

EXACT EXAM TOPIC: Pain control in orthodontics

MARKS / WEIGHTAGE: 10 marks

★ **INTRO:** During orthodontic treatment, pain/discomfort is common.

- Caused by pressure, ischemia, inflammation and edema in periodontal ligament (PDL).
- Severity varies with type of procedure, force, age, sex and individual pain threshold.

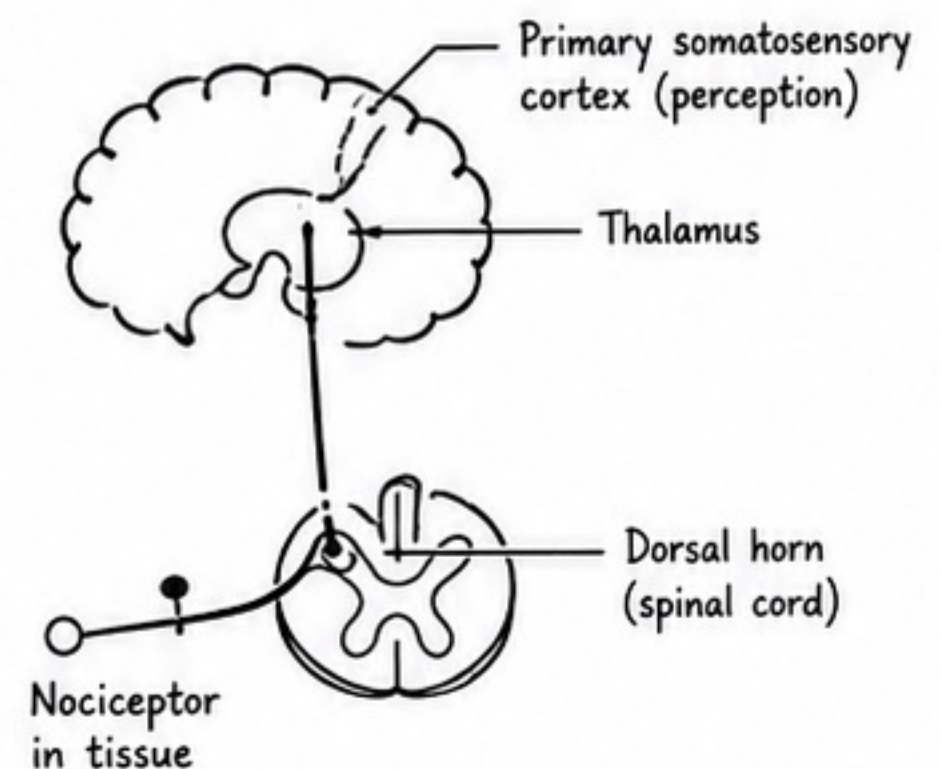
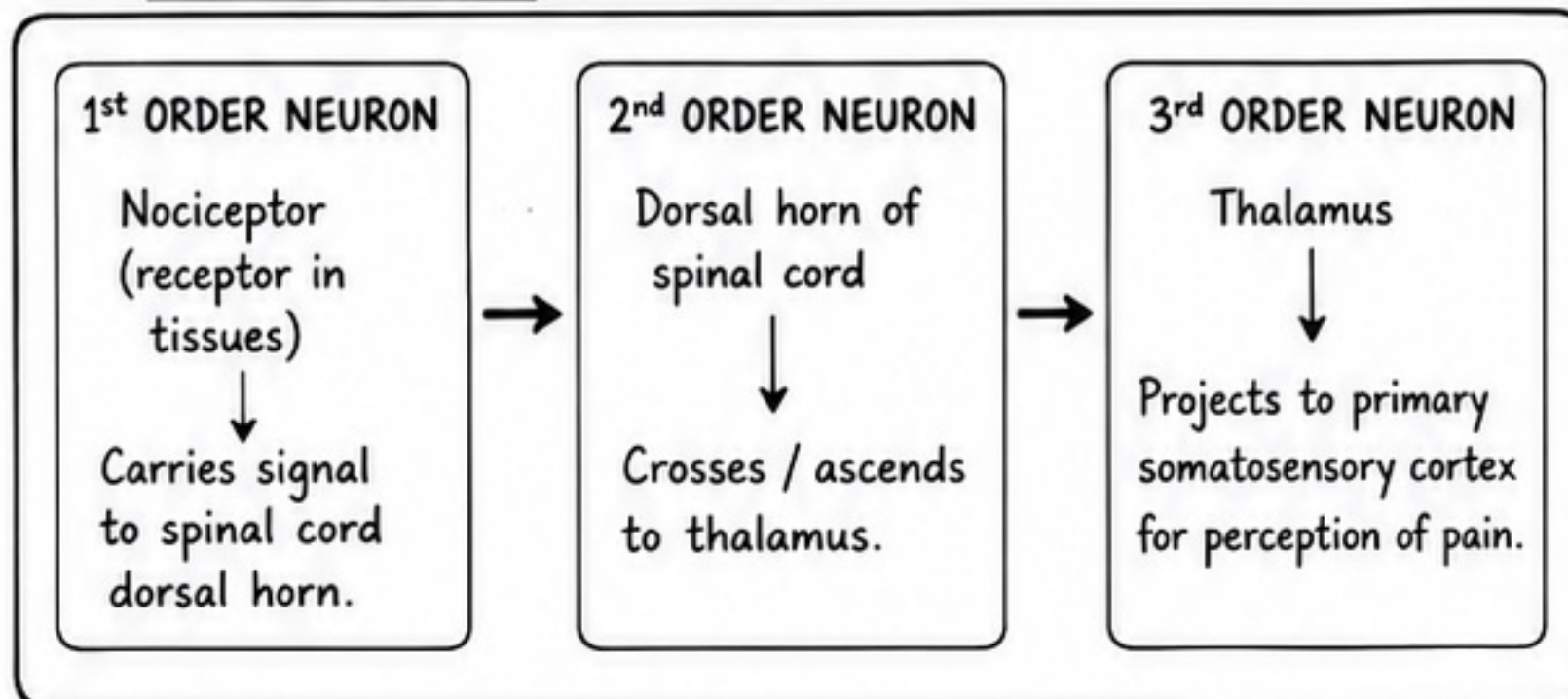
DEFINITION OF PAIN (IASP)

