

Cementation and Bonding Protocols for Zirconia Crowns

A Review of In-Vitro Studies

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INTRODUCTION

There are two primary means to cement a zirconia crown or coping to the tooth structure. Conventional luting cements provide mechanical resistance to dislodgment by curing within the cement space between the crown and tooth. Adhesive cements utilize chemical bonding of zirconia crown to the underlying tooth surface in addition to mechanical resistance. The literature has abundant studies of each, yet a definitive universal protocol has not been established providing optimal crown retention.

OBJECTIVE

To review available literature regarding different in vitro cementation and bonding protocols for zirconia crowns in the past 5 years to assess an optimal protocol for retention.

METHODS

An electronic search of the current English language articles published in peer-reviewed journals from 2018 to July 2024 was conducted using PubMed database with keywords cementation, bonding, bond strength, zirconia, tooth, enamel, dentin, resin cement, resin modified glass ionomer cement, self-adhesive cement, luting cement using Boolean operators ‘AND/OR.’ Inclusion criteria was in-vitro studies only, full contour zirconia cemented/bonded to enamel/dentin, resin cements only. Exclusion criteria were studies that included materials other than full contour zirconia (such as metals, porcelain, or porcelain fused to zirconia, PEEK etc); animal studies, orthodontic bracket studies, bonding of zirconia to materials other than enamel/dentin.

P.I.C.O. Question

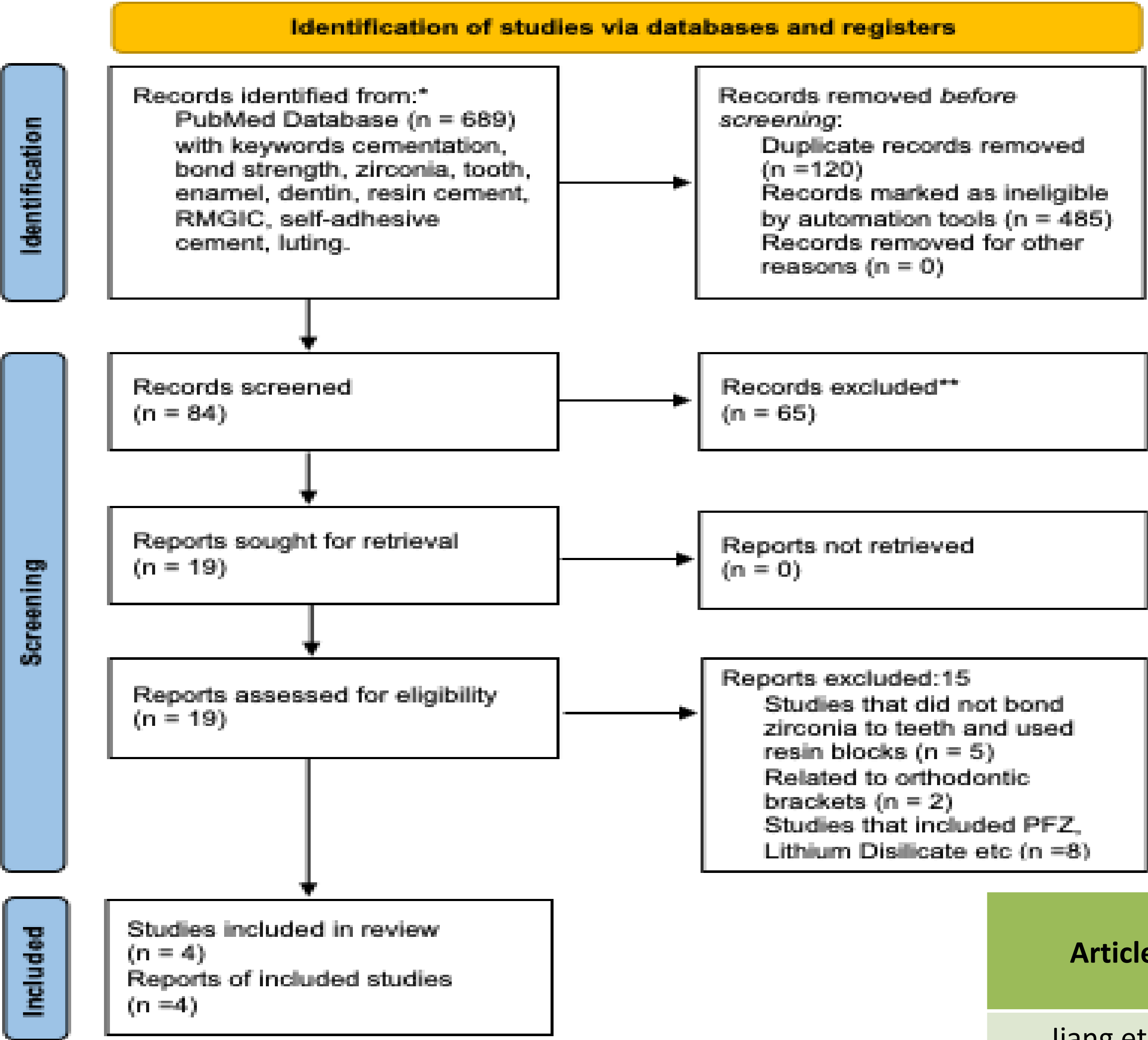
P - Population: Patients indicated for Zirconia Crowns

