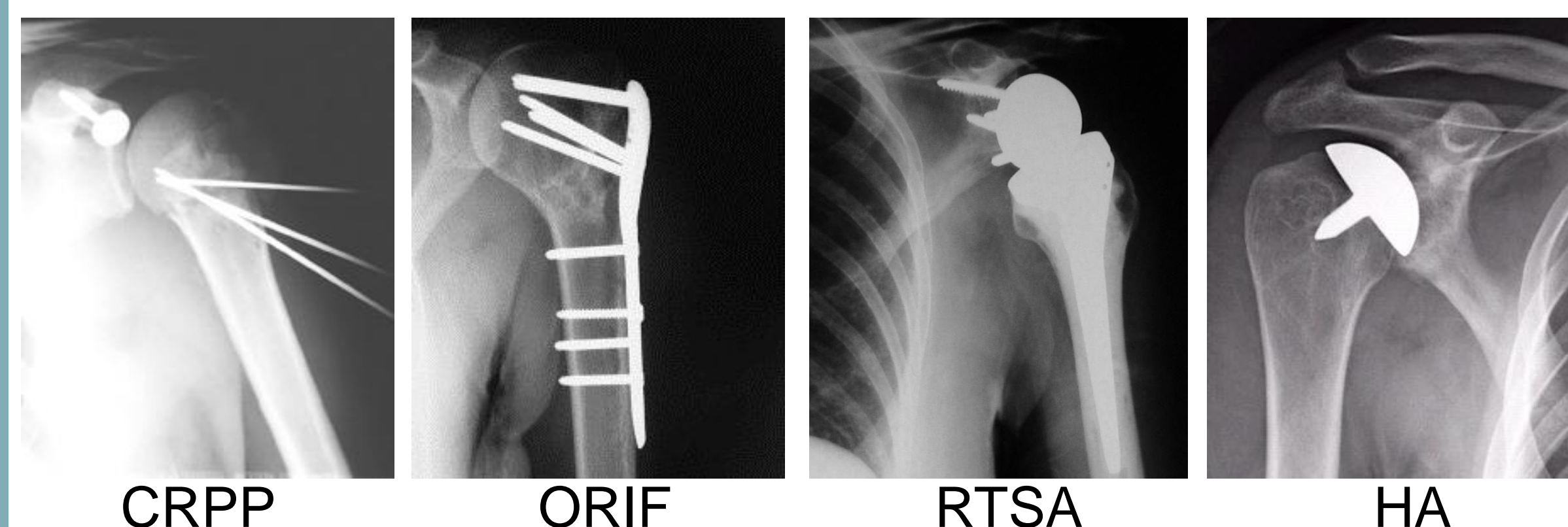


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## Introduction

Proximal humerus fractures (PHFs) are common but they do not have a standard of treatment. Historically, surgeons have opted for closed reduction percutaneous pinning (CRPP) or open reduction internal fixation (ORIF) for simple fractures and hemiarthroplasty (HA) for more complex fractures.<sup>1</sup> ORIF has become increasingly popular because of its expanded utility with locking plates.<sup>2-4</sup> The use of CRPP has declined and been limited to simple fractures with recent literature showing unexpectedly higher complication rates.<sup>5,6</sup>

Reverse total shoulder arthroplasty (RTSA) was introduced in the U.S. in 2003 and has been used to treat complicated shoulder problems such as cuff tear arthropathy, revision, and 4-part PHFs. The aim of this study was to analyze the shifting emphasis between operative modalities for displaced PHFs. We hypothesized that the rate of total shoulder arthroplasty (TSA) would increase after the introduction of RTSA.



## Materials and Methods

The National Hospital Discharge Survey (NHDS) provided data for analysis. All individuals admitted with a primary diagnosis of PHF were selected, excluding those with isolated greater tuberosity fractures. Primary procedures of interest were CRPP, ORIF, TSA/RTSA, and HA. ICD-9 CM does not distinguish between TSA and RTSA in this database, and therefore this study made the assumption that TSA codes in the second time period indicated RTSA. Subpopulations were defined as follows:

**Time:** Period I (1998-2002) and Period II (2003-2009)

**Age:** Group I (<65) and Group II (≥65)

**Gender:** Males and females

**Race:** Only whites were included for subpopulation analysis.

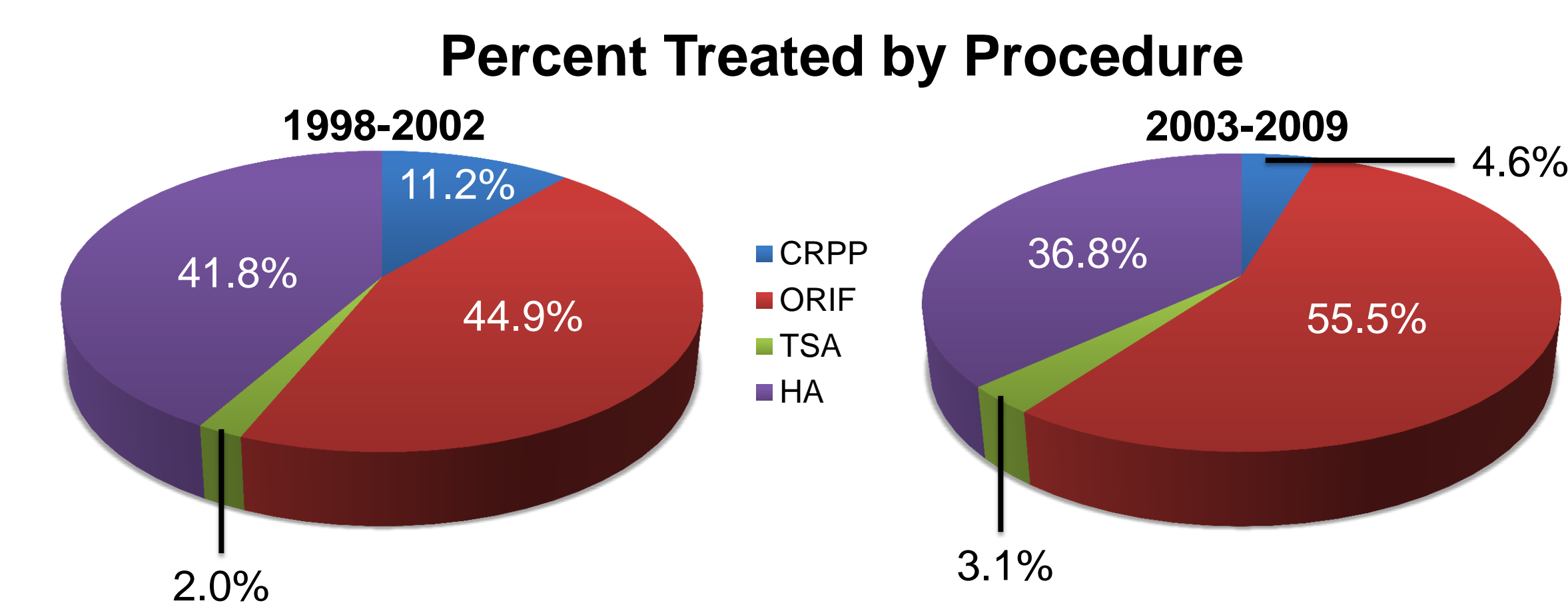
Other racial groups comprised too little of the dataset or were deemed incomplete to be analyzed for trends. However, these patients were included as part of other subpopulation analyses.

Associations between time periods, age, gender, and race and the distribution of procedures were examined using the chi squared test for independence. Significance was set at a p-value of 0.05.

## Results: Entire Study

Entire Study, 1998-2009	
# of Patients	1,304
Procedures	7.0% CRPP, 51.7% ORIF, 2.7% TSA or RTSA, 38.6% HA
Age	60.9% ≥ 65
Gender	72.7% female
Race	68.2% white

When the entire study was compared between time periods, significant change was observed for rates of procedures (p = 0.005).