An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.

◆ TYPES OF PAIN

TYPE	CAUSE / MECHANISM	KEY FEATURES
Nociceptive pain	Direct stimulation of nociceptive fibers by mechanical / chemical / thermal triggers.	Inflammatory pain. Typical in orthodontic mechanics.
Neuropathic pain	Due to lesion / damage of nerve or nervous system.	Burning, shooting, numbness, electric-like pain possible.
Nociplastic pain	Altered nociception without clear evidence of actual or threatened tissue damage.	Central sensitization / dysfunction in pain processing.

→ PAIN PATHWAY (3-STEP)



★ THEORIES OF PAIN

THEORY	ONE-LINE GIST
Specificity theory	Maxmilian Von Frey, 1895; separate pain receptors/channels; no longer accepted.
Intensity theory	Aristotle concept; pain due to excessive stimulation / summation.
Pattern theory	Specific patterns of neural activity encode pain.
Gate control theory	Melzack; spinal cord "gate" modulates transmission of pain signals to brain.
Biopsychosocial model	Pain influenced by biological, psychological, social and environmental factors.

★ EXAM PEARL

Orthodontic pain is mainly nociceptive inflammatory pain.

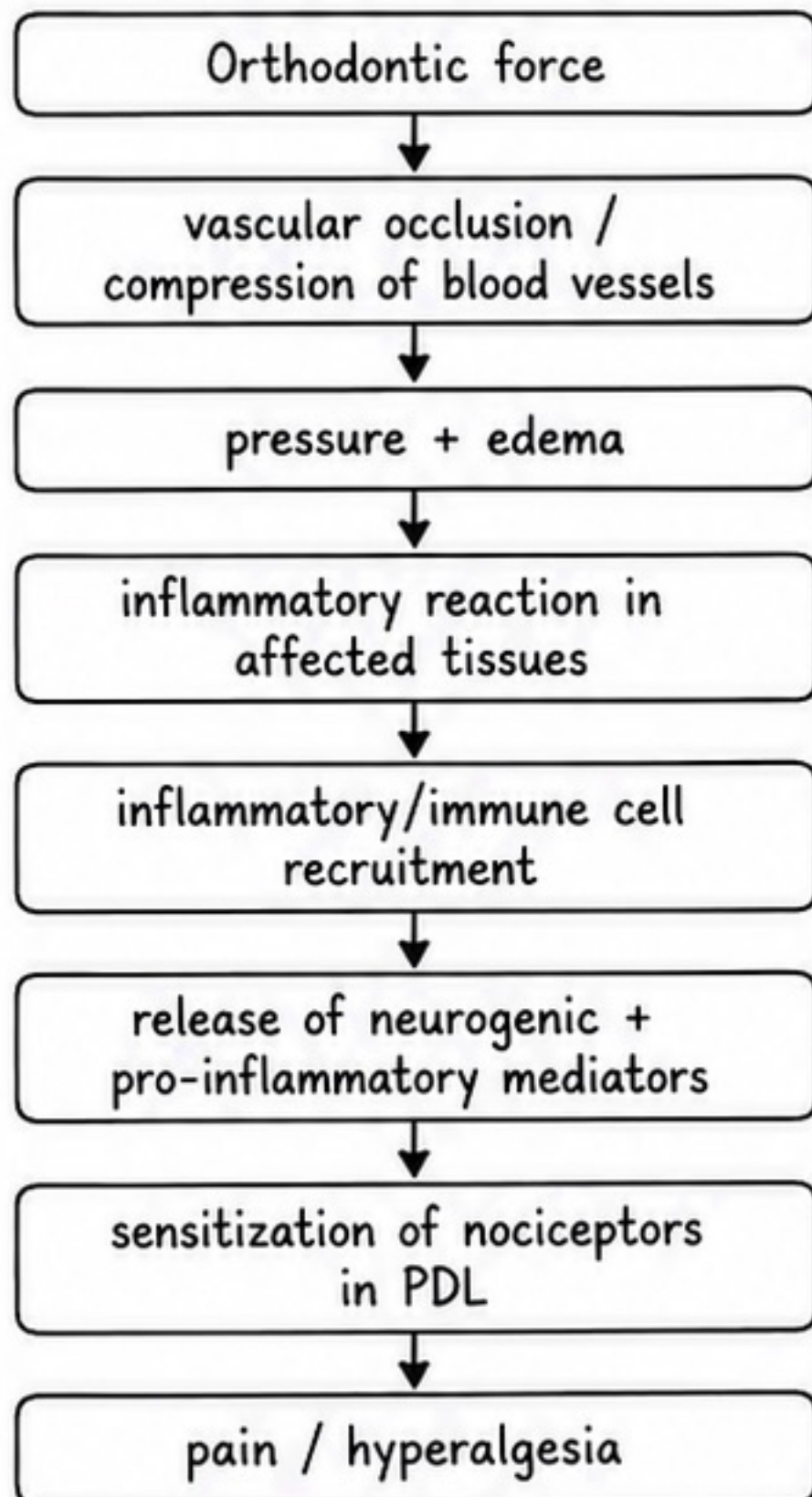
★ BURSTONE / CLINICIANS' GROUPING OF PAIN OF ORTHODONTIC ORIGIN

- By relation of force to pain:
 - First degree
 - Second degree
 - Third degree
- By onset:
 - Immediate
 - Delayed

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★ ORTHODONTIC PAIN PATHWAY



★ SHORT NOTE

Orthodontic pain is part of an inflammatory reaction. Changes in blood flow following orthodontic force application lead to the release of chemical mediators.