I - Intervention: Mechanical or Chemical Cementation

C - Comparison: Optimal Method for Cementation

O - Outcome: Retentive Strength

Characteristics Of Included Studies



QR code of complete
reference list of included
studies

Data from the Articles Reviewed

Articles	Cement	Sample Size	Zirconia Surface Tx	Tooth Surface Tx	Storage	Bonding Agent
Jiang et al	Rely X 400 Self-Adhesive cement	136	1. Abraded with 110 µm alumina, 4 bar, 20s 2. Ar NTP 3. 20 % O ₂ + 80 % Ar NTP 4. No Tx	Polished with 600, 800, 1500, & 2000 grit Si-C	dH ₂ O at 25°C for 24h	No
Chamaly et al	GIC Rely X Ultimate	48 caries free 3 rd molars	Abraded with 50 µm Al ₂ O ₃ at 36.25 psi for 15s	1. Er,Cr:YSGG laser 2. No Tx		Yes
Swarnakar et al	Self Adhesive Resin Cement	60 caries free pre-molars	1. No surface Tx 2. Diode laser radiation 3. Silane coupling agent 4. Abraded with 50 µm Al ₂ O ₃ for 15s at 35psi		Artificial Saliva medium for 2 days	No
Yenamandra et al	Rely X U200 G-Cem Linkforce	80 caries free pre-molars	1. No Tx 2. Abraded with 50µm Al ₂ O ₃ for 10s at 2 bar 3. Etched with 48 % HF 4. Etched with 48% HF & 70% HNO ₃		dH ₂ O for 24h	Yes, for G-Cem Linkforce

Risk of Bias Assessment

Article	Teeth Randomized	Caries-free or no restorations	Materials used per IFUs	Same operator	Sample Size Calculation	Blinded Operator	Risk of bias
Jiang et al	No	Yes	Yes	Yes	No	Yes	Medium
Chamaly et al	No	Yes	Yes	Yes	No	Yes	Medium
Swarnakar et al	No	Yes	Yes	Yes	No	Yes	Medium
Yenamandra et al	No	Yes	Yes	Yes	No	Yes	Medium

RESULTS

The PubMed database search yielded 689 articles. After applying filters for English language, publication years restriction, and in vitro studies), 204 titles were retrieved and abstracts reviewed by the primary author. After duplicate removal of similar studies, 84 unique protocols remained and reduced to 19 for full-text review. Application of inclusion and exclusion criteria identified 9 additional publication for removal with only 10 publication fitting the criteria. Example studies are shown in the Tables, the QR code may be used for the full list.

The studies varied in use of conventional and adhesive materials, surface preparation of tooth and Zirconia surfaces, curing protocols, application of curing load, etc. Uniform outcomes were limited despite application of systemic review procedures due to protocol variance.

CONCLUSION

Review of studies from 2018-2024 note great variance of placement of zirconia crowns demonstrating a lack of consensus and conclusive evidence supporting a universal protocol, material selection, or necessity of bonding. More robust studies with large sample sizes are needed for developing a universal protocol.

SELECTED REFERENCES

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- Swarnakar, Arka, et al. "Comparative Analysis of Three Surface Treatments on the Bond Strength of Zirconia to Resin-luting Agents: An In Vitro Study." The Journal of Contemporary Dental Practice 23.9 (2022): 884.
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