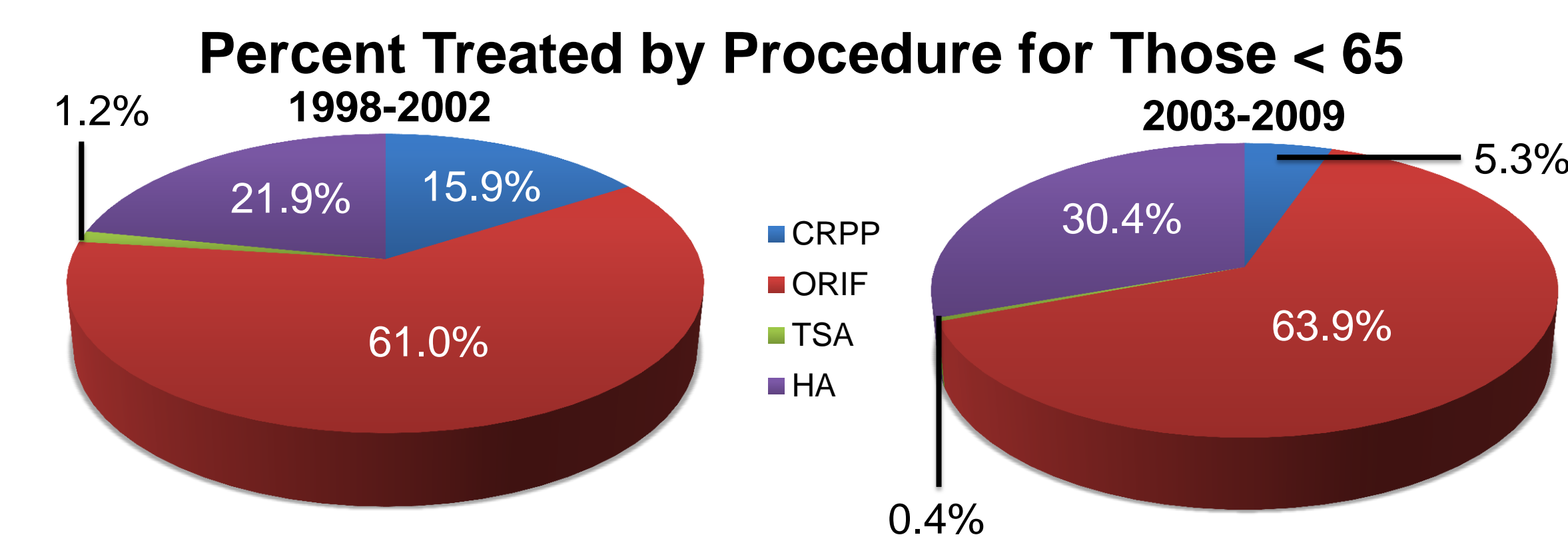


## Results: Age

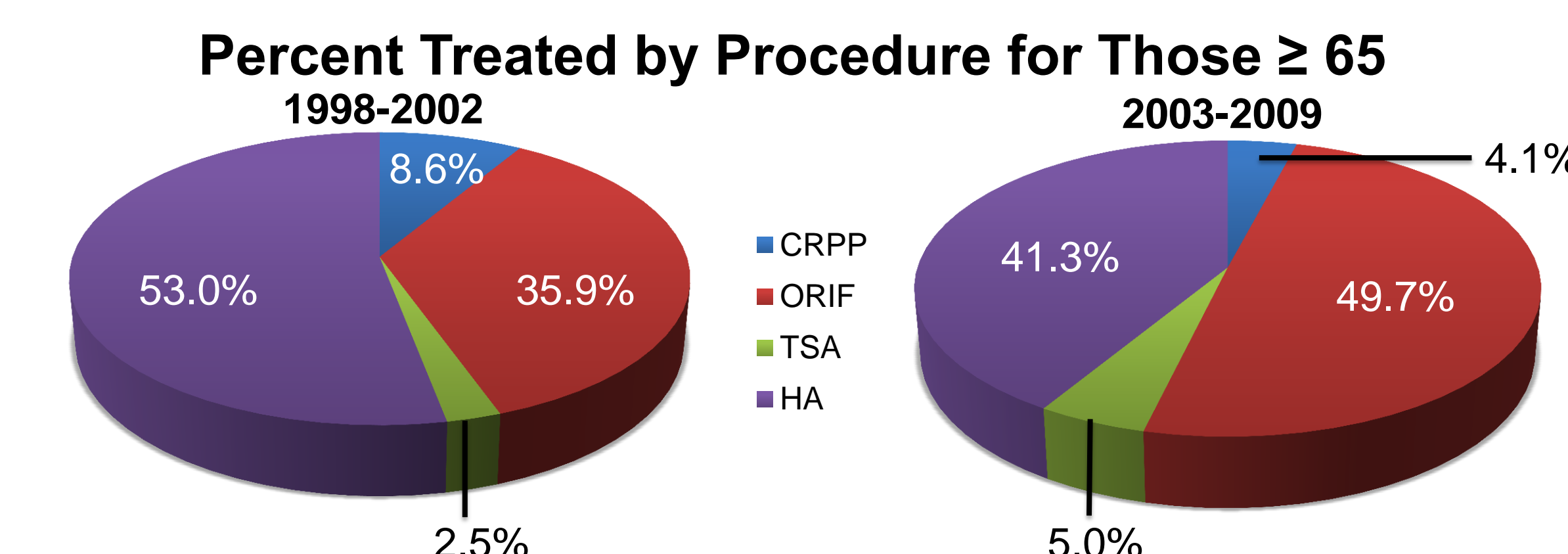
Age	CRPP	ORIF	TSA/RTSA	HA
< 65	8.8%	62.9%	0.7%	27.6%
≥ 65	5.8%	44.4%	4.0%	45.8%