◆ NEUROPEPTIDES INVOLVED IN ORTHODONTIC PAIN

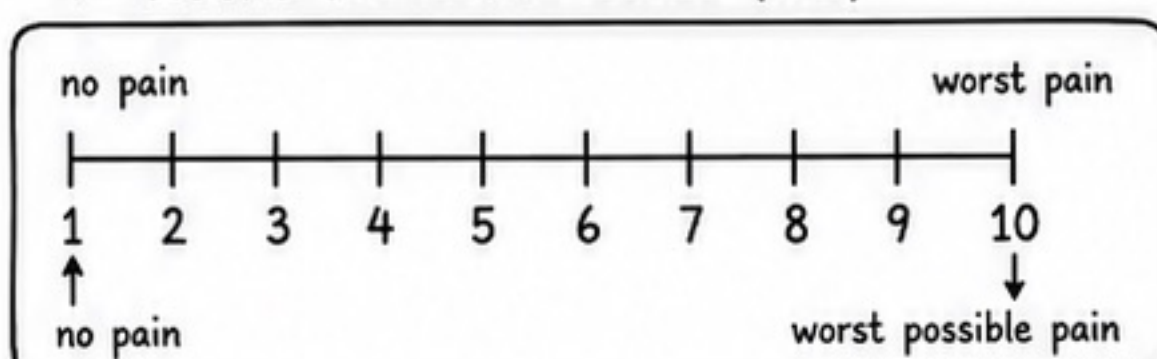
NEUROPEPTIDE	KEY ROLE / NOTE
Substance P (SP)	• Key role in pain signalling. • More strongly correlated with pain than other neuropeptides.
CGRP	Calcitonin gene-related peptide; involved in pain modulation.
Neurofilament protein (NFP)	Marker of nerve damage / regeneration; associated with pain processing.
Vasoactive intestinal polypeptide (VIP)	Modulates inflammation and nerve activity.
Neuropeptides Y (NPY)	Involved in modulation of pain and stress responses.

Mangano et al.: Stimulation of periodontal nerve fibres by mechanical forces may induce the release of Substance P (SP) in the dental pulp and PDL.

★ METHODS FOR PAIN EVALUATION

METHOD	WHAT IT DOES	KEY POINT
Patient interview / questionnaire	Set of specific questions about experience of pain.	Subjective assessment; easy to use.
Visual analogue scale (VAS)	Patient marks a point on a 10 cm line (1–10).	Most common pain scale in orthodontic studies.
McGill Pain Questionnaire (MPQ)	Quantitative descriptors of pain; pain rating index.	Provides detailed measurement of pain.
Verbal rating scale (VRS)	Describes pain intensity using adjectives.	Simple and quick; categorical assessment.
Algometer	Measures pressure pain threshold (force application).	Simmons, 1994; useful for evaluating orofacial pain / force-related pain.

→ VISUAL ANALOGUE SCALE (VAS)



→ VERBAL RATING SCALE (VRS)

no pain	mild pain	moderate pain	severe pain	very severe pain	worst pain possible
0	1	2	3	4	5

★ **EXAM PEARL** VAS is the most frequently used pain scale in orthodontic studies.

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★ FACTORS AFFECTING PAIN INTENSITY

FACTOR	EFFECT / SIGNIFICANCE
Impulses from brainstem / previous painful experiences	Central processing can amplify or reduce pain.
Emotional state	Stress and anxiety lower pain threshold.
Age	Younger patients often report less pain than adults, but evidence is variable; peak pain frequency reported in 13-16-year-olds in one study.
Gender	Older literature suggests females may be more sensitive, but recent reviews show no consistent difference.

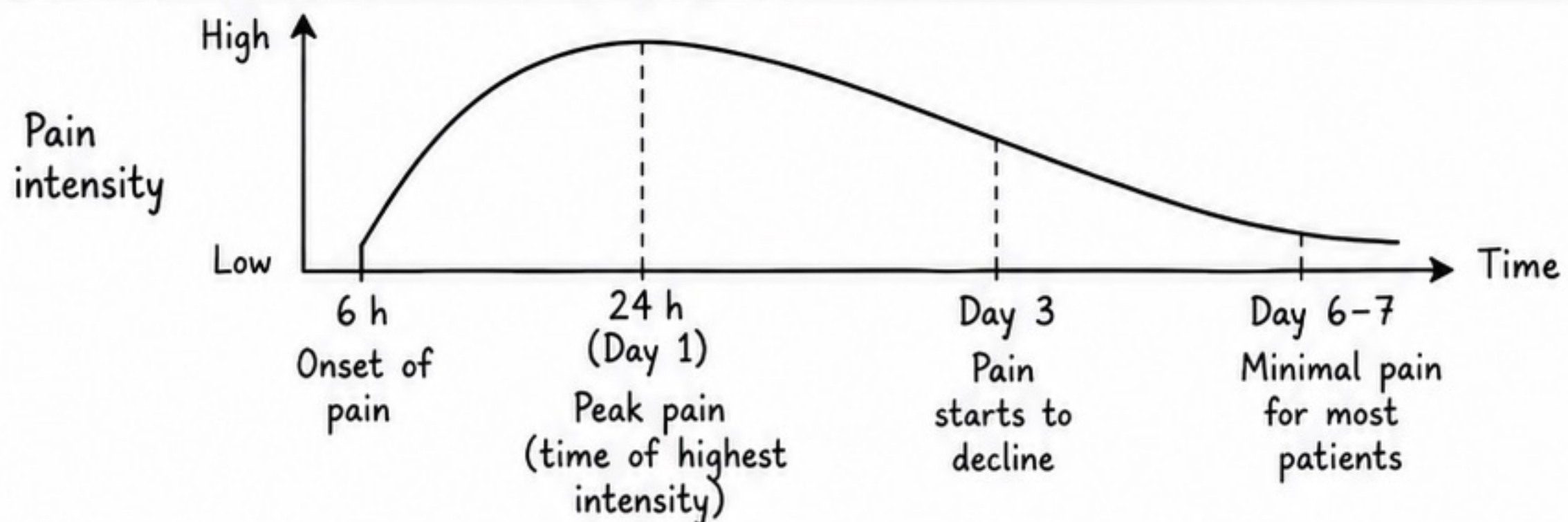
★ PAIN AND PATIENT COMPLIANCE



KEY POINTS

- Jeffrey Chow et al: poor cooperation may result from pain besides functional and esthetic impairment.
- Nearly 90% of orthodontic patients report pain during treatment.
- About 10-20% discontinue treatment mainly because of pain.
- One study: 87% (48/55) patients reported pain in first week after appliance placement.
- Highest intensity: day after separator placement.
- 42% still had pain at day 7.
- Pain scores significant in late phase day 3-7 of first follow-up week.
- More than 40% of teenagers still reported some pain after 1 week.