p = 0.0002 for significance of difference

When the younger than 65 group was compared between time periods, significant change was observed (p < 0.0001).



When the older than 65 group was compared between time periods, significant change was observed (p = 0.004).

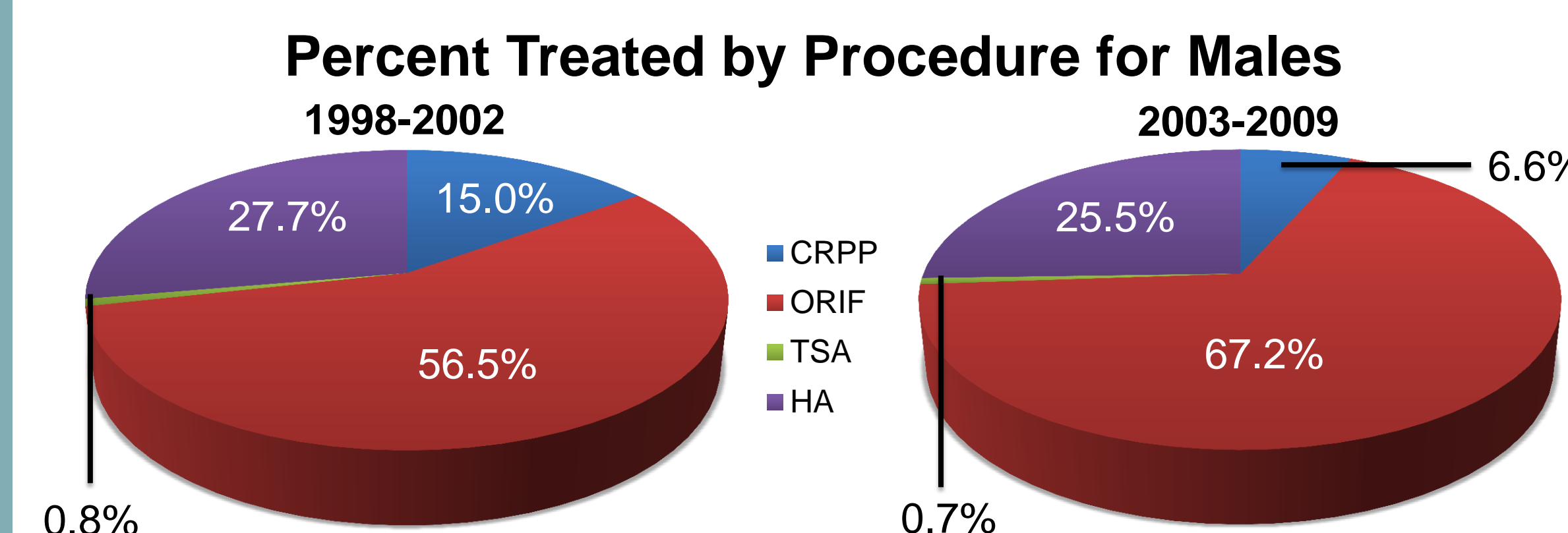