★ PAIN TIME COURSE (TYPICAL)



★ EXAM PEARL

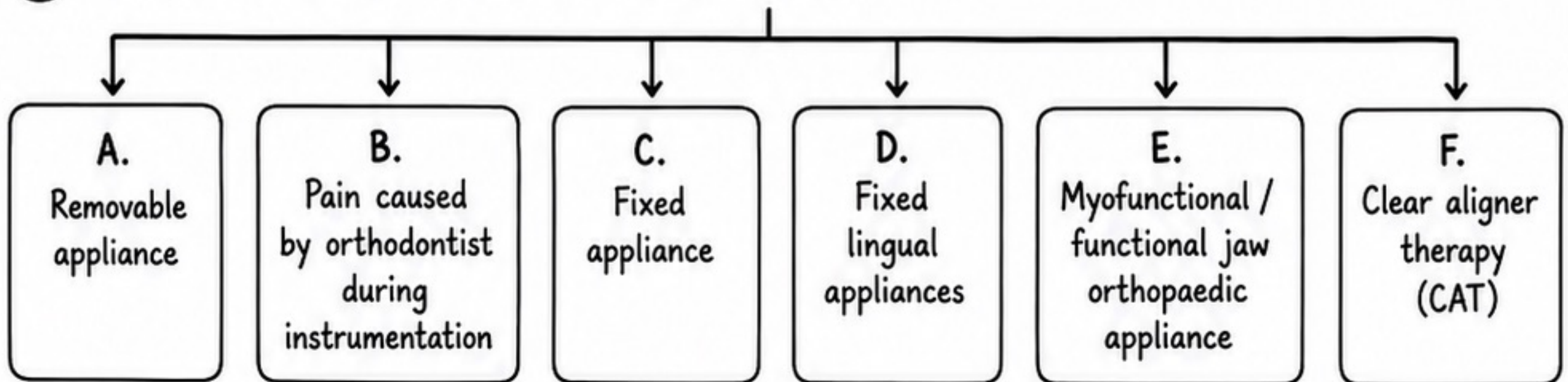


Anxiety management + expectation setting improve perceived pain and compliance.

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① ORTHODONTIC PROCEDURES CAUSING PAIN.



② REMOVABLE APPLIANCE

CAUSE	RESULT
Frequent insertion / removal	Pain, soreness, irritation
Overactivation of springs / bows	Discomfort, tenderness, delayed movement
Distortion of appliance	Pain, soreness, impaired fit
Lack of trimming / acrylic relief	Soft tissue trauma, ulcers, pain
Inadequate space for movement	Pressure, pain, tooth mobility

③ FIXED APPLIANCE

MAJOR PAINFUL PROCEDURES	
1.	Separator placement
2.	Arch wire placement and activation
3.	Arch wire characteristics
4.	Maxillary expansion
5.	Traction to impacted tooth / unfavourable tooth position
6.	Intensity of force
7.	Temporary anchorage device (TAD) insertion
8.	Debonding

④ PAIN CAUSED BY ORTHODONTIST DURING INSTRUMENTATION

- Intraoral clinical photography and use of mouth mirrors can cause discomfort.
- Arch wire ligation is often uncomfortable.
- Steel ligatures, sharp wire ends, and sharp bracket margins may cause ulcers or injury.
- Band insertion and improper handling of instruments can injure the gums and cheeks.
- Suction should be used carefully during procedures to avoid irritation of the lingual frenum and floor of the mouth.

⑤ FIXED LINGUAL APPLIANCES

- Similar discomfort as fixed appliances, due to tongue irritation and limited space.

⑥ MYOFUNCTIONAL / FUNCTIONAL JAW ORTHOPAEDIC APPLIANCE

- Muscle soreness, pressure, and adaptation discomfort.

⑦ CLEAR ALIGNER THERAPY (CAT)

- Pressure during initial wear, soreness, and tightness.

★ EXAM PEARL

Most orthodontic pain is iatrogenic, procedure-related and usually self-limiting.

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★ 1. OTHER APPLIANCES & PHARMACOLOGICAL MANAGEMENT.

APPLIANCE / SITUATION	KEY POINT
Fixed lingual appliances	• Restricted tongue space; tongue soreness/discomfort common. • Eating difficulty may occur. • Adaptation may take up to 3 months. • 57–76% tongue soreness/discomfort reported.
Myofunctional / functional jaw orthopaedic appliances	• Most pain/discomfort after first 24 h, sharp decline after 3 days. • First 2 days are critical for adaptation. • Kharbanda protocol: review at 24–48 h and again at 1 week.
Clear aligner therapy (CAT)	• Pain often less during first 7 days than fixed appliance therapy. • Overall better comfort/quality of life, though findings vary.

◆ 2. PHARMACOLOGICAL MANAGEMENT.



KEY PRINCIPLE: Pre-emptive medication taken about 2 h before orthodontic procedure is often more beneficial than post-treatment medication.

DRUG / METHOD	HIGH-YIELD POINT
Ibuprofen 400 mg	• Commonly used; effective for separator placement and arch wire pain.
Acetaminophen / paracetamol 600 mg	• Effective; less concern regarding interference with tooth movement.
Naproxen	• Strong and sustained analgesic effect; may persist up to 24 h.
Topical naproxen 5% gel	• Useful after separator placement.

★ 3. EVIDENCE.

- Chen et al systematic review: analgesics like ibuprofen, acetaminophen and naproxen are effective in relieving orthodontic pain.
- Concern exists with NSAIDs possibly interfering with inflammation-driven tooth movement, but short low-dose use is unlikely to cause major clinical effect.
- Cochrane review: moderate-quality evidence supports drug efficacy; little difference between NSAID and paracetamol at 2, 6 and 24 h in some studies.

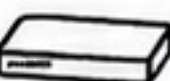
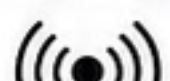
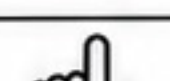
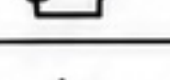
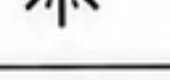
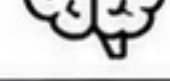
★ 4. EXAM PEARL.

Use the lowest effective dose for the shortest duration.

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★ NON-PHARMACOLOGICAL MANAGEMENT.

Method	High-yield point / evidence
 Vibration	• Helps circulation, reduces PDL compression/inflammatory products; useful during initial alignment.
 Chewing gum	• Santos et al: 5 min after initial arch wire placement and 5 min every 6 h during first week can reduce pain.
 Biting wafers	• Useful for arch wire activation and debonding pain.
 TENS	• Non-invasive stimulation closes “pain gate” and promotes endorphin release; useful after separator placement and in debonding.
 Pulse electromagnetic field (PEMF)	• Jung et al: significantly relieved pain at 24, 48 and 72 h after initial orthodontic wire insertion.
 Acupuncture / acupressure	• ST6 and LI4 points; Boleta-Ceranto et al showed reduction in post-adjustment pain.
 Low-intensity laser therapy / photobiomodulation	• Analgesic, improves microcirculation; Doshi & Bhad used 810 nm in canine retraction.
 Cognitive behavioural therapy (CBT)	• Wang et al; pain control comparable to ibuprofen.
 Music therapy / binaural beat music	• May reduce anxiety and pain during initial arch wire placement.
 Gene therapy	• Experimental future approach; Rui Guo et al, 2019, TRPV1-based rat study.

◆ RECENT EVIDENCE / STUDY TABLE

Procedure	Useful method	Author/year	Key evidence
Separators	Analgesics	Sharaw, 2021	Acetaminophen/ibuprofen effective when taken before procedure.
Arch wire placement	Chewing gum	Guo, 2023	Recommended as analgesic substitute.
Arch wire placement	Photobiomodulation	Zhi, 2021	Significantly reduces pain within a week.
Canine retraction	Tenoxicam 20 mg	Arantes, 2009	Effective pain control.
Maxillary expansion	Ketoprofen lysine salt 40 mg	Cossellu, 2019	Effective on day 1 and for 3 days.
Clear aligners	High-frequency vibration 120 Hz	Ghadirian, 2022	Better than low-frequency 30 Hz.
Debonding	TENS	Rastogi, 2024	Significant pain reduction.

★ RAPID REVISION