## Results: Gender

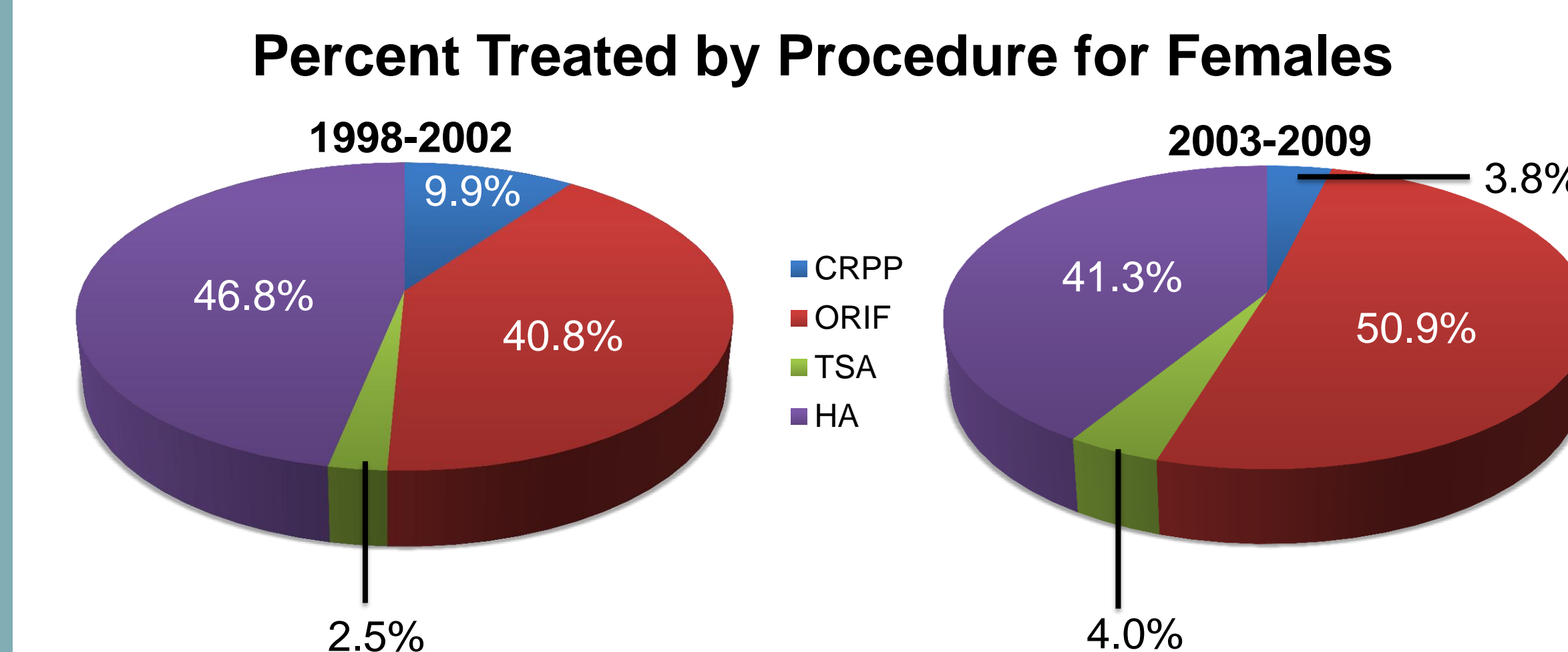
Gender	CRPP	ORIF	TSA/RTSA	HA
Males	9.5%	63.5%	0.7%	26.3%
Females	6.0%	47.2%	3.5%	43.3%

p = 0.0009 for significance of change

When males were compared between time periods, significant change was observed (p = 0.006).

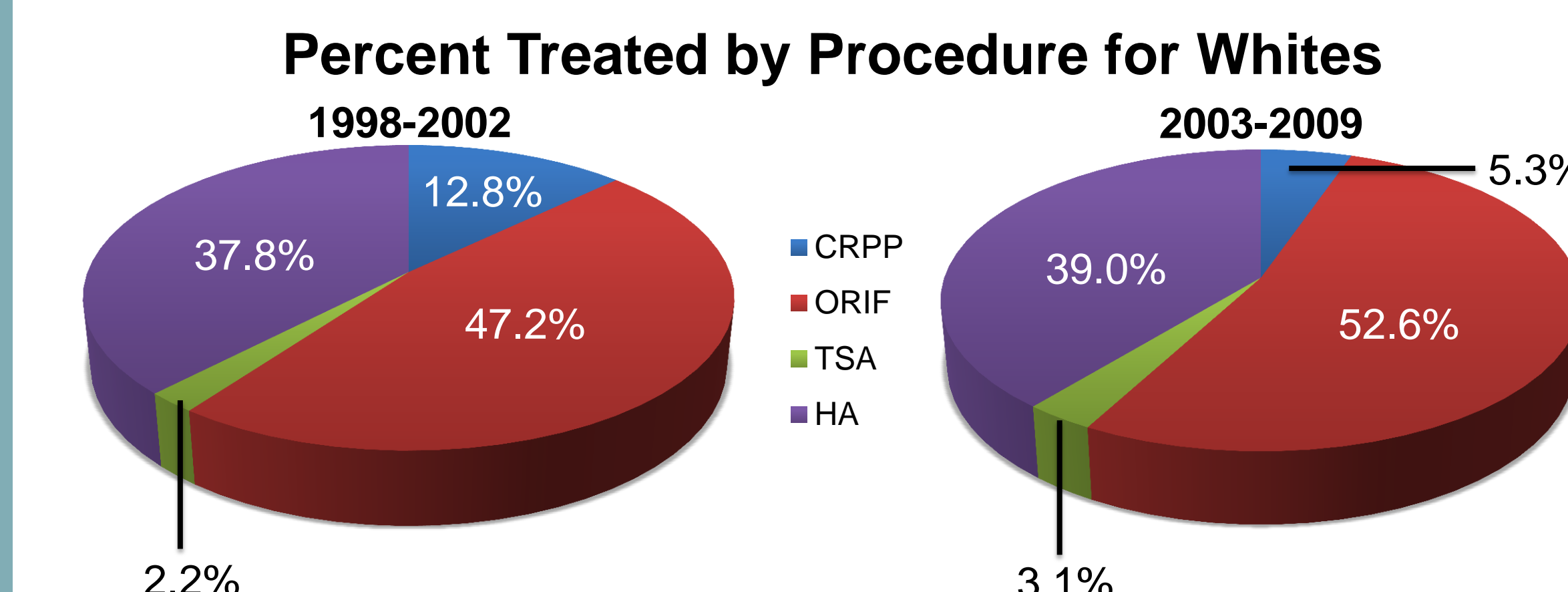


When females were compared between time periods, significant change was observed (p = 0.004).



## Results: Race

Differences between rates of procedures in whites and those of the dataset were not statistically significant (p = 0.9858), but there was significant change of rates between time periods (p = 0.009).



## Conclusions

Proving our hypothesis, TSA rates increased after the introduction of RTSA (2.0% to 3.1%). The lack of a major increase may be multifactorial: the indications for RTSA are limiting, revision is challenging, the procedure is technically demanding, and complication rates are high. On the other hand, an increase from 2.0% to 3.1% may indicate a larger increase than what is seen at face value. This change may have been minimized since the vast majority of operative treatments for PHFs are modalities other than RTSA. Considering percent relative change, this is an increase in more than 50%. Therefore, this modest increase in rate may be the result of cautious surgeons, but it may also indicate a larger increase by the raw number of surgeries. Since the procedure itself was not approved until 2003, a lag may exist between its introduction and acceptance by orthopaedists. Long-term follow-up studies are still needed to prove their utility. It is likely that studies that include more recent time periods will show a dramatic increase in the use of RTSA for treatment of PHFs in the elderly, and therefore, further work is needed. It would also likely be beneficial for RTSA to have an independent ICD-9 CM code used to delineate this from standard TSA since the indications are different.

## Acknowledgements

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## References

- Kontakis G, et al. Prosthetic replacement for proximal humeral fractures. *Injury*. Dec 2008;39(12):1345-1358.
- Ring D. Current concepts in plate and screw fixation of osteoporotic proximal humerus fractures. *Injury*. Sep 2007;38 Suppl 3:S59-68.
- Edwards SL, et al. Two-part surgical neck fractures of the proximal part of the humerus. A biomechanical evaluation of two fixation techniques. *JBS Am*. Oct 2006;88(10):2258-2264.
- Sproul RC, et al. A systematic review of locking plate fixation of proximal humerus fractures. *Injury*. Apr 2011;42(4):408-413.
- Murray IR, et al. Proximal humeral fractures: current concepts in classification, treatment and outcomes. *JBS Br*. Jan 2011;93(1):1-11.
- Harrison AK, et al. Intermediate outcomes following percutaneous fixation of proximal humeral fractures. *JBS Am*. Jul 3 2012;94(13):1223-1228.